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Dear TOJDE Readers

Welcome to Volume 24 Number 4 of TOJDE

There are 20 articles and a book review in October 2023 issue. 55 authors write the articles from 6 different countries. Columbia, Greece, Indonesia, Mexico, Saudi Arabia and Turkiye are the countries.

THE IMPACT OF INQUIRY-BASED ONLINE LEARNING WITH VIRTUAL LABORATORIES ON STUDENTS' SCIENTIFIC ARGUMENTATION SKILLS is the 1st article and Ahmad Fauzi HENDRATMOKO, Madlazim MADLAZIM, Wahono WIDODO and I Gusti Made SANJAYA are the authors. This study uses a one-group pretest-posttest design with n-gain analysis. The results of this study indicate that the application of inquiry-based online learning with a virtual laboratory can improve students' scientific argumentation skills. Uniquely, this only significantly impacts the claim, evidence, and reasoning components, but not the counterclaim and rebuttal components.

The 2nd article is written by Elif OZTURK and Zeynep TURGUT. The title is THE RELATIONSHIP BETWEEN PROSPECTIVE TEACHERS' PERCEIVED IMPORTANCE OF ONLINE TEACHING COMPETENCIES AND THEIR SELF-EFFICACY BELIEFS. The results of this study are expected to make a significant contribution to research on establishing online teaching competencies in Turkiye and assisting teachers in understanding the value of those competencies; as a result, potential implementers may have stronger online teaching self-efficacy in their distance classrooms. The study suggests incorporating technology-based resources into teacher education courses within a digital pedagogy competencies framework to increase pre-service teachers' self-efficacy.

Manuel MEDINA-LABRADOR, Gustavo Rene GARCIA-VARGAS and Fernando MARROQUIN-CIENDUA are the writers of the 3rd article. EFFECTS OF BIAS, GAMIFICATION AND MONETARY COMPENSATION ON MOOC DROPOUTS is the title of the article. This research compares the effect of cognitive bias, gamification, monetary compensation, and student characteristics (gender, age, years of education, student geographical location, and interest in the course certificate) on MOOC dropouts. The results showed that the Peanut effect bias favors the lowest risk of drop up. Likewise, the findings showed the interest in the final certificate as a predictor of retention to complete a four-week MOOC.

The 4th article is titled ASSESSMENT OF SYNCHRONOUS ONLINE ARCHITECTURE EDUCATION FROM STUDENTS' PERSPECTIVE. The authors are Meric ALTINTAS KAPTAN, Ecem EDIS and Aslıhan UNLU. This research aims to identify and investigate different dimensions and underlying factors influencing the successful implementation of e-Learning, from participants' viewpoint, i.e. architecture students. The results are discussed in different dimensions in the article.

Hale ILGAZ, Denizer YILDIRIM, Nevzat OZEL, Salih DEMIR and Mesut SEVINDIK are the authors of the 5th article, titled THE INSTRUCTOR PARAMETERS OF TRANSITION TO FULLY ONLINE LEARNING. This study examined XXX University instructors' perspectives regarding the emergency remote teaching period in terms of their professional experience, discipline area, online instruction experience, and whether they received training in online instruction. According the results of the research, the need to support the instructors according to the needs specific to the disciplines has been revealed, and it is recommended to investigate the relationships between self-competency for online teaching and the perception of institutional support in depth.

DIALOGIC-INTERACTIVE MEDIA IN ONLINE LEARNING: EFFECTIVENESS IN SPEAKING SKILLS is the 6th article. This article is written by ATMAZAKI, Syahrul RAMADHAN and Vivi INDRIYANI. The objective of this research is to build dialogic-interactive media in language learning to enhance students' speaking abilities in online learning. The results show that dialogic-interactive media is effective in increasing students' speaking skills in online learning.

The 7th article is titled PROGRAM EVALUATION IN OPEN AND DISTANCE LEARNING: THE CASE OF OPEN EDUCATION SYSTEM CALL CENTER SERVICES ASSOCIATE DEGREE PROGRAM.

Yagmur TUC and Nejdet KARADAG are the authors. This study aims to evaluate Anadolu University Open Education Faculty Call Center Services Associate Degree Program, which is carried out through open and distance education, according to learner views within the framework of Stufflebeam's Context, Input, Process, Product (CIPP) Evaluation Model and to make suggestions for the development of the program. The results reveal that the program objectives are determined in accordance with the expectations of the learners, learning resources are designed in accordance with the objectives, learning activities are carried out in accordance with the expectations of the participants and learning outcomes are achieved in the program.

EXAMINATION OF THE PREDICTION OF FLEXIBILITY FOR LEARNER SATISFACTION IN ONLINE COURSES is the 8th article. Arif AKCAY is the author. The aim of this study is to examine whether the flexibility of time management, the flexibility of teacher contact, and the flexibility of content predict online course satisfaction. Based on the results of the research, implications, and suggestions are presented.

The 9th article title is THE ROLE OF E-LEARNING READINESS ON SELF-REGULATION IN OPEN AND DISTANCE LEARNING, and the authors are Hasan UCAR and Yusuf Zafer Can UGURHAN. The results of this study indicate that learners with high e-learning readiness levels have higher self-regulated learning skills compared to those with low levels. It is also determined that self-regulated learning skills do not differ in terms of the gender of the learners while they differ in terms of the time the learners spent on the learning management system.

Mohammed Kamal AFIFY, Abdulrazak Mohamed ALQOOT and Saffanah Abdel Kader ZEDAN are the authors of the 10th article. The title is CRITERIA FOR DESIGNING AND EVALUATING THE QUALITY OF VIRTUAL CLASSROOMS DURING EMERGENCY LEARNING. The aim of this research is to determine the quality criteria for designing virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment. The results are discussed in the study.

EVALUATION OF LEARNING MANAGEMENT SYSTEMS USING INTERVAL VALUED INTUITIONISTIC FUZZY-Z NUMBERS is the 11th article. Duygu SERGI and Irem UCAL SARI are the authors of this article. In this study, it is aimed to determine the features that the systems used in distance education should have and to compare the existing systems according to these features. For this purpose, a novel fuzzy extension, interval valued intuitionistic fuzzy Z-numbers, is defined for modeling uncertainty, and AHP and WASPAS methods using proposed fuzzy numbers are developed to determine the importance of decision criteria and compare alternatives.

The title of the 12th article is FACTORS AFFECTING TEACHERS' ONLINE LEARNING EXPERIENCES IN PROFESSIONAL DEVELOPMENT PROGRAM: STRUCTURAL EQUATION MODELLING. This article is written by Lastika Ary PRIHANDOKO. This study investigates the interplay of the factors affecting participants' online learning experience namely self-directed learning and TPACK (Technological, Pedagogical, and Content Knowledge). The results show that Self-directed learning and TPACK are positively and significantly associated with online learning experience.

Baran KAYNAK, Osman TUNA, Ugur OZBEK, Ali AKSOY, Ahmet OZMEN, Baris HORZUM and Burak GOL are the authors of the 13th article. The title is UZEP: A CLOUD-BASED DISTANCE EDUCATION PLATFORM FOR HIGHER EDUCATION INSTITUTIONS. In this study, a new online learning platform has been developed for higher education institutions to solve these problems using state-of-the-art cloud technologies. The new system provides easy to use-learn interfaces, offers an economical solution for e-learning by sharing the resources, and compliant with the law on protection of personal data.

DIGITAL DIVIDE AND EMERGENCY REMOTE EDUCATION: RECONSIDERING THE USE OF EDUCATIONAL RADIO DURING THE PANDEMIC is the 14th article. Burcin YERSEL, Basak KALKAN, Fikret ER, Arzu Celen OZER and Aysel Ulukan KORUL are the authors. In this exploratory study, the main aim is to see the usefulness of university radio for education during the pandemic process by looking at the experiences gained during the Covid 19 pandemic period. The results highlight the importance of the radio.

The 15th article is EXPLORING OPPORTUNITIES FOR EMBEDDING POST-PANDEMIC SCHOOL PRACTICES: LESSON LEARNED FROM COMPULSORY ONLINE LEARNING. The authors are Dedi IRWAN, Muhammad Iqbal Ripo PUTRA and Nurussaniah NURUSSANIAH. This study aims at exploring the opportunities of embedding online learning as an integral part of post-pandemic teaching practices in urban and rural school in West Kalimantan province. This research reports a number of strategic recommendations proposed by participating schools.

The 16th article is written by Betul TONBULOGLU, and the title is STATE OF RESEARCH ON E-ASSESSMENT IN EDUCATION: A BIBLIOMETRIC ANALYSIS. This study aims to reveal the trend of research on e-assessment in the field of educational sciences through scientific mapping and bibliometric analyses. For this purpose, the numerical distribution of research on e-assessment, citation analysis, research themes and the change of trend topics are examined. The findings reveal that e-evaluation activities have displayed a development and transformation over time with the effect of developing technology, the pandemic, the spread of e-learning, the expansion of communication opportunities and many other factors.

IDENTIFYING VARIABLES THAT PREDICT STUDENTS' GEOGRAPHICAL INQUIRY SKILLS DURING THE COVID-19 PANDEMIC is the title of the 17th article. Hulya YIGIT OZUDOGRU is the author. The purpose of this study was to observe the predictive power of the practices carried out in distance geography courses conducted during the Covid-19 pandemic in students' self-efficacy in geographical inquiry skills. Based on this study, it is recommended that teachers take on the responsibility of raising their students as individuals who are independent and learned to learn.

Adamantia SPATIOTI, Ioannis KAZANIDIS and Jenny PANGE are the authors af the 18th article. This article is titled EDUCATIONAL DESIGN AND EVALUATION MODELS OF THE LEARNING EFFECTIVENESS IN E-LEARNING PROCESS: A SYSTEMATIC REVIEW. The purpose of this study is both the investigation of the academic performance, the self-regulated learning and the collaborative learning in relation to the models of ADDIE, Kirkpatrick and Bloom in distance online environments and their effectiveness to the learning process. Based on the study results, all three examined models reinforce students' positive attitudes and perceptions, even while transferring the acquired knowledge to the workplace.

SELF-DIRECTED LEARNING AND MOOC INTEGRATION INTO HIGHER EDUCATION EFL CLASSROOMS is the 19th article. Nazife SEN ERSOY and Yunus DOGAN are the authors. This research includes the first cycle of an application based on the integration of a MOOC given in the field of "writing" into the formal education curriculum to reinforce classroom teaching and support the learning process to improve English writing skills. Results are discussed in different dimensions in the study.

The author of the 20th article is Zulal AYAR. PERSPECTIVES OF ENGLISH LANGUAGE INSTRUCTORS ON POPULAR LEARNING MANAGEMENT SYSTEMS AND SOFTWARE is the title of the article. The results regarding the challenges and suggestions of the participants cannot be reported through a system-based analysis, system-independent offers are presented to policymakers and researchers. The researcher has drawn out a set of implications for future implementations in the study.

There is a book review in this issue. HYFLEX COURSE DESIGN AND TEACHING STRATEGIES is the title of the book. This is an editorial book and the editors are Angela BARCLAY, Krista CECCOLINI, Kathleen CLARKE, Nicole DOMONCHUK, Sidney SHAPIRO, Jupsimar SINGH, Mel YOUNG and Jenni HAYMAN. The reviewers are Alev ATES COBANOGLU and Tayfun FIRAT.

Hope to meet you in the next issue of TOJDE.

Cordially,

Dr. T. Volkan YUZER

Editor in Chief

THE IMPACT OF INQUIRY-BASED ONLINE LEARNING WITH VIRTUAL LABORATORIES ON STUDENTS' SCIENTIFIC ARGUMENTATION SKILLS

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ABSTRACT

Scientific argumentation is a higher-order thinking skill that is a major focus in education in the 21st century. This is a skill that plays an important role in knowledge construction which in reality is rarely implemented in science learning. The facts show that most students have low scientific argumentation skills and still need to be improved. In improving scientific argumentation skills, the learning design used must give students more opportunities to build and criticize arguments, make claims, and use evidence in the process of reasoning based on inquiry activities. Based on the results of previous research, it is known that inquiry-based learning has extraordinary potential in developing students' scientific argumentation skills. Interestingly, no research has been found that reveals the effect of inquiry-based online learning on students' scientific argumentation skills. Therefore, this study aims to determine the impact of inquiry-based online learning with a virtual laboratory on students' scientific argumentation skills. This study uses a one-group pretest-posttest design with n-gain analysis. The results of this study indicate that the application of inquiry-based online learning with a virtual laboratory can improve students' scientific argumentation skills. Uniquely, this only significantly impacts the claim, evidence, and reasoning components, but not the counterclaim and rebuttal components.

Keywords: Scientific argumentation skills, online learning, inquiry-based online learning, virtual laboratory.

INTRODUCTION

The era of disruption confronts students with the realities of 21st-century life which are full of volatility, uncertainty, complexity, and ambiguity. Educational institutions need to produce students who are ready and able to adapt to such an environment (Seow et al., 2019). Therefore, students must be equipped with the skills and competencies needed, one of which is scientific argumentation skills (Haug & Mork, 2021; Lobczowski et al., 2020; Noroozi et al., 2020; Noviyanti et al., 2019).

Scientific argumentation is a higher-order thinking skill that is the main focus of education in the 21st century (Guilfoyle & Erduran, 2021; Noviyanti et al., 2021). This is also one of the core practices that must be implemented in science learning (Loper et al., 2019; Mao et al., 2018; Mikeska & Lottero-Perdue, 2022). This is because scientific argumentation skills affect conceptual understanding (Greene et al., 2018; Jin & Kim, 2021; Larrain et al., 2019; Ping et al., 2020; Rahayu et al., 2020), are related to critical thinking skills (Convertini, 2021; Giri & Paily, 2020; Hong & Talib, 2018; Kuhn, 2019), can promote scientific literacy (Archila et al., 2018; Chen, 2019; Yacoubian & Khishfe, 2018), can improve scientific reasoning (Sari & El Islami, 2020), can develop analytical thinking skills (Perdana et al., 2019), can develop reflective thinking skills (Gulen & Yaman, 2019), can develop innovative thinking (Turabova, 2021), can support social collaboration (Henderson et al., 2018), can increase awareness of the surrounding environment (Faize & Akhtar, 2020), and is needed in expressing opinions, making decisions, and solving problems in everyday life (Songsil et al., 2019).

Scientific argumentation is a skill used to make, support, challenge, or enhance scientific claims that lead to validation and credible conclusions based on empirical data and evidence (Evagorou & Osborne, 2013; Lin & Mintzes, 2010; Songsil et al., 2019). This is described as what scientists do in building and defending their scientific ideas (Roviati & Widodo, 2019). Where scientific arguments are used by scientists to identify, resolve, and reduce uncertainty through debate and rejection of claims and evidence to build a collective understanding of a phenomenon fenomena (Bricker & Bell, 2008; Y.-C. Chen, 2020; Grooms et al., 2018; Lee et al., 2014). This is done through the use of language rhetorically or dialogically with most analytic frameworks focusing on claims, evidence, reasoning, counterclaims, and rebuttals (see Figure 1) (Schen, 2013; Xing et al., 2020).

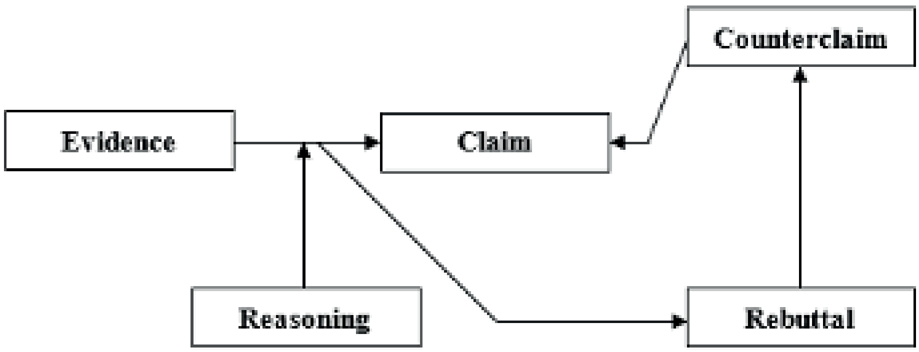

Figure 1. The Structure of Scientific Argumentation

Scientific argumentation is a skill that plays an important role in science, which is rarely applied in the science learning process (Kurniasari & Setyarsih, 2017; Muna & Rusmini, 2021; Rahayu et al., 2020). This resulted in the dominant quality of students' scientific argumentation skills at level 1, namely arguments consisting of simple claims and students sometimes making claims based on inaccurate conceptual understanding (Wardani et al., 2018). This statement is also reinforced by findings based on a preliminary study conducted at a public senior high school in Surabaya, Indonesia, which shows that the majority of students have scientific argumentation skills that are in the low category. Where, most students have been able to make claims quite well, but are not good enough at constructing evidence, reasoning, counterclaim, and rebuttal.

The findings from previous researchers and the results of preliminary studies indicate that students' scientific argumentation skills still need to be improved. In improving scientific argumentation skills, the learning design used must give students more opportunities to build and criticize arguments, make claims, and use evidence in the process of reasoning based on inquiry activities (Mikeska & Howell, 2020). Inquiry-based learning is defined as a multifaceted construction, which in the learning process integrates various components such as conceptual, social, procedural, and epistemological activities (Forbes et al., 2020) which can ultimately affect students' scientific argumentation skills.

Based on the results of previous research, it is known that inquiry-based learning has extraordinary potential in developing students' scientific argumentation skills (Akili et al., 2022; Andrews-Larson et al., 2019; Conn et al., 2020; Hendratmoko et al., 2016; Mariam et al., 2020; Muntholib et al., 2021; Nam & Chen, 2017; Pitorini et al., 2020; Psycharis, 2016; Rohayati et al., 2022; Roja et al., 2020; Sandhy et al., 2018; Septyastuti et al., 2021; Stanford et al., 2016). Where most of the research was conducted in the implementation of inquiry-based offline learning. In other words, there has not been any research that reveals the effects of inquiry-based online learning on students' scientific argumentation skills.

Online learning is a form of distance education that involves the use of technology as a mediator in the learning process and learning is fully delivered via the internet (Heng, 2021; Siemens et al., 2015). Online learning has proven to be quite helpful in carrying out learning in various conditions, such as disasters and pandemics such as Covid-19 (Dhawan, 2020). This shows that online learning offers effectiveness and flexibility in learning activities. Where online learning is also quite effective in supporting student inquiry activities (Williams et al., 2017), this is done with the help of a virtual laboratory. According to Romano et al. (2021), a virtual laboratory can be seen as a technologically enriched environment to support students' scientific argumentation skills.

Based on the previous explanations, it is known that inquiry-based online learning with virtual laboratories seems to be able to provide convenience, flexibility, and effectiveness in improving students' scientific argumentation skills. Therefore, this study aims to reveal the impact of inquiry-based online learning with a virtual laboratory on students' scientific argumentation skills.

Purpose of Study

This study used a one-group pretest-posttest design. According to Ventura et al. (2021), one-group pretest-posttest design is a study conducted in one group, internal validity is limited and there is no control group. According to Sugiyono (2014), the one-group pre-test-posttest design is described as shown in Figure 2.

METHOD

Design

This study used a one-group pretest-posttest design. According to Ventura et al. (2021), one-group pretest-posttest design is a study conducted in one group, internal validity is limited and there is no control group. According to Sugiyono (2014), the one-group pre-test-posttest design is described as shown in Figure 2.

Figure 2. Research Design

The pretest is used to determine students' initial scientific argumentation skills before being given treatment. While the posttest is used to determine students' final scientific argumentation skills after being given treatment. The pretest and posttest scores are then used as a reference in measuring and determining the increase in students' scientific argumentation skills after being given treatment.

The treatment given is the implementation of inquiry-based online learning with a virtual laboratory in science learning. The implemented learning activities are adapted from the inquiry-based lesson (Arends, 2012) which are integrated with the virtual laboratory of PhET Interactive Simulations. The learning activities are divided into three main activities, that is opening online learning, inquiry with a virtual laboratory, and discussion and reflection. The learning steps carried out are presented in Table 1.

Table 1. The Steps of Inquiry-Based Online Learning with a Virtual Laboratory

Phase	Sub Phase	Activity
Opening online learning	Preparation and explanation of the inquiry process.	The teacher opens virtual learning activities through video conferencing by conveying the objectives and learning process.
	Giving problems to be investigated	The teacher divides students into several groups and provides problems related to science and its implementation through student worksheets.
Inquiry with virtual laboratory	Formulate hypotheses	The teacher divides the video conference into several breakout rooms according to the student groups and encourages students to formulate hypotheses or claims for the problems given. Claims that are formulated will direct students to inquiry activities.
	Collecting data	The teacher encourages students to design and conduct experiments using the virtual laboratory of PhET Interactive Simulations to obtain evidence to support the claims that have been made.
	Formulate reasoning and/or conclusions	The teacher asks students to formulate reasoning and/or conclusions based on experimental data. The reasoning made must show the connection between claims and evidence based on related scientific concepts/laws/theories.
Discussion and reflection	Discussion	All students are directed to return to the main video conference room. The teacher guides students to discuss the conclusions of the experiments that have been carried out. In this phase, it is directed to bring up counterclaims and rebuttals based on arguments from the conclusions that have been made.
	Reflection	The teacher asks students to rethink what they have learned. In these steps, the teacher makes students think about their thinking processes and reflect on the inquiry process.

Participants

This study was conducted on science classroom students using a relatively small sample. This was done to optimize the treatment given during the study. The participants were randomly selected using a simple random sampling technique. According to Acharya et al., (2013), the use of simple random sampling allows each individual to have the same opportunity to be selected as the research sample and has the advantage of the ease of data analysis.

The participants of this study were 16 students of grade XII at a public senior high school in Surabaya, Indonesia. The students consisted of 6 male students and 10 female students aged between 16-17 years old. These students will take part in inquiry-based online learning with a virtual laboratory for 6 meetings. Where the first and last meetings were used as a pretest and posttest of scientific argumentation skills.

Data Collection and Analysis

The data collected and analyzed in this study were the pretest and posttest scores of students' scientific argumentation skills. The pretest scores of students' scientific argumentation skills were measured before students took inquiry-based online learning with a virtual laboratory. The posttest scores of students' scientific argumentation skills were measured after students participated in inquiry-based bold learning with a virtual laboratory. Scientific argumentation skills are measured based on a written scientific argumentation test which includes 5 components, that is claims, evidence, reasoning, counterclaims, and rebuttals. The score obtained from each indicator is used as the basis for determining the final score of scientific argumentation skills. The assessment of the student's scientific argumentation skills test is based on the rubric of the assessment of the scientific argumentation skills test with a range of 0 – 3. The method of calculating the final score is written as follows.

$$\text{Final score} = \frac{\text{total score of all components}}{\text{max score}} \times 3$$

The final score obtained by students is then used as the basis for determining the category of students' scientific argumentation skills. The categories of students' scientific argumentation skills are presented in Table 2.

Table 2. Category of Students' Scientific Argumentation Skills

Score	Category of Students' Scientific Argumentation Skills
0.00 – 0.75	Beginner
0.76 – 1.50	Intermediate
1.51 – 2.25	Advanced
2.26 – 3.00	Proficient

The scientific argumentation skill scores obtained from the pretest and posttest were then analyzed using normalized gain (n-gain). N-gain can be calculated using the following equation.

$$n - \text{gain} = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Max Score} - \text{Pretest Score}}$$

N-gain is used to determine the increase in students' scientific argumentation skills after being given treatment. According to Hake (1999), the results of the n-gain calculation are then converted with the following criteria (see Table 3).

Table 3. Category N-Gain Students' Scientific Argumentation Skills

Score	Category of n-gain
$0.70 < \text{n-gain}$	High
$0.30 \le \text{n-gain} \le 0.70$	Medium
$\text{n-gain} < 0.30$	Low

The treatment given, that is inquiry-based online learning with a virtual laboratory is said to have a positive impact if the average n-gain score is at least in the medium category. The use of n-gain can also be used to analyze the improvement of each indicator of scientific argumentation skills before and after participating in inquiry-based online learning with a virtual laboratory.

FINDINGS

Students' scientific argumentation skills were assessed using a scientific argumentation skill test given before and after participating in inquiry-based online learning with a virtual laboratory. The results of the scientific argumentation skills test, both pretest, post-test, and n-gain scores of scientific argumentation skills are presented in Table 4.

Table 4. The Results of Student's Scientific Argumentation Skills Test

Student	Pretest							Posttest							Enhancement	
	C	E	R	Cc	Rb	FS	Category	C	E	R	Cc	Rb	FS	Category	<g>	Category
1	2	2	1	0	0	1	Intermediate	3	3	3	1	1	2,2	Advanced	0,6	Medium
2	2	2	2	1	1	1,6	Advanced	3	3	2	2	1	2,2	Advanced	0,43	Medium
3	2	2	1	1	0	1,2	Intermediate	3	3	2	1	0	1,8	Advanced	0,33	Medium
4	2	2	1	1	0	1,2	Intermediate	3	3	1	1	0	1,6	Advanced	0,22	Low
5	3	3	1	1	0	1,6	Advanced	3	3	3	1	0	2	Advanced	0,29	Low
6	1	1	1	0	0	0,6	Beginner	2	2	2	1	1	1,6	Advanced	0,42	Medium
7	2	1	1	0	0	0,8	Beginner	3	3	2	0	0	1,6	Advanced	0,36	Medium
8	3	2	1	0	0	1,2	Intermediate	3	3	2	1	0	1,8	Advanced	0,33	Medium
9	2	2	1	1	1	1,4	Intermediate	3	3	1	2	1	2	Advanced	0,38	Medium
10	1	1	1	0	0	0,6	Beginner	3	3	3	2	1	2,4	Proficient	0,75	High
11	2	2	2	1	0	1,4	Intermediate	3	3	2	1	1	2	Advanced	0,38	Medium
12	2	2	2	0	0	1,2	Intermediate	2	2	2	1	0	1,4	Intermediate	0,11	Low
13	3	1	1	0	0	1	Intermediate	3	2	1	1	0	1,4	Intermediate	0,2	Low
14	2	1	1	2	1	1,4	Intermediate	3	3	3	2	1	2,4	Proficient	0,63	Medium
15	2	1	1	1	1	1,2	Intermediate	3	2	2	1	0	1,6	Advanced	0,22	Low
16	1	1	1	0	0	0,6	Beginner	3	3	3	0	0	1,8	Advanced	0,5	Medium
Ave.	2	1,6	1,2	0,6	0,3	1,1	Intermediate	2,9	2,8	2,1	1,1	0,4	1,9	Advanced	0,38	Medium

Note: C = Claim; E = Evidence; R = Reasoning; Cc = Counterclaim; Rb = Rebuttal; FS = Final Score; <g> = n-gain Score

Based on the data in Table 4 it is known that the average score of students' initial scientific argumentation skills is in the intermediate category. Then after being given treatment the average score of students' final scientific argumentation skills is in the advanced category. This shows an increase in students' scientific argumentation skills after being given treatment. This increase is also reinforced by the average n-gain score which is in the medium category. The majority of the n-gain scores for students' scientific argumentation skills are also in the medium category, as presented in Figure 3. This shows that the treatment given has an impact on improving students' scientific argumentation skills.

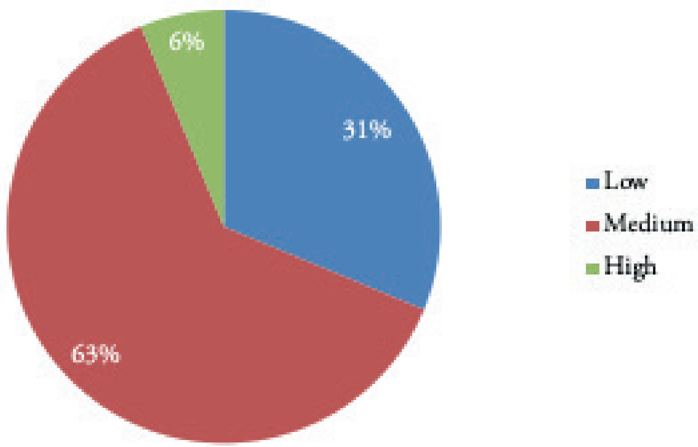

Figure 3. The N-gain Scores for Students' Scientific Argumentation Skills

Furthermore, the scientific argumentation skills test from the pretest and posttest were analyzed for each component. The results of the analysis of the scientific argumentation skills test for each component, that is claim, evidence, reasoning, counterclaim, and rebuttal are presented in Table 5.

Table 5. The Score of Each Component of Students' Scientific Argumentation Skills

Component	Pretest		Post-test		Enhancement	
	Average Score	Category	Average Score	Category	n-gain Score	Category
Claim	2.00	Advanced	2.875	Proficient	0.875	High
Evidence	1.625	Advanced	2.75	Proficient	0.82	High
Reasoning	1.1875	Intermediate	2.125	Advanced	0.52	Medium
Counterclaim	0.5625	Beginner	1.125	Intermediate	0.23	Low
Rebuttal	0.25	Beginner	0.4375	Beginner	0.07	Low

The counterclaim and rebuttal components have a fairly poor average score compared to the other three components. This is also reinforced by the average n-gain score which is only in the low category. The comparison of average pretest and posttest scores for each component of students' scientific argumentation skills is presented in Figure 4.

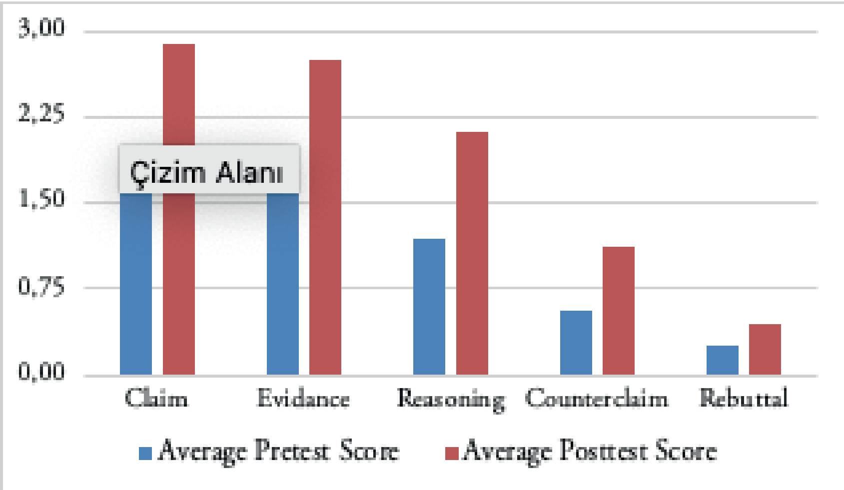

Figure 4. Comparison of Each Component of Students' Scientific Argumentation Skills

DISCUSSIONS AND CONCLUSION

Scientific argumentation is a key component in developing students' knowledge (Ho et al., 2019), especially in science learning practices (Osborne et al., 2019). Where one of the focus points of learning science is to develop students' skills to actively participate in discussions and build scientific argumentation (Tsai, 2018). These skills emphasize the importance of students' social and epistemic interactions for the purpose of developing and critiquing knowledge (Grooms et al., 2018).

Since ancient times, when philosophers started looking for reasons for things, argumentation reached a fundamental position in the construction of knowledge and public debate (Torres & Cristancho, 2018). The concept of scientific argumentation has subsequently become an attraction among policymakers in various countries (Admoko et al., 2021; Henderson et al., 2018). Scientific argumentation has also become a central issue in various studies and research related to science learning in recent years (Kim & Roth, 2018; Nazidah et al., 2022; Valero Haro et al., 2019; Wang et al., 2022; Wulandari et al., 2019). These studies mostly focus on implementing effective learning designs or strategies in improving students' scientific argumentation skills (Ault et al., 2015; Henderson et al., 2018; Osborne et al., 2019; Ping et al., 2020; Sampson et al., 2011). This is what was done in this study, which is investigating the impact of inquiry-based online learning with a virtual laboratory on students' scientific argumentation skills.

Inquiry-based online learning with a virtual laboratory has been proven to improve students' scientific argumentation skills (see Table 4). This is evidenced by the average n-gain score for students' scientific argumentation skills which is 0.38 or is in the medium category. In addition, the majority of the n-gain scores for students' scientific argumentation skills are also in the medium category (see Figure 3). According to (Hake, 1999), a treatment is said to have a positive impact if the n-gain score is at least in the medium category.

Online learning is defined as a learning experience in a synchronous or asynchronous environment using different devices (eg, mobile phones, laptops, etc.) with internet access (Dhawan, 2020). Learning activities that offer this flexibility have developed rapidly over the last decade in most parts of the world (Adnan, 2020; Bayrak et al., 2020; Pei & Wu, 2019). This is also due to the effectiveness of online learning on student learning outcomes (Maness et al., 2023; Panigrahi et al., 2018; Pei & Wu, 2019; Purba, 2020) and the acquisition of higher-order thinking skills (Coman et al., 2020; Dumford & Miller, 2018; Fiock, 2020), especially scientific argumentation skills (Y.-R. Lin et al., 2020; Yeh & She, 2010) as the results of this study.

Inquiry-based online learning with a virtual laboratory which is the focus of this study was developed by adapting inquiry-based lessons (Arends, 2012). Learning is carried out through 3 main activities, namely opening online learning, inquiry with a virtual laboratory, and discussion and reflection (see Table 1). Where learning activities are carried out through video conferences and inquiry activities in the learning process are facilitated with a virtual laboratory from PhET Interactive Simulations. These learning activities are illustrated in Figure 5.

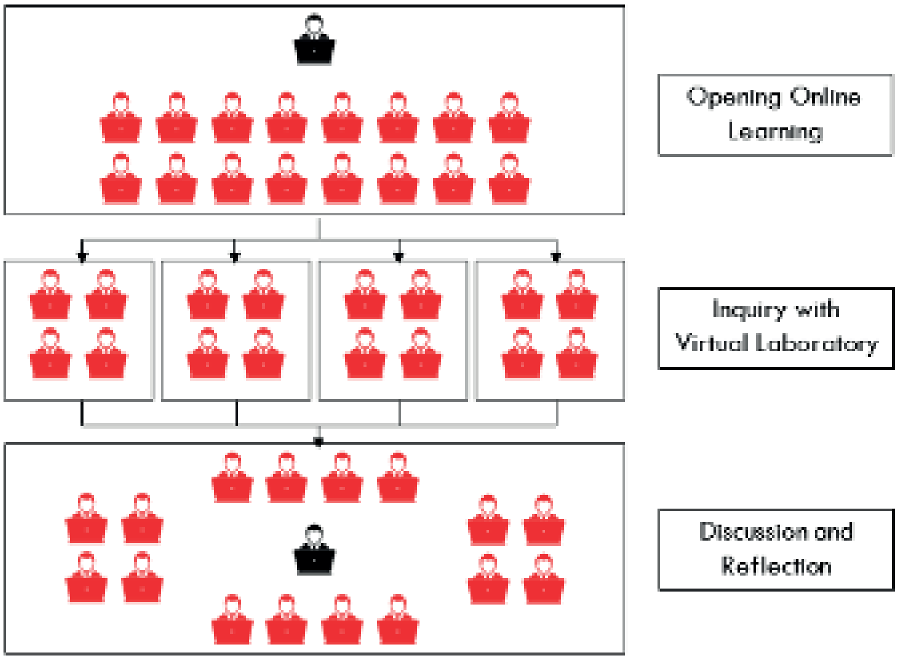

Figure 5. The Design Inquiry-Based Online Learning with Virtual Laboratory

Online learning activities begin with the teacher opening virtual learning via video conferencing. The activity is directed at preparing students and providing an explanation regarding the inquiry process that will be carried out. The teacher conveys the objectives and the learning process that will be carried out. The results of the study show that the delivery of learning objectives can provide a focused mindset for students who are involved in learning (Mitchell & Manzo, 2018). This is the earliest strategy that must be carried out by every teacher because the benchmark for the learning interaction itself departs from the opening learning strategy (Ginting, 2017). In addition, in this initial activity, the teacher also conveyed apperception and motivation to students. Providing apperception and motivation is important for the teacher to do so that students are interested in learning more about the context and content of learning (Rakhmawati, 2016). This is reinforced by the theory of learning motivation which states that for students to be successful in learning, students must be able to take strong initiatives and generate persistence in learning (Arends, 2012). Students must also focus on mental resources, focus on the stimulus provided, and pay attention to the instructions given by the teacher (Moreno, 2010; Santrock, 2011; Woolfolk, 2016). Therefore, focusing and motivating students at the beginning of learning activities is a must to optimize students' scientific argumentation skills.

After students are ready to participate in learning activities, the teacher then divides students into several groups and provides problems related to science and its implementation through student worksheets. The problems given are contextual. Previous findings show that giving problems before the learning process can improve student readiness and learning outcomes (Jayadiningrat et al., 2017). Providing contextual problems at the beginning of learning can help students solve problems with strategies they understand, this is because they can see the relevance of the material being studied to their daily lives and use initial knowledge that is appropriate to the problems at hand (Mulyati, 2016). The problems given are used as a stimulus in encouraging students to carry out inquiry activities. Where inquiry activities are directed at facilitating and improving students' scientific argumentation skills consisting of claims, evidence, reasoning, counterclaims, and rebuttals.

The next step is an inquiry activity with a virtual laboratory. At this step, students are guided to formulate hypotheses, collect data, and formulate reasoning and/or conclusions. Where in this activity, the teacher divides the video conference into several breakout rooms according to student groups. Students carry out inquiry activities through virtual laboratories from PhET Interactive Simulations.

Inquiry activities begin with students formulating hypotheses on the problems given. The formulated hypothesis will direct students to inquiry activities. Formulation of hypotheses is also directed at facilitating students in making claims about a problem. Just as in constructing hypotheses, understanding the learning material is one way for students to be able to make good claims (Ariyanti et al., 2021). In making claims students need to carry out discussions in their groups. Discussion is a way of presenting learning materials in which educators provide opportunities for students or groups of students to hold scientific discussions in order to collect opinions, make claims, make conclusions, or compile various alternative problem-solving (Junita & Siregar, 2018).

The treatment given in the hypothesis formulation activity proved effective in improving students' scientific argumentation skills on the claim component (see Table 5). The average pretest and posttest scores for the claim component have a significant difference (see Figure 4). The increase in the claim component is in the high category with an average n-gain score of 0.875. The final average score of students on the claim component is in the proficient category. This shows that in scientific argumentation, students have been able to make good claims about the problems given.

The treatment given in the hypothesis formulation phase guides students to explore and use prior knowledge that they already have in making claims on the problems given. In addition, an understanding of the problem can also affect the resulting claims. Therefore, students are directed to discuss making claims. Through discussion activities, there is a process of exchanging information and knowledge between students regarding the problems given.

Based on the claims that have been formulated, students are directed to activities to collect data. Students are encouraged to carry out inquiry activities by designing and conducting experiments with virtual laboratories. Inquiry activities have a positive effect on students to control their learning process through experimentation (Rutten et al., 2015), in this case, scientific argumentation skills. In addition, the positive impact of inquiry activities in the learning process can also arouse student activity in participating in learning and can increase student interest in learning (Pardimin et al., 2021). On the other hand, virtual laboratories make learning more meaningful by enabling the concretization of abstract subjects, supporting interest, bringing joy, and motivating students towards learning science (Yildirim, 2021). Inquiry-based virtual laboratories provide opportunities for students to construct conceptual understanding through simulation activities and virtual practicum. Learning using inquiry-based virtual laboratories can foster self-confidence and develop students' creative thinking skills and critical thinking (Junaidi et al., 2016). Critical thinking skills are the basis for building scientific arguments.

Falk & Brodsky (2013) stated that inquiry activities can support students in building scientific argumentation. Scientific inquiry is an important part of scientific argumentation which is intended to produce evidence and rational justification (Muntholib et al., 2021). Inquiry activities through experiments using virtual laboratories are carried out to collect data as evidence to strengthen claims. Evidence is the second component of scientific argumentation skills. Based on the research results, it is known that inquiry activities through experiments with virtual laboratories can improve students' scientific argumentation skills on the evidence component. The evidence component experienced an increase in the high category with an average n-gain score of 0.82 (see Table 5). The average pretest and posttest scores for the evidence component have a significant difference (see Figure 4). The average student's final score for the evidence component is in the proficient category. This shows that in scientific argumentation, students have been able to provide strong evidence to substantiate their claims.

Data or scientific evidence that has been collected based on inquiry activities with a virtual laboratory is then analyzed by students. An analysis is part of an important cognitive ability, analysis is used to identify actual intentions and conclusions between sentence relationships, questions, structures, concepts, descriptions, opinions, reasons, information, and explanations (Facione, 2011). Data analysis was carried out to produce reasoning which is the third component of scientific argumentation skills.

Reasoning is one of the basic forms of simulated thinking, and the process of inferring new judgments (conclusions) from one or several existing judgments (premises) (Y.-C. Chen, 2020). According to Lawrence & Reed (2020), the task of understanding argument reasoning requires a system to use the given premises and conclusions to distinguish between two given alternative possibilities (there is also further contextual information available, with explicitly identified topics and backgrounds). In the context of scientific argumentation, the reasoning is used to show the relationship between claims and evidence based on related science concepts/laws/theories.

Based on the research results, it is known that the reasoning component has increased to the medium category with an average n-gain score of 0.52 (see Table 5). The average pretest and posttest scores for the reasoning component have a not-too-significant difference (See Figure 4). The average student's final score for the reasoning component is in the advanced category. This shows that in arguing scientifically students have been able to provide reasoning, but the reasoning given is not good enough. This also indicates that students have been able to show the connection between claims and evidence, but have not provided enough support with related science concepts/laws/theories.

Not enough good reasoning is produced by students because compiling reasoning requires a complex level of thinking, students must use higher-order thinking skills, such as critical thinking skills. Therefore, the teacher must guide students so they can make good reasoning. The guidance given can be in the form of an explanation regarding the structure of reasoning in scientific argumentation. Where in scientific argumentation, the reasoning is an explanation that shows the connection between claims and evidence based on related science concepts/laws/theories. Understanding of learning materials and interest in reading needs to be developed by students so that they can improve their ability to make a reasoning. Therefore, the teacher's role is very important to guide and direct students so that they want to develop an interest in reading and understand the learning material well (Ariyanti et al., 2021).

The next step of inquiry-based online learning activities with a virtual laboratory is discussion and reflection. This is the final phase of the learning activity. At this step, all students are directed to return to the main video conference room. The teacher guides students to discuss the conclusions of the experiments that have been carried out. This class discussion activity is expected to be able to facilitate counterclaim and rebuttal components.

The discussion process begins with the teacher asking one of the representatives from the student group to submit a claim to the problems given at the beginning of the lesson. The other groups were then asked to respond to these claims. In the activity of responding to each other, a claim that is contrary to the initial claim is known as a counterclaim. However, the results of this study indicate that the increase in the counterclaim component is in a low category with an average n-gain score of 0.23 (see Table 5). The average pretest and posttest scores for the counterclaim component have a not-too-significant difference (See Figure 4). The final average score of students on the counterclaim component is in the intermediate category. This means that the average student has not been able to produce a counterclaim that is in direct conflict with the initial claim so the arguments produced are at a low level. This is as stated by Erduran et al. (2004) who state that, when there is a debate among students but the debate consists only of unrelated counterarguments, this is considered a low-level argument.

As is the case with a counterclaim, students' skills to produce rebuttals have increased in the low category with an average n-gain score of 0.07 (see Table 5). The average pretest and posttest scores for the rebuttal component have a not significant difference (See Figure 4). The final average score of students for the rebuttal component is at the beginner level. This shows that students have not been able to produce rebuttals to the arguments given.

Counterclaims and rebuttals are key elements in argumentation, this is a skill to oppose arguments by presenting counterarguments. This is a significant component for determining the quality of an argument (Erduran et al., 2004) and when it is added, the argument becomes more complex (Anisa et al., 2019; Capkinoglu et al., 2020). It is an important skill, not easy to learn, and valued in many fields such as politics and science (Orbach et al., 2019).

Counterclaims and rebuttals are indicators of argumentation skills that are more complex than other components, so they require special treatment to experience optimal improvement. The low-quality improvement of counterclaims and rebuttals in this study indicates that discussion activities are not sufficient to facilitate this. Therefore, to produce a good counterclaim and rebuttal quality, it is necessary to present a debating method in the learning process. Debate in learning activities encourages students to convey, refute, and defend ideas or opinions (Al Giffari et al., 2021; Darman, 2022; Wagu & Riko, 2020). This is the practice of speaking skills and intelligent behavior in dealing with various points of view which are proven to be able to develop students' abilities to think critically, rationally, argumentatively, and creatively (Pudjantoro, 2015). The application of the debate method in science learning activities is proven to improve students' scientific argumentation skills (Dawson & Carson, 2017; Felgenhauer & Xu, 2019; Lytos et al., 2022; Martini et al., 2021; Mohammed et al., 2019; Suraya et al., 2019; Turabova, 2021).

The final step of inquiry-based online learning activities with a virtual laboratory is reflection. At this step, the teacher asks students to rethink what they have learned. Teachers get students to think about their thought processes and to reflect on inquiry processes. Although it does not contribute directly to students' scientific argumentation skills, reflection activities still need to be presented at the end of the lesson. According to Listiyani (2018), reflection activities are one of the basic process skills of students in concluding the learning process that is used to determine the extent of students' knowledge and achievements in understanding the material after participating in learning and conducting inquiry activities. Reflection in learning is needed for students to review what they have learned for improvement and deep learning. This allows students to document their learning journey and provide references and suggestions for the future (Chang, 2019).

In conclusion, the application of inquiry-based online learning with a virtual laboratory can be used to improve students' scientific argumentation skills. The increase in students' scientific argumentation skills on average is in the medium category with an average n-gain score of 0.38 (see Table 4). This means that inquiry-based online learning with virtual laboratories has a positive impact on increasing students' scientific argumentation skills. Students' scientific argumentation skills increased with a high category on the claim and evidence components. The reasoning components increased with the medium category. However, counterclaims and rebuttals increased with the low category. This means that the treatment given during the learning activities is not sufficient to facilitate counterclaim and rebuttal components. This is to the findings from Hendratmoko et al. (2016) which state that the implementation of inquiry-based learning has no significant impact on the counterclaim and rebuttal components. This is because these two components are components of more complex scientific argumentation skills that require higher critical thinking skills and reasoning processes. In addition, the stages in inquiry-based learning also cannot facilitate the development of counterclaim and rebuttal components.

The essence of scientific argumentation is to support claims with evidence and reasoning and then refute or refute the opponent's claims and evidence (Woolfolk, 2016). As this study concludes, supporting claims with evidence and reasoning can be facilitated through inquiry-based learning. However, to produce a counterclaim and rebuttal of the opponent's claims and evidence it is not enough just to apply the discussion method to learning activities. To facilitate these two components, it is necessary to present a debating method in learning activities. Where the debate method is proven to be able to improve students' scientific argumentation skills (Dawson & Carson, 2017; Felgenhauer & Xu, 2019; Lytos et al., 2022; Martini et al., 2021; Mohammed et al., 2019; Suraya et al., 2019; Turabova, 2021). Therefore, as a follow-up to this study, it is suggested to integrate inquiry-based learning with the debate method to optimally improve students' scientific argumentation skills.

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THE RELATIONSHIP BETWEEN PROSPECTIVE TEACHERS' PERCEIVED IMPORTANCE OF ONLINE TEACHING COMPETENCIES AND THEIR SELF-EFFICACY BELIEFS

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ABSTRACT

Online teaching caught in-service teachers off-guard with emergency distance education and sparked interest to teacher education programs. Purpose of this study is to explore self-efficacy beliefs of prospective teachers in teaching online (SETO) and to determine the relationship between pre-service teachers' importance of online teaching competencies (IOTC) perceptions and their SETO beliefs. 101 pre-service teachers were asked to fill faculty readiness to teach online scale and the responses were analyzed through ANOVA and Pearson Correlation. The results showed a significant difference between pre-service teachers' majors, exposure to ICT-related experiences, and their SETO beliefs. In addition, there is a significant relationship between pre-service teachers' IOCT perceptions and SETO beliefs. Understanding the existing SETO beliefs of pre-service teachers is critical because it provides evidence to reassess how pre-service teachers are supported to build their online teaching competencies. The results are expected to make a significant contribution to research on establishing online teaching competencies in Turkiye and assisting teachers in understanding the value of those competencies; as a result, potential implementers may have stronger online teaching self-efficacy in their distance classrooms. The study suggests incorporating technology-based resources into teacher education courses within a digital pedagogy competencies framework to increase pre-service teachers' self-efficacy.

Keywords: Pre-service teachers, online teaching competencies, online teaching self-efficacy.

INTRODUCTION

The emergency distance education that has entered our lives because of the COVID-19 pandemic has pushed governments to close schools and provide full-time remote schooling (Carretero et al., 2021). Instructors changed the delivery mode of instruction from face-to-face to online teaching. They attempted to integrate cutting-edge technologies into their online classroom settings in order to meet the individual needs of students and achieve curriculum goals and objectives. Some in-service teachers stated that they lacked the expertise and abilities to transfer offline content to online ones (Izhar et al., 2021), and they had not previously been educated or trained for teaching online (Schleicher, 2020). Before the pandemic, distance learning was an already accessible method of teaching and learning (Marek et al., 2021); however, many instructors, including those who are senior and experienced in their field, have only recently been introduced to this schooling type with pandemic and emergency distance education. Bruder (1989) defined distance education as a style of education in which students and lecturers are physically separated, i.e., they live in different places, and instruction is conveyed between them using various technologies. It has undoubtedly grown and changed in recent years, and many nations have recently started to implement some kind of it due to a dramatic move away from classrooms in many areas of the world; most instructors nowadays consider distance education to be a novel concept; however, the ideas that underpin distance education are over a century old, and the field's lengthy traditions are what continue to steer it in the right path (Simonson et al., 2019).

According to Pregowska et al. (2021), online teaching seems to 'become the latest norm' (p. 2). Teaching and learning have become more reliant on information and communication technology (ICT) ever than before with the pandemic (Brown, 2020). Even if the pandemic will be out of our lives, the reality of online education has now taken its place in our system. According to the report published by Education Reform Initiative (2020), the competencies related to digital pedagogy in online learning environments are now essential skills that teachers should possess.

Digital Competence

According to the report published by TEDMEM (2020), teachers' digital abilities were one of the major themes of distance education throughout the pandemic. So far, several definitions and conceptual frameworks related to digital competence have been proposed to increase teacher candidates' and teachers' digital capacities (Falloon, 2020, as cited in TEDMEM, 2021). Facer & Selwyn (2021) argue that for more than 30 years, the development of digital competence in teacher education has been considered (as cited in TEDMEM, 2021). In policy documents and studies published by international organizations, the idea of digital competence essentially comprises social-emotional components for utilizing and comprehending digital devices and digital abilities. To illustrate it, within the framework of digital competence, which is one of the Lifelong Learning Competencies prepared by the European Parliament (2006), digital competence is defined as using digital technologies with a confident and critical perspective to gain knowledge, communicate, and solve fundamental problems in all aspects of life (as cited in TEDMEM, 2021). In recent years, many nations have developed digital competency initiatives and changed their educational systems to achieve this goal (Paacola et al., 2016).

In Turkiye, digital competence is not defined as a different field within the General Competencies for Teaching Profession Report published by the Ministry of National Education General Directorate of Teacher Training and Development (2017). In the Digital Literacy Teacher's Guide (2020), which is one of the guidebooks shared by the Turkish Ministry of National Education with teachers during the pandemic, digital literacy is defined as the set of knowledge, skills, and attitudes needed to participate in digital life, to live, learn and work in a digital society (as cited in TEDMEM, 2021).

Technological Pedagogical Content Knowledge (TPACK) Framework

Online teaching is fundamentally different from traditional classroom instruction in that it is entirely dependent on technology. Before beginning their online teaching career, teacher candidates must be prepared with technological, pedagogical, and subject understanding (Koehler & Mishra, 2009). The basis of the TPACK framework is the Pedagogical Content Knowledge model proposed by Shulman (1986). The technology dimension, which is among the new century skills, was added by Koehler and Mishra to Shulman's model in 2009 and the TPACK model emerged. According to this paradigm, teachers must grasp both conventional academic subjects and digital components of the teaching subject (Gudmundsdottir & Hatlevik, 2018). TPACK is the foundation of effective technology-assisted education, requiring a grasp of how concepts are represented using technology. It addresses pedagogical strategies for teaching material that make constructive use of technology, how technology may assist students in solving some of their challenges, and how technology may be used to build on current knowledge in order to create new epistemologies or reinforce existing ones (Koehler & Mishra, 2009). Consequently, the TPACK framework develops a lens through which to view instruction that emphasizes technology. Because online classes rely on technology, teachers must comprehend the TPACK structure (Koehler & Mishra, 2009).

Online Teaching Competencies

Based on a review of literature, Martin et al. (2019) looked at four categories of online teaching competencies: course design, course communication, time management, and technical skills. Varvel (2007) stated that course objectives, instructional strategies, instructional materials, and the assessment procedures that fit with objectives are all part of the course design competence (as cited in Martin et al., 2019). Goodyear et al. (2001) highlighted the significance of interpersonal contact and interaction between the teacher and students as a course communication competence in online courses (as cited in Martin et al., 2019). Varvel (2007) argued that competent teachers are able to manage their time well so that their personal responsibilities do not interfere with their ability to teach the course (as cited in Martin et al., 2019). Finally, technical competence includes being able to take advantage of softwares, synchronous and asynchronous tools, operating systems, learning systems and tools, and web browsers (Martin et al., 2019).

Teacher education programs are designed to train competent instructors who are ready to enter the classroom and handle the challenges that come with being a new teacher (Ooyik et al., 2021). Moran & Hoy (2001) indicated that as a new teacher, being underprepared has an impact on self-efficacy, confidence, and readiness to adopt good teaching practices (as cited in Ooyik et al., 2021).

Teacher Self-efficacy

Bandura's Social Learning Theory established the notion of self-efficacy belief, which is about one's confidence in their capacity to deal with the duties, responsibilities, and problems that come with their vocation (Bandura, 1982). According to Sheldon & Byers (2002), teachers that have high levels of self-efficacy in instructional technologies employ more technology in their classrooms. In this regard, instructors with a low degree of self-efficacy in technology integration are less likely to succeed (Wang et al., 2004). In their study, Karatas et al. (2017) argued that inexperienced instructors lack confidence in their ability to successfully educate by utilizing technology in the classroom (as cited in Martin et al., 2020). Tondeur 's research study (2012) suggests that the amount and quality of pre-service technological experiences provided in teacher education programs is a critical element affecting beginning teachers' self-efficacy in use of technology (as cited in Martin et al., 2020).

PURPOSE OF THE STUDY

When most of the recent studies in the literature are examined, teachers highlighted that a lack of online teaching abilities among teachers was driven by their lack of experience (Aytac, 2021; Hassan et al., 2020; Izhar et al., 2021; Schleicher, 2020; Yastibas, 2021). In his study Aytac (2021) revealed that teachers are unsure about which web tools and resources to use, as well as which strategies to employ. Izhar (2021) found that teachers' online teaching skills were lacking because of their lack of experience. As a result, they had difficulties in developing instructional materials that could cater to students of various levels, devising appropriate methods for all students, and planning lessons. When Hassan et al. (2020) asked teachers to rank the complexity of developing e-content or using online modes of teaching, the majority of teachers rated it as extremely tough. The recent studies in the literature emphasize that teachers that were caught off-guard in emergency distance education period were unfamiliar with the concept of online teaching during their pre-service education period (Corcuera & Alvarez, 2021; Yastibas, 2021) and it shifted the arrows in the direction of pre-service education. This study intends to determine the extent to which the future implementers, prospective teachers, perceive the importance of online teaching competencies and whether they have a high self-efficacy in teaching online. Several studies conducted with pre-service teachers have recently emphasized the significance of prospective teachers' self-efficacy beliefs and technology integration (Birisci & Kul, 2019; Caner & Aydin, 2021; Chukwuemeka et al., 2019; Kim & Lee, 2018; Naz et al., 2020; Song, 2018). With the light of literature, it is crucial for preservice teachers to have a high self-efficacy belief in order to integrate technology and create efficient distant learning programs (Baser, 2021; Caka, 2021; Cooper et al., 2020).

In their experimental study Kim & Lee (2018) demonstrated that The TPACK education program proved effective in increasing preservice teachers' self-efficacy. In their research study Naz et al. (2020) advise using technology-based materials in teacher education courses linked to technology integration to improve pre-service teachers' self-efficacy about online teaching. In the study conducted by Caner & Aydin (2021) it is proposed that pre-service teacher education institutions should plan additional programs to improve pre-service teachers' technology integration skills, particularly in using technology in the classroom. Similarly, Cooper et al. (2020) noted that prospective teachers are more comfortable using computers when a full technology integration project is completed. This study aims to contribute to this growing area of research by exploring Turkish prospective teachers' self-efficacy beliefs in teaching online according to their majors, years of study and previous exposure to ICT. This study seeks to obtain data which will help to address teacher education curricula to include technology courses that may be utilized in online teaching and provide pre-service teachers with the skills, expertise, and experience needed to conceive, design, and deliver online courses (Yastibas, 2021). This work will generate fresh insight into making arrangements by adding the online teaching dimension to pre-service teachers' currently implemented curricula and internship experience. The importance and originality of this study is that it explores the relationship between prospective teachers' IOTC perceptions and their self-efficacy in teaching online. The findings related to the relationship are expected to make an important contribution to the field of teacher education and educational technology. Understanding the link between IOTC and SETO is expected to make a major contribution to research on establishing online teaching competencies and assisting prospective teachers in understanding the value of those competencies, and consequently it might help future implementers to have stronger online teaching self-efficacy in their future distance classrooms. As underlined in the TEDMEM Report (2021), when the available resources on teacher digital competencies in Turkiye are examined, it is seen that although there are guidebooks, scientific studies, and additional resources to develop these competencies, there is no Teacher Digital Competence Framework determined according to national needs at the central level. When the General Competencies for Teaching Profession (2017) published by the Ministry of National Education are examined, it is noteworthy that digital pedagogy has not been issued and the online teaching dimension has not been acknowledged. Absence of a digital pedagogical competence framework and overlooking the significance of online teaching competencies in General Competencies for Teaching Profession are the biggest impediments to determine which online teaching competencies to instill in prospective teachers during the pre-service phase and develop an action plan. Therefore, this study this study will raise awareness about updating the General Competencies for Teaching Profession published in 2017 in a way that will also address the online teaching dimension highlighted by the emergency distance education reality in 2020. Furthermore, it offers a fresh perspective on the guidance for a new framework to be created in Turkiye to define pre-service teacher online teaching competencies.

This study aimed to address the following research questions:

1. Does pre-service teachers' self-efficacy in teaching online significantly differ according to their majors, years of study, and previous exposure level to ICT?
2. Is there a relationship between pre-service teachers' importance of online teaching competencies perceptions and their self-efficacy beliefs in teaching online?

METHOD

Research Design

The research is design as quantitative research. Fraenkel et al. (2012) argue that quantitative studies seek to create correlations between variables and occasionally explain the causes of such relationships. The goal of quantitative educational research is to understand and predict relationships. The ultimate goal is the construction of laws that allow prediction rather than a comprehension of what things signify to others (Fraenkel et al., 2012). Therefore, for this study, to be able to explore self-efficacy beliefs of prospective teachers in teaching online (SETO) and to determine the relationship between pre-service teachers' importance of online teaching competencies (IOTC) perceptions and their SETO beliefs; quantitative research method is used.

For the first research question the design of this quantitative study was selected as causal-comparative research since the researcher tries to figure out 'what causes or effects differences that already exist between or among groups' of students (Fraenkel et al., 2012, p.366). The fundamental causal-comparative strategy starts with a noticeable difference between two groups and searches for plausible causes or effects. Thus, the researcher's purpose in this casual comparative research design was to see if the independent variables have an effect on the dependent variable by comparing two or more groups of people (Fraenkel et al., 2012).

The correlational research methodology was selected for the second research question because the aim is to determine the link between two variables rather than to establish a cause-and-effect explanation (Fraenkel et al., 2012).

Participants

By applying the purposive sampling method, the data were collected from 101 pre-service teachers. Fraenkel et al. (2012) argue that purposive sampling differs from convenience sampling in that researchers do not just study anyone is available, but rather utilize their judgment to select a sample that they believe will offer the data they require based on past information. Since the must and elective ICT courses were not available to first-year students at the well-known university where the data was gathered, they were excluded from the study. Thus, the target population of the study is the sophomores, juniors, and seniors.

Among the participants (*N*=101), 19.8 % of them were from the department of Computer Education and Instructional Technology (CEIT) (*n*=20), 22.8 % of them were from the department of Elementary and Early Childhood Education (ELE) (*n*=23), 29.7 % of them were from the department of Foreign Language Education (FLE) (*n*=30), and 27.7 % of them were from the department of Mathematics and Science Education (MSE) (*n*=28). Frequency table related to departments is shown in Table 1.

Table1. Departments of the Student

	Frequency	Percent	Cumulative Percent
Computer Education and Instructional Technology	20	19.8	19.8
Elementary and Early Childhood Education	23	22.8	42.6
Foreign Language Education	30	29.7	72.3
Mathematics and Science Education	28	27.7	100
Total	101	100	

Among the participants (*N*=101), 36.6 % of them were sophomores (*n*=37), 30.7 % of them were juniors (*n*=31), 32.7 % of them were seniors (*n*=33). Frequency table related to departments is shown in Table 2.

Table 2. Students' Years of Study

	Frequency	Percent	Cumulative Percent
2nd year student	37	36,6	36,6
3rd year student	31	30,7	67,3
4th year student	33	32,7	100,0
Total	101	100,0	

To understand the level of exposure to ICT, pre-service teachers were asked whether they had ever taken a course related to technology integration in education, and whether they had a training or course that has an online teaching as a dimension or component. While 12.9 % of the participants stated that they had not taken a course related to technology integration in education (*n*=13), 87.1 % of the participants stated that they had taken a course related to technology integration in education (*n*=88). While 51.5 % of the participants stated that they had not taken a course or training that has a component or dimension regarding online teaching (*n*=52), 48.5 % of the participants stated that they had taken a course or training that has a component or dimension about online teaching (*n*=49).

According to the descriptive results, 10.9 % of the participants had a low level of exposure to ICT (*n*=11), 42.6 % of the participants had an average level of exposure to ICT (*n*=43), and 46.5 % of the participants had a high level of exposure to ICT (*n*=47). Frequency table related to exposure is shown in Table 3.

Table 3. Total Exposure of Students

	Frequency	Percent	Cumulative Percent
Low (1.00)	11	10.9	10.9
Average (1.50)	43	42.6	53.5
High (2.00)	47	46.5	100
Total	101	100	

Instrumentation

Pre-service teachers were asked to fill a 5-point Likert faculty readiness to teach online scale which was developed by Martin et al. in 2019. The scale has two constructs: perceived importance of online teaching competencies and self-efficacy beliefs in online teaching. The Cronbach's alpha was found to be 0.88 and 0.92 for the two constructs, respectively. Online teaching competencies include the skills related to course design, course communication, time management and technical. Course design competencies include constructing an online course orientation, writing quantifiable learning objectives, organizing instructional materials into modules, developing learning activities that allow students to participate, making online quizzes, designing online assignments, and managing marks online. Course communication competencies include sending out announcements to students, creating discussion forums, responding to students' inquiries quickly, providing feedback on tasks, and using web conferencing tools. Time management competencies include arranging time to develop the course prior to delivery, sparing weekly hours to facilitate the online course, allocating weekly hours to evaluate assignments, and arranging time to learn about new tactics and tools. Lastly, technical competencies include performing basic computer operations, sharing open educational resources, and utilizing online help resources for assistance.

At first, participants were asked to judge how significant each competency is for online teaching on a 5-point Likert scale ranging from 1 (not at all important) to 5 (very important). After then, they rated how well they can do the tasks based on their own assessments of their abilities on a 5-point Likert scale ranging from 1 (I can't do it at all) to 5 (I can do it perfectly).

Data Analysis

The descriptive and inferential analysis of the study were conducted using the Statistical Package for Social Science Version 28.0 (SPSS 28.0). The data were initially condensed and summarized using descriptive statistics. After then, since first research question has only one dependent variable (self-efficacy) and it has more than two groups, one-way analysis of variance (ANOVA) was utilized for the independent variable one-to-one (majors, years of study & ICT experience). An alpha level of .05 was utilized for the study. Before running one-way ANOVA, the normality assumption was checked by examining Skewness & Kurtosis values. Homogeneity assumption was checked by Levene's Test (Gravetter & Wallnau, 2018).

Correlational aspect of the study was analyzed with Pearson correlation coefficient. An alpha level of .01 was utilized for the study. The linearity assumption was checked by examining the scatter plot. (Gravetter & Wallnau, 2018).

RESULTS

Descriptive Results

The mean score of the sum of IOTC perception scores were found to be 146.61 (*SD*= 10.50). As displayed in the histogram, Figure 1, sum of importance perception levels has a negatively skewed distribution. Mean (146,61) is lower than the mode (152). On the right side of the graph, more scores are drawn, whereas on the left side, the tail of the distribution is longer.

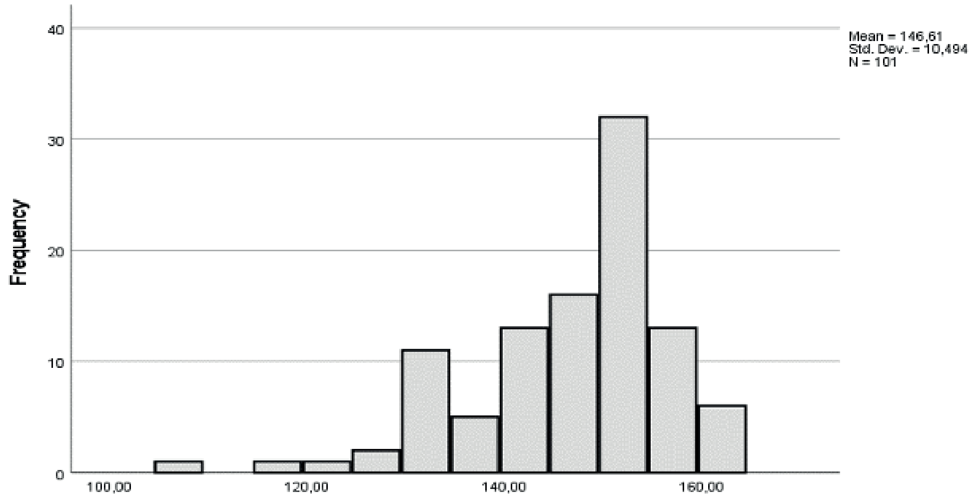

Figure 1. The mean score of the sum of IOTC perception scores

The mean score of the sum of pre-service teacher SETO scores were found to be 146.61 (*SD*= 14.81). As displayed in the histogram, Figure 2, sum of self-efficacy levels has a negatively skewed distribution. Mean (140.70) is lower than the mode (160). On the right side of the graph, more scores are drawn, whereas on the left side, the tail of the distribution is longer.

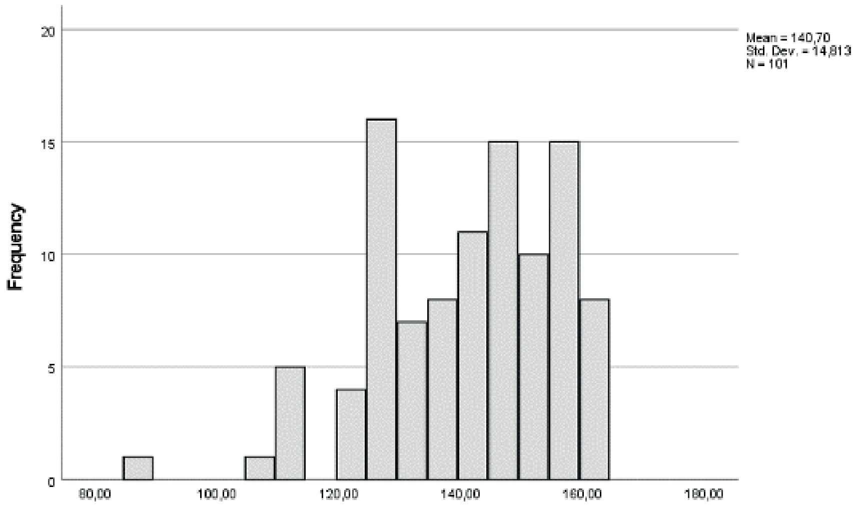

Figure 2. The mean score of the sum of pre-service teacher SETO scores

The data gathered by summing all IOTC perception levels were split into four by departments of the students. Statistics showed that mean of the sum of IOTC perception levels was slightly higher for participants from CEIT department (*M*= 151.20, *SD*= 6.80) than participants form MSE department (*M*= 150.57, *SD*= 10.72). Furthermore, mean of the sum of IOTC perception levels was slightly higher for participants from ELE department (*M*= 145.73, *SD*= 10.63) than participants from FLE department (*M*= 140.53, *SD*= 9.40). Descriptive statistics of the importance perception levels by departments is displayed in Table 4.

Table 4. Mean of Sum Perception by Departments

Departments	N	Mean	SD
CEIT	20	151.20	6.79
MSE	28	150.57	10.72
ELE	23	145.74	10.63
FLE	30	140.53	9.40

The data gathered by summing all self-efficacy levels were split into four by departments of the students. Statistics showed that mean of the sum of self-efficacy levels was slightly higher for participants from CEIT department (*M*= 148.85, *SD*= 8.80) than participants form MSE department (*M*= 146.14, *SD*= 14.16). Furthermore, mean of the sum of self-efficacy levels was slightly higher for participants from ELE department (*M*= 137.17, *SD*= 11.60) than participants from FLE department (*M*= 132.90, *SD*= 16.43). Descriptive statistics of self-efficacy in teaching online by departments is displayed in Table 5.

Table 5. Mean of Sum Efficacy by Departments

Departments	N	Mean	SD
CEIT	20	148.85	8.80
MSE	28	146.14	14.16
ELE	23	137.17	11.60
FLE	30	132.90	16.43

The data gathered by summing all IOTC perception levels were split into three by students' years of the study. Statistics showed that mean of the sum of importance perception levels was slightly higher for senior students (4^{th} year) (*M*= 148.27, *SD*= 11.15) than junior students (3^{rd} year) (*M*= 146.06, *SD*= 10.97). Finally, the mean of the sum of importance perception levels was lowest for sophomore students (2^{nd} year) (*M*=145.73, *SD*= 10.63). Descriptive statistics of the importance perception levels by years of study is displayed in Table 6.

Table 6. Mean of Sum Perceptions by Years of Study

Years of Study	N	Mean	SD
Senior	33	148.27	11.15
Junior	31	146.06	10.97
Sophomore	37	145.59	9.55

The data gathered by summing all self-efficacy levels were split into three by students' years of study. Statistics showed that mean of the sum of self-efficacy levels was slightly higher for junior students (*M*= 145.10, *SD*= 1.40) than sophomores (*M*= 137.73, *SD*= 16.90). Finally, the mean of the sum of importance perception levels was lowest for senior students (*M*= 139.91, *SD*= 12.90). Descriptive statistics of self-efficacy in teaching online by years of study is displayed in Table 7.

Table 7. Mean of Sum Efficacy by Years of Study

Years of Study	N	Mean	SD
Junior	31	145.10	13.39
Senior	33	139.91	12.90
Sophomore	37	137.73	16.90

The data gathered by summing all importance perception levels were split into three by pre-service teachers' previous experience in ICT. Statistics showed that mean of the sum of perceived importance was higher for pre-service teachers who had a high level of exposure to ICT (*M*= 149.40, *SD*= 10.46) than students who had an average level of exposure (*M*= 144.67, *SD*= 10.20). Finally, the mean of the sum of importance perception levels was lowest for students who had low level of ICT related experiences (*M*= 142.27, *SD*= 9.34). Descriptive statistics of the importance perception levels by ICT exposure is displayed in Table 8.

Table 8. Mean of Perceptions by Exposure

Total Exposure	N	Mean	SD
High	47	149.40	10.46
Average	43	144.67	10.20
Low	11	142.27	9.34

The data gathered by summing all self-efficacy levels were split into three by pre-service teachers' previous experience in ICT. Statistics showed that mean of the sum of self-efficacy in teaching online was higher for pre-service teachers who had a high level of exposure to ICT (*M*= 149.40, *SD*= 10.46) than students who had an average level of exposure (*M*= 144.67, *SD*= 10.20). Finally, the mean of the sum of self-efficacy in teaching online was the lowest for students who had low level of ICT related experiences (*M*= 142.27, *SD*=9.34). Descriptive statistics of self-efficacy in teaching online by ICT exposure is displayed in Table 9.

Table 9. Mean of Sum Efficacy by Exposure

Total Exposure	N	Mean	SD
High	47	146.66	12.12
Average	43	137.21	14.89
Low	11	128.90	14.66

Results of the First Reseach Question

Does pre-service teachers' self-efficacy in teaching online significantly differ according to their majors, years of study, and previous exposure level to ICT?

According to Levene's test, the homogeneity of variance assumption is not violated for the self-efficacy levels & students' majors. (*F Levene* (3,97) = 1.87, $p > .05$). According to Levene's test, the homogeneity of variance assumption is not violated for the self-efficacy levels & students' years of study. (*F Levene* (2,98) = 1.44, $p > .05$). According to Levene's test, the homogeneity of variance assumption is not violated for the self-efficacy levels & pre-service teachers' ICT related experiences. (*F Levene* (2,98) = .31, $p > .05$). Thus, it can be said that populations from which the samples were selected had equal variances.

Skewness and Kurtosis values for each level was examined. The first level of the first independent variable, the department of CEIT, had a normal sampling distribution with skewness of -.60 (*SE*= .51) and kurtosis of -.20 (*SE*= .99). The second level of the first independent variable, the department of MSE, had a normal sampling distribution with skewness of -.84 (*SE*= .44) and kurtosis of -.48 (*SE*= .86). The third level of the first independent variable, the department of ELE, had a normal sampling distribution with skewness of -.55 (*SE*= .48) and a kurtosis of .05 (*SE*= .94). The fourth level of the first independent variable, the department of FLE, had a normal sampling distribution with skewness of -.73 (*SE*= .43) and kurtosis of .48 (*SE*= .83). The researcher assumed that the normality assumption was not violated.

The first level of the second independent variable, sophomores, had a normal sampling distribution with skewness of -.95 (*SE*= .39) and kurtosis of .78 (*SE*= .76). The second level of the second independent variable, juniors, had a normal sampling distribution with skewness of -.68 (*SE*= .42) and kurtosis of -.40

(*SE*= .82). The third level of the second independent variable, seniors, had a normal sampling distribution with skewness of -.59 (*SE*= .41) and kurtosis of -.08 (*SE*= .80). The researcher assumed that the normality assumption was not violated.

The first level of the third independent variable, low exposure level to ICT, had a normal sampling distribution with skewness of .05 (*SE*= .66) and kurtosis of -1.13 (*SE*= 1.28). The second level of the third independent variable, average level of exposure to ICT had a normal sampling distribution with skewness of -1.14 (*SE*= 3.61) and kurtosis of 1.64 (*SE*= .71). The third level of the third independent variable, high level of exposure to ICT had a normal sampling distribution with skewness of -.61 (*SE*= .35) and kurtosis of -.85 (*SE*= .68). The researcher assumed that the normality assumption was not violated.

As it can be seen from Table 10, one-way ANOVA was conducted on self-efficacy beliefs of pre-service teachers with respect to differences in four different departments. The results indicated that there is a significant difference between pre-service teachers' majors and their self-efficacy beliefs in teaching online. $F(3, 97) = 7.11$, $p < .05$, $\eta 2 = .18$. According to the standards proposed by Cohen (1988), it is a large effect, and 18% of the variance in self-efficacy is explained by the pre-service teachers' majors. Scheffe post-hoc test results indicated that CEIT department significantly differs from the department of FLE (*MD*= .48). Additionally, the department of FLE significantly differs from the department of MSE (*MD*= .41). No significant difference found between the departments of CEIT and MSE. Scheffe didn't indicate a significant difference between MSE and ELE. The post-hoc test indicated a non-significant difference between the departments of FLE and ELE. Finally, post-hoc revealed that CEIT and ELE doesn't significantly differ in terms of their self-efficacy in teaching online.

Table 10. ANOVA by Departments

	Sum of Squares	df	Mean Square	F	η2
Between Groups	3.77	3	1.26	7.11*	.18
Within Groups	17.13	97	.18		
Total	20.90	100			

**p < .05*

As it can be seen from Table 11, one-way ANOVA was conducted on the subscales of self-efficacy beliefs of pre-service teachers with respect to differences in four different departments. The results indicated that there is a significant difference between pre-service teachers' majors & their self-efficacy beliefs in course design features. $F(3, 97) = 13.67$, $p < .05$, $\eta 2 = .30$. According to the standards proposed by Cohen (1988), it is a large effect. The results indicated that there is a significant difference between pre-service teachers' majors & their self-efficacy beliefs in time management competence of online teaching. $F(3, 97) = 13.67$, $p < .05$, $\eta 2 = .30$. According to the standards proposed by Cohen (1988), it is a large effect. The results didn't indicate a significant difference between pre-service teachers' majors & their self-efficacy beliefs in course communication competence of online teaching. $F(3, 97) = 2.26$, $p > .05$. The results indicated that there is a significant difference between pre-service teachers' majors & their self-efficacy beliefs in technical competence. $F(3, 97) = 4.24$, $p < .05$, $\eta 2 = .12$. According to the standards proposed by Cohen (1988), it is a large effect.

Table 11. ANOVA of the Subscales by Departments

		Sum of Squares	df	Mean Square	F
Technical	Between Groups	10.34	3	3.45	12.76*
	Within Groups	26.19	97	.27	
	Total	36.53	100		
Course Design	Between Groups	9.00	3	3.00	13.67*
	Within Groups	21.29	97	.22	
	Total	30.29	100		
Course Communication	Between Groups	1.19	3	.40	2.26
	Within Groups	17.05	97	.18	
	Total	18.24	100		
Time Management	Between Groups	7.35	3	2.45	4.24*
	Within Groups	56.04	97	.58	
	Total	63.39	100		

*$p < .05$

One-way ANOVA was conducted on self-efficacy beliefs with respect to differences in three different years of study. The results as shown in Table 12 indicated that there is no significant difference between pre-service teachers' years of study and their self-efficacy in teaching online $F\ (2, 98) = 1.85$, $p > .05$.

Table 12. ANOVA by years of study

	Sum of Squares	df	Mean Square	F
Between Groups	.76	2	.38	1.85
Within Groups	20.14	98	.21	
Total	20.90	100		

One-way ANOVA was conducted on self-efficacy beliefs of pre-service teachers with respect to differences in three different levels of exposure to ICT. The results presented by Table 13 indicated that there is a significant difference between pre-service teachers' previous exposure to ICT and their self-efficacy in teaching online. $F\ (2, 98) = 8.92$, $p < .05$, $\eta 2 = .15$. According to the standards proposed by Cohen (1988), it is a large effect, and 15% of the variance in self-efficacy beliefs is explained by the pre-service teachers' previous ICT related experiences. Post-hoc comparisons using Scheffe test indicated a significant difference in self-efficacy between students who had low and high levels of exposure to ICT (*MD*= .52). Furthermore, comparison revealed that students who had an average level of exposure to ICT significantly differ from the students who had a high level of ICT experience (*MD*= .28). Finally, a non-significant difference was found between students who had an average level of exposure to ICT and low level of exposure to ICT in terms of their self-efficacy in teaching online.

Table 13. ANOVA by exposure levels

	Sum of Squares	df	Mean Square	F	η2
Between Groups	3.22	2	1.61	8.92*	.15
Within Groups	17.68	98	.18		
Total	20.92	100			

*$p < .05$

As it can be seen from Table 14, one-way ANOVA was conducted on the subscales of self-efficacy beliefs of pre-service teachers with respect to differences in three different levels of experience in technology integration in education. The results indicated that there is a significant difference between pre-service teachers' experience & their self-efficacy beliefs in course design features. $F\,(3, 97) = 13.13$, $p < .05$, $\eta 2 = .21$. According to the standards proposed by Cohen (1988), it is a large effect. The results indicated that there is a significant difference between pre-service teachers' majors & their self-efficacy beliefs in time management competence of online teaching. $F\,(3, 97) = 6.19$, $p < .05$, $\eta 2 = .11$. According to the standards proposed by Cohen (1988), it is a moderate to large effect. The results didn't indicate a significant difference between pre-service teachers' majors & their self-efficacy beliefs in course communication competence of online teaching. $F\,(3, 97) = 1.42$, $p > .05$. The results indicated that there is a significant difference between pre-service teachers' majors & their self-efficacy beliefs in technical competence. $F\,(3, 97) = 8.51$, $p < .05$, $\eta 2 = .15$ According to the standards proposed by Cohen (1988), it is a large effect.

Table 14. ANOVA of the subscales by exposure levels

		Sum of Squares	df	Mean Square	F
Technical	Between Groups	5.41	2	2.70	8.51*
	Within Groups	31.13	98	.32	
	Total	36.53	100		
Course Design	Between Groups	6.40	2	3.20	13.13*
	Within Groups	23.89	98	.24	
	Total	30.29	100		
Course Communication	Between Groups	.51	2	.26	1.42
	Within Groups	17.73	98	.18	
	Total	18.24	100		
Time Management	Between Groups	7.11	2	3.56	6.19*
	Within Groups	56.28	98	.57	
	Total	63.39	100		

Results of the Second Research Question

Is there a relationship between pre-service teachers' importance of online teaching competencies perceptions and their self-efficacy beliefs in teaching online?

As displayed in Figure (3), since the points on the scatterplot closely resemble a straight line, the relationship between pre-service teachers' IOTC & SETO shows approximately linear moderate positive correlation. In positive linear correlations, when one variable increases by approximately the same rate as the other variable change (Gravetter & Wallnau, 2016). The researcher assumed that linearity assumption was assured.

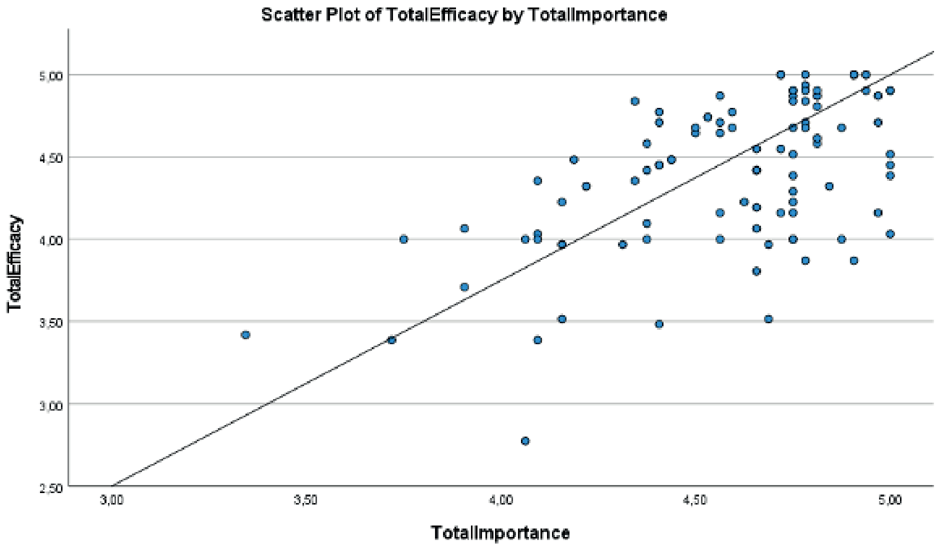

Figure 3. The Scatterplot Showing the Relationship between IOTC & SETO

As shown in Table 15, a Pearson correlation coefficient was computed to assess the linear relationship between IOTC & SETO. A positive significant correlation was detected between two variables, r=.57, n=101, p < .01. According to the guidelines proposed by Cohen (1988) it's a strong association.

Table 15. Pearson Correlation IOTC * SETO

		Total Perceived Importance	Total Self-Efficacy
Total Perceived Importance	Pearson Correlation	1	.57**
	N	101	101

p <.01

It can be concluded from the ANOVA results of the study that prospective teachers' self-efficacy beliefs in teaching online in their future distant classrooms vary significantly according to their exposure level to ICT (having a course related to technology integration in education and exposing to a training that has an online teaching component) and whether they study at CEIT department or not. When looking at the dimensions of the competencies, pre-service teachers' self-efficacy beliefs in the course design features, time management and technical competencies significantly differ. It means that prospective teachers studying at CEIT department and prospective teachers who have a good level of exposure to ICT have a significantly high self-efficacy beliefs in constructing an online course orientation, writing quantifiable learning objectives, organizing instructional materials into modules, making online quizzes, designing online assignments, managing their future students' marks online, sparing weekly hours to facilitate the online course, allocating weekly hours to evaluate assignments, arranging time to learn about new tactics and tools, performing basic computer operations, sharing open educational resources, and utilizing online help resources for assistance. Evidence from a most recent and related experimental study (Cooper et al., 2020) has similarly established that after completing the technology integration project and two semesters of online education courses, pre-service teachers' technology integration self-efficacy toward online teaching increases. At the end of the study those pre-service teachers felt more comfortable using computers, which facilitated their willingness to teach online. Those pre-service teachers felt more comfortable using computers at the end of the project, which increased their readiness to teach online.

The results of this study also revealed that pre-service teachers' years of study in their majors does not significantly contribute to their self-efficacy in teaching online. Even though a few research studies have supported this finding (Berkant, 2016; Tuncer & Tanas, 2011), more recently, Caner & Aydin (2021) have offered contradictory finding which revealed a significant correlation between the views of computer self-efficacy and grade levels among pre-service teachers.

It can be concluded from the correlational aspect of the results that prospective teachers' self-efficacy beliefs in teaching online is significantly related to their perceptions of online teaching competencies. In other words, the study revealed that if pre-service teachers perceive the importance of course design, course communication, time management and technical competencies of online teaching, they will have more high level of self-efficacy in teaching online. Even though the existing literature suffers from revealing the correlation between IOTC & SETO, as a most recent and a related study, Zhang et al. (2023) found no direct association between pre-service teachers' ICT competencies and their ICT self-efficacy. However, Martin et al. (2019) noted in their study that it is critical to incorporate components of online teaching skills such as course design, course communication, technical competency, and time management into programs and a special emphasis should be focused on competencies that pre-service teachers rated as low in importance.

DISCUSSION AND SUGGESTIONS

When most current studies in the literature were studied, teachers stated that a lack of online teaching abilities among teachers was caused by a lack of experience. (Aytac, 2021; Hassan et al., 2020; Izhar et al., 2021; Schleicher, 2020; Yastibas, 2021). Given the importance of online teaching in today's system, it is critical that beliefs and perceptions about online teaching and its competencies be cultivated and strengthened during teacher education. In this study, the data collected from pre-service teachers with various years of study, different departments and varying degrees of ICT-related experience were analyzed in terms of their self-efficacy in teaching online. The researcher concludes from the study's overall findings that pre-service teachers have high self-efficacy beliefs to teach online in their future online classrooms (M= 4.41, SD=.46). Despite the great majority of studies in the literature did not expressly discuss the online teaching dimension of self-efficacy, there are some studies that looked into ideas like technology integration, implementing computer supported education, and computer technology self-efficacy. (Berkant, 2016; Caner & Aydin, 2021; Topkaya, 2010; Tuncer & Tanas, 2011). At first glance, a gain in SETO may be expected to increase in tandem with prospective teachers' years of study. However, the results of the years of study issue showed that preservice teachers' self-efficacy beliefs did not differ significantly on any dimensions of the competencies. The finding of this study regarding the insignificant years of study difference on all of the subscales of the online teaching self-efficacy is consistent with the finding of prior study which revealed insignificant differences among the freshman, sophomore, junior and senior group of preservice teachers in their self-efficacy beliefs and attitudes towards implementing computer supported education (Berkant, 2016). In their investigation of the computer self-efficacy of pre-service teachers, Tuncer & Tanas (2011) found that there was no appreciable change in prospective teachers' evaluation of their own computer self-efficacy across their years of study. However, in their study Caner & Aydin (2021) discovered that there was a statistically significant variation in pre-service teachers' self-efficacy in using computer technology across grade levels. Similarly, in her research, Topkaya (2010) found a correlation between the views of computer self-efficacy and grade levels among pre-service teachers. Unal (2013) also found that there is a significant difference between years of study in terms of pre-service teachers' self-efficacy beliefs of using computer technologies.

The significant effect of studying at CEIT department, having a course related to technology integration in education and exposing to a training that has an online teaching component can be explained by the fact that students' good level of exposure to ICT. Tekinarslan (2011) also found that CEIT program participants had significantly higher self-efficacy mean scores in online technologies than counterparts from other programs. Tekinarslan (2011) argued that when compared to students in other programs, students in the CEIT program may have more computer and Internet experience, which may be the cause of their higher self-efficacy mean scores. Demiralay & Karadeniz (2010) contended that computer use experience had a beneficial effect on prospective teachers' self-efficacy. Akkoyunlu & Kurbanoglu (2003) found a difference between the students' self-efficacy perceptions and their computer self-efficacy perceptions for the benefit of CEIT. The difference stems from the fact that the students of the CEIT have more knowledge and experience in ICT than the students of the other departments (Akkoyunlu & Kurbanoglu, 2003). Cooper et al. (2020) has similarly proven that pre-service teachers' technology integration self-efficacy toward online teaching increases after finishing the technology integration project and two semesters of online education courses. Those pre-service teachers felt more comfortable using computers at the end of the study, which increased their readiness to teach online. Additionally, the results of Caner & Aydin's (2021) study showed that the pre-service teachers' self-efficacy with regard to integrating technology was significantly influenced by their majors. Similarly, Keser et al. (2015) revealed that based on the department pre-service teachers are studying, there were substantial differences in their TPACK proficiency levels and self-efficacy perception levels towards technology integration. Conversely, Unal's study (2013) discovered that there are no appreciable departmental differences in the mean scores of pre-service teachers' self-efficacy perceptions for technology integration.

A correlational aspect of the study showed that pre-service teachers' self-efficacy in teaching online was substantially correlated with their understanding of the significance of online teaching competencies. Relatively little research has been carried out on significance of online teaching competencies, and even less on its' relationship with self-efficacy. According to Martin et al. (2019), it is crucial to include components of online teaching competences such course design, course communication, technical proficiency, and time management to the programs. Particular focus should be placed on competencies that pre-service teachers evaluated as being of low value. The findings highlight the significance of defining and imparting online teaching competencies in teacher education in Turkish higher education institutions, its implementation in different departments, and the role of online teaching during school practicum. It is assumed that it must be a required subject across disciplines in teacher education programs to boost confidence and competence in all areas of online teaching. The practical recommendations and suggestions for further research are also listed below.

- Given the considerable impact that extensive ICT exposure has on pre-service teachers' confidence in their ability to teach online, it is important to create environments and conditions that allow for adequate interaction with ICT for educational purposes.
- Teachers-in-training should experience the educational uses of technology through their education, and academics who play a part in teacher education should use technology successfully in their lessons.
- Since a significant correlation was found between importance of competencies perception and self-efficacy, it is necessary to create a framework for digital pedagogy competencies which may include course design, course communication, time management, and technological skills. Consequently, elevating their sense of importance can help teachers feel more confident in their abilities.
- The study's correlational component does not offer a justification for the connection. The relationship could have a number of causes, but the audience is unaware of these factors. A mixed model utilizing qualitative data collection methods like interview can be applied in future investigations.
- In their book Fraenkel et al., 2012 state that the likelihood of a subject characteristics threat is the most serious threat to the internal validity of a causal comparative research studies. Because the student groups are constructed without the researcher's manipulation, there is always the possibility that the groups are not equivalent on one or more factors (Fraenkel et al., 2012). Furthermore, the main disadvantage of purposive sampling is that the researcher's judgment may be incorrect—he or she may be incorrect in assessing the representativeness of a sample or in their knowledge of the information required (Fraenkel et al., 2012). For further research, the researchers may form groups by random sampling with an experimental design to increase the generalizability of the findings.

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EFFECTS OF BIAS, GAMIFICATION AND MONETARY COMPENSATION ON MOOC DROPOUTS

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ABSTRACT

The dropout rate is the most significant disadvantage in Massive Open Online Courses (MOOC); most of the time, it exceeds 90%. This research compares the effect of cognitive bias, gamification, monetary compensation, and student characteristics (gender, age, years of education, student geographical location, and interest in the course certificate) on dropout. We use survival analysis to identify the predictors of dropout and its related factors. The results showed the lowest dropout (74.2%) for cognitive bias and gamification. The results showed that the Peanut effect bias favors the lowest risk of drop up. Likewise, the findings showed the interest in the final certificate as a predictor of retention to complete a four-week MOOC.

Keywords: MOOC, gamification, choice bias, monetary compensation, Peanut Effect.

INTRODUCTION

Retention is one of the biggest challenges in Massive Open Online Course (MOOC), and it is expressed as Terminal Efficiency (TE) or percentage of students who complete a course. The terminal efficiency of MOOCs is between 9.5% and 10% (Montoya et al., 2022; Garcia-Leal et al., 2021; Goopio & Cheung, 2020) and is influenced by cultural contexts and social networks via the internet (Bozkurt & Akbulut, 2019). Retention has been approached from different models: Composite Persistence (Rovai, 2003), Revised CPM (Park, 2007), SIEME Model (Chyung, 2004), Model of Adamopoulus (2013), and finally the Model of Retention and Decision for Open Learning Environments (AMOES, Gutl et al., 2014) that groups the variables raised in the previous models. According to these models, TE can be associated with online gamification (setting experience), cognitive biases, monetary compensations and student characteristics.

This research presents the continuation of the analysis of dropout in a MOOC carried out by Medina-Labrador et al., (2019) by adding three factors: gamification, choice bias, and monetary compensation. The course analyzed was offered through Coursera in Spanish. This study considered the variables of gender, age, educational level of the students, and the continent of origin of the participants. The research questions considered were:

1. Is choice bias, presented as the number of questions at the time of the evaluation, associated with attrition in MOOCs?
2. Can gamification decrease dropout? What are the best predictors of dropout?
3. Does monetary compensation, granted as reinforcement and considered as a discount in the payment of the MOOC, reduce dropout?

In this study, we use survival and risk analysis to answer the questions presented; our main goal was to know the combined effect of choice biases (number of questions asked), monetary reinforcements, and games on survival and risk attrition.

Cognitive Biases

Traditional economics is a rational-choice paradigm that suggested decision errors can be interpreted as instances of misweighting (putting either too much weight or too little weight on specific types of costs and benefits); when this happens, the use of cognitive bias produces a compensatory reweighting that offsets the initial misweighting (Loewenstein et al., 2013). From the behavioral economics approach, people make decisions in two phases: edition and evaluation—first, the results are ordered under a heuristic scheme to establish a reference point. The highest results are classified as gains and the lowest as losses. Second, the evaluation assesses the utility and selects the one that has the most significant result with their respective probabilities (Kahneman & Tversky, 1981; Loewenstein et al., 2010; Thaler & Benartzi, 2004). However, most decisions are made intuitively through fast paths called cognitive biases (Kahneman, 2003). These biases are used to face complex or unknown tasks (Referencia), pressure situations (Furse, Punj & Stewart, 2016), and aversion to loss in small monetary amounts (Shimizu & Udagawa, 2018).

Cognitive biases have been used to nudge behavior in different areas such as health (Loewenstein et al., 2013; Kullgren et al., 2013) and finance (Thaler & Benartzi, 2004). For example, the "peanuts effect" bias states that people are more willing to gamble when playing for "peanuts" (a small outcome). It means, people do not care about the risk or consequences when gambling small amounts or efforts (minor behavioral changes), and as a result, they are willing to risk "small amounts" doing something that implies little-gradual-changes. To describe the effect of decreasing risk-aversion with decreasing monetary rewards (e.g., a student who spends little time answering a test with few questions will reassess the decision to follow or drop out of a MOOC based on the cost-benefit of their efforts). Likewise, the underestimation of delayed consequences is included within this bias, and it happens when people only see the current benefits without long-term consequences consideration (e.g., a student who passed an exam after answering a few questions will underestimate the gradual effect of the questions and the consequences in the future for not knowing all the content to be addressed).

Medina-Labrador et al. (2019) found that the peanuts bias effect favored TE when few evaluative questions were applied in week one, with low increases in the MOOCs, compared to the courses that used several fixed courses evaluative questions during the learning weeks. The peanuts effect bias has been used in settings other than learning. According to the National Federation of Consumers of the United States, 82% of citizens like the idea of saving; however, they feel unable to start because they believe they should do it with much money. Thaler & Benartzi (2004) research results show that employees felt more motivated when they allocated small amounts of money to start (3 USD) instead of more significant amounts. In the medical sector, the peanuts effect bias has been successful among weight request programs for overweight subjects. Studies by Loewestein et al. (2010) show that overweight patients undergoing a weight loss treatment in small daily pounds (0.16 lb.) were more likely to remain in the program than the group who were asked for high fixed amounts of weight (2 lb.) for two months.

Gamification

Gamification, seen as the consumption and use of games in non-traditional environments, can be used in internal factors, in students, in the factors of the MOOC provider, and in the expectations of the operation. Gamification is defined as a process and set of experiences in learning environments, based on the idea of solving problems, creative thinking and elaboration of decision strategies (Sezgin & Yuzer, 2022). Different authors interpret the concept of gamification based on the principles; goal orientation, reinforcement of knowledge, competition, skills and fun. Likewise, the literature reports different dimensions of gamification: logistics, interaction, comparison, psychological and economic gains. Gamification provides an experience that favors consumption by providing a motivational experience and purchases intention, looking for fun, excitement, and sensory estimates. Games have internal consequences for consumption since their experimentation is immediate and fulfills affective functions by acting positively (Sailer et al., 2013).

Setting experiences as gamification have shown to favor retention in the use of MOOCs (Gene et al., 2014; Romero-Rodriguez et al., 2019). The prizes in engaging activities (Collazos et al., 2016; Ortega-Arranz et al., 2019) and the learning tasks in games motivate students to stay and finish the course (Gupta & Vaibhav, 2014; Aparicio et al., 2019). Those games that use material goods online have the highest efficiency rates (9.52% TE), redeemable points (8.45% TE), and team leaderboards (7.34% TE) (Chang & Wei, 2015; Krause et al., 2015). According to An et al., (2021) the use of gamification in MOOCs increases students' social interactions by 91.6%, retention 85%, and level of learning (52.3%). This research reports other results: young people between 20-49 years old are more likely to use gamification, and students who had previous experience in gamification are more likely to use a game again in MOOC. However, gamification presents drawbacks among students: lack of time, inconsistency between the course content and the proposed game, and lack of funding to take the courses.

Based on De Notaris et al., (2021), gamification has also been combined with simulation for the learning of soft skills and business strategies, achieving a higher level of learning in the participants and a lower dropout rate. According to Rincon-Flores et al., (2020), gamification achieved a dropout rate of 12.89% in technologies and clean energies, establishing a positive relationship with participation during the course and motivation. The participants presented an interval of acceptance of gamification between 95.6% -97.3%, and this strategy helped them in their learning process during the course. The implementation of games increased the cognitive dimension among students between 21-30 years old; men accepted the games in the form of challenges to solve problems, while women did so with the leader board.

Monetary Compensation

From the perspective of behavioral psychology, the reinforcements used to improve retention in MOOCs may not necessarily be monetary, but they can be tangible, unlike physical money that can be perceived as compensation rather than a reward. 60% of employed students did not drop out since they considered this incentive durable (Sureephong et al., 2020). Monetary compensation favors decision-making. Loewenstein et al. (2010) proposed an activity to reduce fuel consumption and promote public transport. This activity was presented through a rewards system based on a raffle, motivating the participants through a monetary prize. Through an electronic ticket card, passengers who used the transportation system that day would be informed daily about the card winner (prize). People would be expected to increase their transportation system use because of the slim chance of winning a monetary prize. This approach shows monetary compensation in non-habitual contexts of consumption (Deterding et al., 2011).

METHOD

This research used a quantitative methodology with a longitudinal non-experimental study, and the information was collected in 2020. A university offered the MOOC, and the participants were recruited by social network in Colombia. The cost of the final certificate was 49 USD. The course belonged to the discipline of engineering, in the area of sales forecasts for beginner salespeople. The MOOC was carried out over four weeks, during which the participants had access to written information, interaction with the teacher to solve questions, and games at the time of the evaluations. The learning contents were supplied week by week and at the end of each week the participants received the evaluation and compensation according to the case. Two types of studies were applied: (a) experimental type, with "pure" experiments with two or more comparison groups. (b) non-experimental longitudinal trend design type.

Participants

Participants were 1,289 students from mainly Spanish-speaking countries registered in a popular online educational platform. The characteristics of the study population were predominantly male (64.4%) and 34 years old on average (SD = 9.5) distributed in the ranges 18-28 (32.1%), 28-38 (39.7%), 38-48 (17.3 %), 48-58 (6.9%), 58-68 (1.5%) and > 68 (2.5%), The mean level of education (according to the USA Educational System) was 16.7 with a standard deviation of SD = 2.6. Student were from South America (68%), Central America (21.7%), Europe (7.3%), North America (1.7) Asia (0.6%), Africa (0.6%). The students were recruited through digital advertising for two months, and the course lasted for four weeks. Participants who took the course at their own pace, those under 18 years of age, 80 individuals who did not sign the informed consent, and those who had previous experience with MOOCs were excluded from participating in the research. There was only one start date; after this date, the course was closed for any enrollment.

Data Collection

Information was gathered from a university platform through three different data set: (1) Registration, (2) interest in the Certificate, and (3) Weekly evaluation. The weekly evaluations were carried out based on previous investigations of Medina-Labrador et al., (2019). The weekly evaluation test was multiple-choice questions, and the response time was one day. Therefore, it was not possible to return to correct the answer. After the evaluation was finished, the individuals continued with the next module. Participants received the informed consent forms and signed them before starting the experiment.

The MOOC took as its primary theme the forecasts of commercial demand. The cost of the certificate was 49 USD. The duration of the course was four weeks.

Three types of studies were applied: (A) Experimental type with two or more comparison groups "pure" experiments. (B) Survival analysis and (C) Longitudinal non-experimental type of trend design type. The participants were randomly assigned to each factorial group, depending on the experimental factors (peanut bias, game, and monetary compensations); absence or presence of factors, and the homogeneity of the participants in the factorial groups was guaranteed (Table 1). The results were analyzed according to the three established phases. All stages used SPSS version 27.

Table 1. Experimental design and number of individuals per experimental group

	Without Peanut Effect Bias		With Peanut Effect Bias	
	With $1	Without $	With $1	Without $
With game	168	183	154	178
Without game	178	166	176	86

In Phase 1, a descriptive and relational analysis was performed based on attrition. In Phase 2, a 2x2x2 factorial design was carried out; Students' dropout behavior was analyzed in two groups (peanut effect): (1) Number of weekly variable questions (5, 7, 9, 11) and (2) Number of fixed questions weekly. (8, 8, 8, 8). Subsequently, each group was subjected to two factors: gamification and compensatory consideration. The levels of both factors were absence and presence. For gamification, a digital roulette was used where the student who finished a week could receive 1 USD or 0 USD as a discount to purchase the final certificate. In the case of the compensatory consideration, the participants could receive 1 USD for each week finalized and take that money as a discount in the final certificate. The students were randomly assigned to each experimental group (Table 1). The design presented a small magnitude $\omega 2 = 0.1$ and a power of 0.7.

Data Analysis

The analysis was carried out based on the steps contemplated and the experimental part through two-way factorial analysis; where the positive effect of the minutiae bias and gamification on droop out was found. Survival Analysis curves in MOOCs have shown that desertion decreased 80% during the first week, and the probability of dropout is affected by: the peanut bias represented in the numbers of questions, the education level, the age level, and the interest in the certificate. From a predictive point of view, the Cox Regression showed that interest in the certificate is a predictor of dropout (Medina-Labrador et al., 2020). Yang et al., (2015) found that the probability of desertion is low when there are collective experiences in synchronous reflection exercises, and the risks of desertion increase with the number of attempts to correctly solve the exam questions. The risk of dropping out increases when there is disinterest in the certificate and lack of commitment during the course. The details of the analysis by steps can be seen below.

FINDINGS

In the first descriptive and relational phase, the total dropout rate in this MOOC was 92.9%. The results allowed us to identify that the highest terminal efficiency is found in the group with peanut effect bias, gamification, and without monetary compensatory (25.8%); that is, desertion of 74.2%. The group with the lowest terminal efficiency was that without "Peanut effect" bias, without compensatory consideration, and without gamification (1.2%); in conclusion, a dropout rate of 98.8%. Statistically significant differences were found between attrition and the experimental groups $\chi 2$ (7, N = 1,289) = 100.33, p <.0 and also between attrition and "peanut effect" bias $\chi 2$ (1, N = 1,289) = 25.86, p < .0. Students belonging to the group of fixed amounts (no peanut effect bias) had a 33.2% higher risk of attrition (OR = 0.33) than those of the variable question amounts (95% CI between 0.21 and 0, 51). No associations were found between dropout and gender, age, educational level, and continent.

In the second experimental phase, the inter-subject tests show that the model is significant $\chi 2$ (7, N = 1.289) = 92.96, p <.0. Significant effects were found with the week of attrition and the factors: peanut bias $\chi 2$ (1, N = 1.289) = 26.08, p <.0, peanut bias and gamification $\chi 2$ (1, N = 1.289) = 6.37, p < .0, "peanut effect bias and compensatory reinforcement $\chi 2$ (1, N = 1.289) = 33.76, p <.0 and compensatory reinforcement and gamification $\chi 2$ (1, N = 1.289) = 22.31, p <.0. The highest partial squared Eta value was presented in the peanut effect segment (EPC = 0.16) and the lowest in gamification and peanut effect bias (EPC = 0.04). There were no effects of the factors gamification, compensatory remuneration, and the combination of gamification, compensatory remuneration, and peanut bias. Regarding the experimental groups, significant differences were found for the drop-out week f (7, N = 1.289) = 10.55 p <.0. Tukey's test indicated that there are two homogeneous subsets; the group with the greatest permanence in the course is the one that contains gamification (M = 1.12); the other groups reported a mean (0.21 - 0.55).

In phase 3, the survival and risk analysis were performed for each type of bias; the influence of the study variables on survival was then analyzed through the operator of Kaplan-Meier, and finally, a Cox regression was carried out to know the influence of the associated variables in the last dropout. In the results of Phase (3) of the survival analysis, the probability density function was estimated for each factorial design. Dropout and dropout probability were analyzed weekly; initially, the study was carried out without the influence of covariables and later with the independent variables associated with attrition. The results indicate that the probability of survival is higher in the group of variable questions (with bias) (24%) compared to the group of fixed questions (without bias) (17%) during the first week. At the end of the fourth week, the probability of survival is higher in the variable quantity group (12%) than for the fixed group (4%). Likewise, the cumulative dropout risk index is higher in the group with fixed questions during the first week (IR = 69%) than that of the group with variable questions (IR = 34%) (Figure 1).

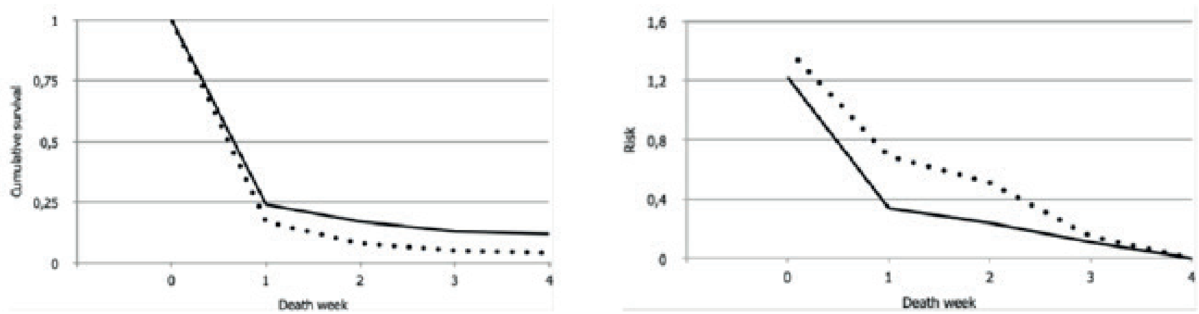

Figure 1. (a) Left. Probability of survival as a function of bias. (b) Right. Cumulative risk probability as a function of bias. (.) Without bias. (-) With bias.

Regarding survival and risk within the experimental groups, the best survival function and median week of death (0.74) is group three with gamification and "Peanut effect" bias. Group five, without compensatory reinforcement, without gamification, and without "Peanut effect" bias, had the lowest median week of death (0.58). Regarding the risk of attrition, group five presents the highest function with a weekly risk of 1.48 in the first week, 1.23 in the second, 0.67 in the third and 0.40 in the last. Group three shows the lowest risk of attrition with a weekly risk of 1.02 in the first, 0.15 in the second, 0.08 for the third, and 0 in the last week (see Figure 2).

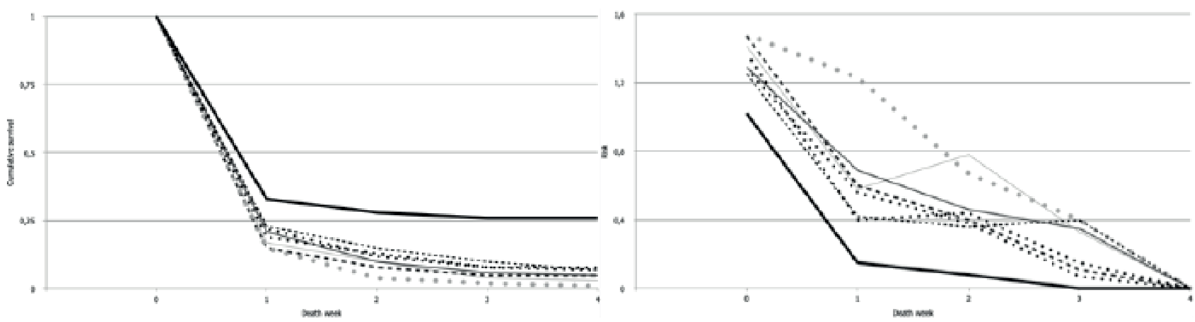

Figure 2. (a) Left. Cumulative survival function with 95% confidence interval. (b) Right. Risk function.

Within this same Phase 2, dropout was analyzed by a multiplicity of probabilities independently for each student and the probability of dropping out in a given week. The survival functions were calculated through the Kaplan-Meier estimator during the maximum period of weeks.

Statistical differences between the survival function and the covariates were made through the Log-Rank test. No influences of gender, continent, education, and age were found in the probability of dropping out of the MOOC participants over time. The results indicated that the increased probability of MOOC attrition is due to: "Peanut effect" bias $\chi2$ (1, N = 1.289) = 24.71, p <.01, compensatory reinforcement $\chi2$ (1, N = 1.289) = 5.43, p = 0.02, gamification $\chi2$ (1, N = 1,289) = 5.10, p = 0.01 and interest in the certificate $\chi2$ (1, N = 1,289) = 123.62, p <.01.

The predictors of risk of attrition and the influence of the covariables on attrition in each bias were analyzed based on a Cox Risk Regression model. The covariables included were gender, age, gamification, monetary compensations, interest in the certificate, and type of certificate. Attrition was estimated as a state variable, and the duration of the MOOC in the four weeks was the moderating variable. 1,289 cases were available for analysis, with 75 censored data. The model frame was estimated based on the forward progressive regression method and the likelihood ratio. The model was adjusted in the first step, showing no changes from step N-1 to N 1. The omnibus test indicates in the fourth step that some of the selected variables contribute significantly to the model χ^2 (1, N = 1.289) = 87.27, p <.01. The variable interest in the certificate was estimated as in the equation as the variable that presented the highest predictive value for risk of desertion

χ^2Wald (1, N = 1.289) = 20.16, p <.01. The weighted average Hazard ratio shows that globally the dropout rate is 23.4 times higher if the students are not interested in the certificate Exp (B) = 0.23. The other variables are not present in the equation.

DISCUSSIONS AND CONCLUSION

High dropout rates are one of the biggest problems in MOOC development. In this study, attrition was analyzed through a single topic MOOC with a 2x2x2 factorial experiment, with the factors: "Peanut effect" bias, gamification, and monetary compensations. The findings of this research expand the Online Learning Participation Tunnel factor and the level of activities proposed by AMOES since it found the lowest dropout rate (74.2%) in the group of participants subjected to the bias of the "peanut effect "(Variable of questions and participants in the proposed game). Furthermore, the attrition rate achieved improves the range reported in the literature (Carey, 2012; Chang & Wei, 2016; Goopio & Cheung, 2020; Gutl, Chang et al., 2014). In addition, these findings show the importance of including variables related to purchasing intention (interest in the certificate, participation in games, compensatory considerations, and choice biases).

The inferential findings associated with attrition are also consistent with those reported in other research: gamification (Chang & Wei, 2016), "Peanut effect" bias, and compensatory considerations (Loewenstein et al., 2000). This study succeeded in (a) adapting student concepts in consumption from the offline world to the digital realm ("Peanut effect") and (b) measuring behaviors of a user of new technologies such as a MOOC, through basic psychological procedures such as motivation and cognitive processes such as effort. This study provides a predictive model of dropout behavior in MOOCs related to the efforts and expectations of students.

Offline research demonstrated the influence of choice biases on individuals' decision-making. It found that the number of variable questions (5, 7, 9, 11) and the use of games such as roulette increased survival in the last week from 24% to 40%. Similarly, the influence of these factors increases the probability of survival from the first week to the last and decreases the risk of desertion reported by Medina-Labrador, 2019. Additionally, the results showed that if there are few questions at the beginning and many at the end and the roulette game is added as motivation to watch the videos, desertion decreases.

The findings of the survival analysis are consistent with the results of Medina-Labrador et al., 2020 regarding the risks of dropping out during the first week of the course. A critical aspect was the predictive capacity of dropout of the "Peanut effect" bias variable reflected by the fact that variable amounts of evaluative questions decrease dropout. The Cox regression analysis confirms what was found by the binary logistic regression regarding the presence of the "Peanut effect" bias and gamification bias. Likewise, the effect of gamification and performance expectations are consistent with reports in the literature (Chang & Wei, 2016; Venkatesh et al., 2003). This research showed that the undervaluation of the efforts required to finish a MOOC is 9.3 times lower when few questions are presented initially and increase each week. Similarly, students subjected to fixed evaluation questions dropout 33% more than those who have incremental variable amounts. Likewise, the "Peanut effect" bias coupled with gamification achieves a terminal efficiency of 25.8%. These results support those found in the offline world by Loewenstein et al., (2000) to help consumers make responsible decisions for themselves.

This research suggests the development of pedagogical strategies aimed at reducing dropouts during the consumption of MOOCs by analyzing their operation, the efforts of the students, and the conditions of ease of use. The results specifically suggest that dropping out of MOOCs is due to a lack of interest in the certificate, low participation in the proposed games, and apathy to present efforts. These outcomes are consistent with recent reports from the literature and bring the results to an inferential level. On the other hand, and taking into account that the students were Colombian, the internal geographic origin within the country may affect each of the manipulated factors, taking into account their meaning, something that is consistent with Bozkurt & Akbulut (2019).

Low number of questions at the beginning increased the cumulative survival during week two, from 51% to 62%, and decreased the cumulative risk of attrition during the same period from 12% to 4%, respectively. The "Peanut effect" bias works not only as a strategy to increase the survival rate and decrease risk, but also operates as a motivator in the intention to consume MOOCs and explains the expectation of effort, decreasing cognitive effort. This effect extends the studies on survival and risk in MOOCs (Medina-Labrador et al., 2022; Ferschke et al., 2015; Yang et al., 2015), highlighting survival's association with participation in forums, videos, and joint activities that entertain the student. This research provides significant evidence to intervene in the first week of the courses, specifying the results reported in the literature (Greene et al., 2015), and explaining the final dropout rate of 74.2%.

Finally, the effect of gamification on the attrition behavior and experience within the MOOC turned out to have a high predictive value of attrition ($\beta = 3.4$). The results showed that gamification could foster the motivation responsible for initiating and continuing the behaviors aimed at completing the course. Perspectives of interest in the certificate, students' dropout trait, self-determination in the week of death, and emotion were evaluated. The monetary discounts linked to the game could act as immediate positive reinforcements since they are perceived as rewards for actions carried out (Sailer et al., 2013).

The survival analysis in education has been used to predict inertia and its associated determinants. The results show the predictors of dropout and its related factors (Stoolmiller, 2016). Survival analysis determines the probability that a subject is present during a time (life) segment until a moment of death (desertion). Likewise, it allows us to know the average time the individual stays within the study and its factors (Ferschke, Yang, Tomar & Rose, 2015; Greene, Oswald & Pomerantz, 2015). Survival analyzes used in MOOCs show that gender is a predictor of dropout; women have a 65.5% chance of dropping out compared to men. This behavior is only described during the first two weeks of the course. Other student characteristic variables, such as having an outgoing personality and previous experience in video games, decrease the probability of survival (Chen et al., 2020). According to Xie (2019), the duration of the MOOC videos and their area of knowledge lead to different probabilities of survival.

Looking holistically at the research, the results of the interventions, highlighted by related and experimental evidence, suggest the possibility of implementing a new expectation of effort using the "Peanut effect" bias, the implementation of gamification activities during the course, and the promotion of the interaction, to increase the intention of the consumption of MOOCs. Furthermore, the solutions presented contribute to redesigning digital tools to monitor the behavior carried out by a MOOC user to enhance acceptance of a new learning technology that is increasingly adhered to in the people's culture and daily lives.

The findings of this study are limited by the fact that the students took only one course on a specific topic related to mathematics. However, the results of this research are consistent with the findings of Medina-Labrador et al., 2019 in that there is a lower probability of dropout when the courses last four weeks and higher when it comes to study material related to mathematics. A change of subject might lead to different behaviors both in the enrollment motivation and in the permanence during the course. Based on the findings of this study, a longer duration of the MOOC may affect the attrition rate found. Future research should analyze other topics with different difficulty and duration levels. Likewise, it is advisable to identify the influence of the number or distribution of questions on choice biases.

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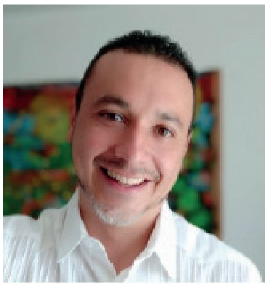

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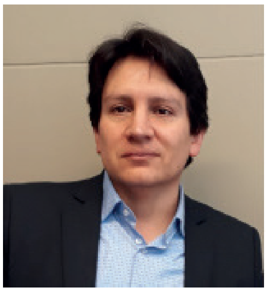

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ASSESSMENT OF SYNCHRONOUS ONLINE ARCHITECTURE EDUCATION FROM STUDENTS' PERSPECTIVE

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ABSTRACT

This research aims to identify and investigate different dimensions and underlying factors influencing the successful implementation of e-Learning, from participants' viewpoint, i.e. architecture students. To examine the constituents of an effective e-Learning experience in education, evaluation themes were formulated as overall substitutability level, cognitive performance, social interaction and engagement, student comprehension and comfort, personal preference, and learners' satisfaction. Through literature survey and review of mostly referred factors affecting e-Learning efficiency, four dimensions were designated for further elaboration in this study: (i) course characteristics, (ii) participant characteristics, (iii) e-Learning environment, and (iv) prior acquaintance, with each category including several sub-measures. Survey method was employed and a questionnaire was administered to 122 architecture students at both undergraduate and graduate levels to investigate participant perspectives in reference to particular synchronous lectures delivered online. Out of ten potential influencing factors hypothesized, seven were verified to be critical determinants of e-Learning effectiveness in architectural education.

Keywords: Architectural education, distance education, e-Learning, statistical analysis, students' satisfaction.

INTRODUCTION

The digital transformation in education has been a subject of remarkable interest for decades and continues its fast-paced evolution, shifting trends in learning and teaching experiences. Coupled with technology and innovation, the digitization of education requires a complete transition in methods, approaches, and mindset. The digital ecosystem, facilitated by information and communications technology, is the current medium for e-Learning, also known as online learning or web learning. Yet, it sustains a long-standing history as a successor to distance education.

Through its history, introducing new media and communication forms have inevitably shaped and revolutionized distance learning. Currently, two main modes of distance education are characterized as synchronous (real-time) and asynchronous distance learning. In this study, synchronous e-learning activities have been explored through distant lectures conducted under various conditions. The lectures were delivered as part of an Erasmus+ partnership project entitled Re-use of Modernist Buildings (RMB - https://www.rmb-eu.com/about), where remote or blended distance education was considered for a prospective master's programme.

The paper investigates different dimensions and underlying factors influencing online teaching/e-Learning effectiveness in architectural education, and examines their relation to various outcome variables such as overall substitutability level, cognitive performance, social interaction and engagement, student comprehension and comfort, personal preference, and learners' satisfaction in comparison to face-to-face instruction. To explore the experience of online architectural education from the perspective of learners, this study employs the survey research method. Feedback data on the distance sessions executed were collected from the audience through a questionnaire administered to participating university students of undergraduate, graduate levels and attendants of the workshop. Participation in the survey was voluntary and completely anonymous. The results acquired through the survey and the subsequent analyses, the presented advantages and obstacles of online architecture education from the perspective of learners, are expected to contribute to the field by advancing and strengthening the remote teaching/learning potentialities.

The results presented here illustrate participants' perspectives and experiences on online education prior to the Covid-19 pandemic, before all actors of education had to adapt to new ways of learning and teaching. Therefore, the focus and outcomes shall be addressed independent of currently offered emergency remote teaching, blended or hybrid methods, and other models to maintain instruction during the pandemic.

THEORETICAL BACKGROUND

The literature agrees on certain prominent models for evaluating e-Learning success. Nevertheless, various researches and studies have introduced different dimensions that impact online education effectiveness regarding the discipline addressed, cultural differences, and the diversity of student populations included. Following sections present a selection of commonly cited factors affecting online education efficiency, success components, and measurement items that were leveraged to further develop the research framework.

Critical Success Factors

A prominent issue in the field of e-Learning is to provide a successful online educational experience, and consequently, several studies have focused on identification of critical success factors (CSFs) influencing online education effectiveness.

A recent literature survey on e-Learning by Al-Fraihat et al. (2020) identifies four prominent approaches for measuring success: DeLone and McLean information systems success model; Technology Acceptance Model; User Satisfaction Models; and E-Learning Quality Models. The original and updated models of DeLone and McLean (1992; 2003) are foremost and frequently employed evaluation models for measuring e-Learning success. A significant number of studies adopt and reformulate its six interrelated constructs: system quality, information quality, service quality, (intention to) use, user satisfaction, and net benefits (e.g., Al-Fraihat et al., 2020; Bhuasiri et al., 2012; Manisi et al., 2018; Mtebe and Raphael, 2018; Raspopovic et al., 2014).

Diverse aspects and measures addressed by different researchers were correlatively reviewed and compiled to identify often-referred factors contributing the e-Learning success (Table 1). The large number of CSFs identified represents differing objectives when analyzed in detail; therefore, similar and consistent CSFs were clustered to establish convenient and manageable criteria set. In particular, technology, e-Learning environment and infrastructure (ENV), instructor and audience characteristics (CHAR), course structure and content design (CRSE) are the main CSF aspects widely associated with effective and successful e-Learning implementation. Communication and interaction among course participants and instructors, besides technical assistance and support, were other up-front factors to consider; thus, included in ENV due to their close affiliation with e-Learning environment. Use of the proffered e-Learning tools and environment (USE), benefits and perceived usefulness of it (ADV) were comparatively rare factors referred to. Finally, learner satisfaction (SATF), being the ultimate objective of a successful implementation, emerges as an uncommon CSF as well.

Table 1. CSFs identified by researchers and associated aspects

Author(s)	CSFs	Aspect
DeLone and McLean (1992; 2003)	System Quality (adaptability; availability; reliability; response time; usability in 2003 model)	ENV
	Information Quality (completeness; ease of understanding; personalization; relevance; security in 2003 model)	CRSE
	Service Quality (assurance; empathy; responsiveness in 2003 model)	ENV-CRSE
	Use (nature of use; navigation patterns; number of site visits; number of transactions executed in 2003 model)	USE
	User Satisfaction (repeat purchases, repeat visits, user surveys in 2003 model)	SATF
	Net Benefits (previously two separate categories as Individual Impact and Organizational Impact in 1992 model)	ADV
Volery and Lord (2000)	Technology (ease of access and navigation; interface design and level of interaction)	ENV
	Instructor Characteristics (attitudes towards students; instructor technical competence, and classroom interaction)	CHAR
	Student Characteristics (the previous use of the technology from a student's perspective)	CHAR
Bolliger and Martindale (2004)	Instructor issues	CHAR
	Communication (i.e., learner-content, learner-instructor, and learner-learner interaction)	ENV-CRSE
	Technology	ENV
	Course management	ENV
	Course web site	ENV
	Interactivity (i.e., social interaction and collaboration)	ENV-CRSE
	General information (i.e., being be motivated, organized, and committed)	CHAR
Eom et al. (2006)	Student self-motivation	CHAR
	Student learning style	CHAR
	Instructor knowledge and facilitation	CHAR
	Instructor feedback	CRSE
	Interaction	ENV-CRSE
	Course structure	CRSE
Selim (2007)	Instructor characteristics (attitude towards and control of the technology; and teaching style)	CHAR
	Student characteristics (computer competency; interactive collaboration; and e-learning course content and design)	CHAR
	Information technology (ease of access and infrastructure)	ENV
	University support	ENV
Sun et al. (2008)	Learner dimension (Learner attitude toward computers; Learner computer anxiety; Learner Internet self-efficacy)	CHAR
	Instructor Dimension (Instructor response timeliness; Instructor attitude toward e-Learning)	CHAR
	Course dimension (E-Learning course flexibility; E-Learning course quality)	CRSE
	Technology dimension (Technology quality; Internet quality)	ENV
	Design dimension (Perceived usefulness; Perceived ease of use)	USE
	Environmental dimension (Diversity in assessment; Learner perceived interaction with others)	ENV
Frimpon (2012)	Student (Discipline; Computer competency; eAttitude; Participation & Involvement)	CHAR
	Faculty (eMindset; Technical competency; Course development; Evaluation & Assessment; eLearning environment)	CHAR
	Technology (eLearning platform; Tech support; Tech quality; eCourse maintenance)	ENV
	Institution (Subject matter experts; Intellectual property; Institutional support; Sustainability)	ENV

Bhuasiri et al. (2012)	Personal dimensions (Learners' Characteristics; Instructors' Characteristics; Extrinsic Motivation)	CHAR
	System dimensions (Infrastructure and system quality; Course and information quality; Institution and service quality)	ENV-CRSE
	Environmental dimensions (E-learning environment)	ENV
Raspopovic et al. (2014)	Systems quality (Flexible for adaptation; Flexible for personalization; Stable Reliable; Secure Responsive; User-friendly)	ENV
	Information quality (Well-organized; Consistent; Clearly written; Systematic; Useful; Personalizable to the individual learning needs; Relevant to the subject)	CRSE
	Service quality (Displayed knowledge; Availability; Promptness; Helpfulness; Evaluation grade for instructors given by students; Stimulating interest in the subject; Understanding the professor; Obtaining feedback from the professor)	ENV-CRSE
Mtebe and Raphael (2018)	System quality	ENV
	Course quality	CRSE
	Service quality (i.e., the quality of services offered by the IT units)	ENV
	Instructor quality	CHAR
	Perceived usefulness	ADV
	Learner satisfaction	SATF
Kerzic et al. (2019)	Student factors (prior experience/knowledge of IT; self-efficacy; self-motivation; learning style and responsibility for one's own learning pace)	CHAR
	Teacher factors (characteristics; ICT competencies; teaching style; knowledge, facilitation, feedback and course structure; online instruction; information quality and service delivery quality)	CHAR
	Technology acceptance and technical support (ease of use; ease of access; user-friendly interface; technical support)	ENV

ADV: benefits and perceived usefulness
CHAR: instructor and audience characteristics
CRSE: course structure and content design
ENV: technology, e-Learning environment and infrastructure
SATF: learner satisfaction
USE: use of the proffered e-Learning tools and environment

The evaluation and measurement of factors affecting e-Learning efficiency have been the subject of a long-running debate; therefore, distinct key determinants and particular derivations of success measures are extensively covered in literature. Based on these findings, four major categories to be explored and employed were identified: (i) course characteristics, (ii) participant characteristics, (iii) e-Learning environment, in association to CRSE, CHAR, and ENV aspects respectively, and (iv) prior acquaintance, which can be linked to CHAR to some extent.

Components of an Effective Online Experience in regards to CSFs

The components of selected dimensions are further examined to distinguish their subscales and are utilized to develop and prepare the evaluation criteria.

Evidently, course characteristics undertake a fundamental role in the success of e-Learning systems. Several researchers (Bolliger and Martindale, 2004; Eom et al., 2006; Sun et al., 2008; Raspopovic et al., 2014; Mtebe and Raphael, 2018) suggest that course-related subscales i.e., management, structure, and quality, are important determinants for creating an effective e-Learning environment.

Another major aspect of e-Learning effectiveness, referred to in a large volume of research, is the student/learner dimension (e.g., Valory and Lord, 2000; Eom et al., 2006; Sun et al., 2008; Frimpon, 2012; Bhuasiri et al., 2012; Seters et al., 2012; Raspopovic et al., 2014; Kerzic et al., 2019). The ongoing debate on gender effects in online education has been revisited and researched in many studies. Several researchers acknowledge differences in learning strategies, participation and perceptions, attitudes, and communication behaviors driven by gender factors in an online educational environment (Lee, 2002; Rovai and Baker, 2005; Price, 2006; Dong and Zhang, 2011).

Volery and Lord (2000) acknowledge reliability, quality, and medium richness of technology as influencing factors in the effectiveness of distance education. Facilitating different communication types and improving the perceived interaction in online delivery is another aspect to be considered to enhance engagement (Bolliger and Martindale, 2004). According to Sun et al. (2008), interaction mechanisms are decisive in affecting learners' satisfaction in virtual learning environments due to increased exposure to distractions and decreasing attention span.

Previous acquaintance implies face-to-face encounters among the learners and instructors, which influence first impressions and interpersonal perceptions. Prior attendance to the instructor's classical-classroom lectures indicates familiarity with the instructor's perspective, attitude, and way of teaching. Both of which could majorly contribute to the social processes in an online environment. Former association with the instructor may enhance the quality of student-teacher interaction, promoting further communication and engagement within the learning medium. There have been numerous studies to investigate this prospective contributing factor in the field of educational psychology. However, a number of questions regarding its effects on university students and learning/teaching methods for undergraduate and postgraduate courses and qualifications remain to be addressed.

Examining the commonly referred CSFs and their extent, this study concentrates on ten potential subscales covered under (i) course characteristics, (ii) participant characteristics, (iii) e-Learning environment, and (iv) prior acquaintance, as detailed in the following sections.

METHODS AND MATERIALS

Focusing on different dimensions and underlying factors influencing e-Learning effectiveness in architectural education, this study examines their relation to various outcome variables compared to face-to-face instruction. This paper aims to identify key factors affecting the efficiency of distance architectural education and to investigate participant satisfaction in reference to the particular courses that were delivered online. The main stages of the research, which aimed to identify key factors affecting the efficiency of distance architectural education considering participant satisfaction, were (i) construction of conceptual research model; (ii) development and employment of survey instrument; and (iii) data analysis and evaluation, all of which will be described briefly in the following subsections. The research model proposed and adopted in this study was based on relevant literature and utilizes quantitative analysis methods. A survey instrument was employed for data collection, and the questionnaire was designed in association with the selected factors in the model.

Conceptual Framework

The conceptual framework adopted, shown in Table 2, presents ten potential factors influencing e-Learning performance and implementation, which are covered under four dimensions identified. Certain potential factors, in particular, age and gender, have been repeatedly identified in literature, while some exceptional ones, i.e., prior acquaintance with the lecturer, were considered noteworthy to be explored by the authors and included in the research. The components of an effective e-Learning implementation, to be observed and measured through survey method, are accordingly nominated as overall substitutability level, cognitive performance, social interaction and engagement, student comprehension and comfort, personal preference, and learners' satisfaction.

Table 2. Potential factors affecting the e-Learning efficiency

SELECTED DIMENSIONS	POTENTIAL INFLUENCING FACTORS
Course characteristics	Distant Lecture Level
	Distant Lecture Subject
	Distant Lecture Method
	Grading Policy
Participant characteristics	Gender
	Age
	Previous experience on Distant Lecture
e-Learning environment	Distant Lecture settings
Acquaintance	Acquaintance with the lecturer
	Acquaintance with her/his face-to-face lecture

Survey Instrument

Survey method employed to conduct this research involves two main steps: (i) questionnaire design, and (ii) execution of distant lectures and data collection.

Design of Questionnaire

The questionnaire employed in this paper was substantially developed by the RMB- Istanbul Technical University (ITU) team within the framework of RMB, aforementioned Erasmus+ partnership project that ran between 2016-2019. The project's consecutive outcome, a joint master programme to be established, was strategically designed to facilitate and contribute to the international collaboration of partner universities, with a particular emphasis on e-Learning and adoption of remote teaching formats (Altintas Kaptan et al., 2021). In this context, a survey form was designed to explore and understand participants' (i.e., students') experiences and perspectives regarding the distant education sessions executed in line with the project's objectives. The survey form comprises a total of 10 questions (Figure 1), addressing several evaluands and influencing factors (Table 2) through multiple-choice questions, Likert scale questions, and open-ended text boxes.

The first set of questions includes multiple-choice questions and free text boxes, intended to collect demographic information and to identify the characteristics and setting of the distant lecture attended. The influencing factors identified (Table 2), except for grading policy, were addressed via questions 1 to 6 (Figure 1). The grading policy, though not explicitly integrated into the questionnaire, was investigated as an additional factor within the study, based on student-evaluation approach used during the distant lecture. The second part of the questionnaire was designed to investigate the effectiveness of both theoretical lectures and design studios attended in an online environment and other online experiences, if any, to be explored through several themes formulated as; overall substitutability level, cognitive performance, social interaction & engagement, student comprehension & comfort, personal preference, and satisfaction (Figure 1). 5-point Likert-scale questions were adopted to measure respondents' agreement with various statements compared to traditional face-to-face learning (see Table 4 in Analyses and Findings for the statements). In the scale, 1 stands for 'strongly disagree', 3 for 'neutral', and 5 for 'strongly agree'. Additionally, the option of 'undecided' was included to eliminate and minimize blank or inconsistent answers. Still, there were several participants who preferred not to answer some questions, although in fewer numbers. The third and last part of the questionnaire was reserved for any feedback and input from respondents regarding the distant lecture attended, provided through a free text box.

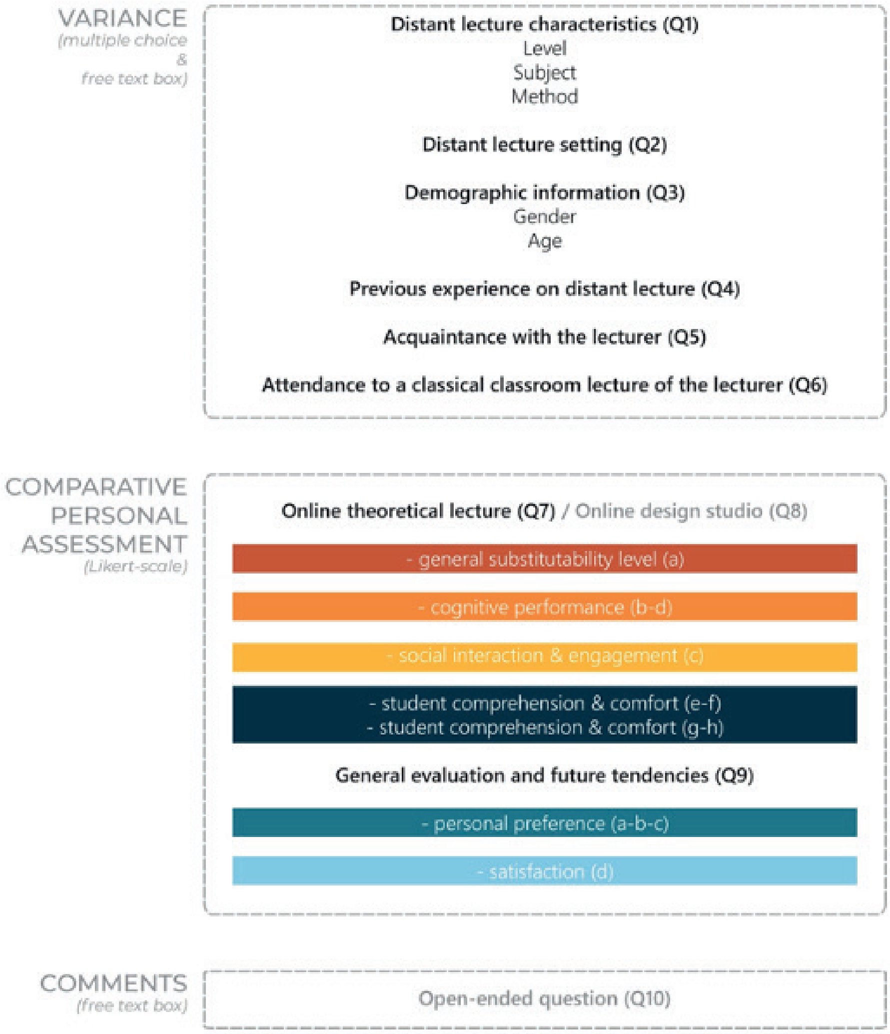

Figure 1. Questionnaire structure (Altintas Kaptan et al. (2021), revised by authors)

Delivery of Distant Lectures and Data Collection

At ITU, synchronous online seminars, lectures, and a design studio have been organized - some in collaboration with partner universities - with reference to the RMB project, to explore and experience distance teaching strategies in design education (Altintas Kaptan et al., 2021). Starting from 2017-2018 spring semester until the end of 2019-2020 fall semester (i.e., the last semester before the Covid-19 pandemic), a total of seven distant lectures with varying characteristics and participant populations were conducted either as part of a semester-long course or as independent events. Except for the student workshop lecture on 'history', all online lectures executed were of either at the undergraduate or graduate-level, and the main subject covered was 'technology'. In the student workshop, both undergraduate and graduate-level students participated together. The teaching method adopted in the majority of distant sessions executed was of 'theoretical lecture'; there was only one lecture delivered as a 'design studio'. All online sessions were performed using Adobe Connect. The list of distant lectures executed, together with their characteristics, is presented in Table 3.

After each session, the questionnaire was distributed to collect attendee feedback and, eventually, to identify the determinants of online architectural education efficiency through participant evaluation. It was a self-administered, voluntary, and anonymous questionnaire, and was completed by 122 respondents participating in online synchronous lectures.

Table 3. The list of distant lectures executed

Distant Session #	Semester	Session language[a]	Level[b]	Subject	Method[c]	Setting[d]	# of responses	Grading Policy
DS1	17-18 spring	Eng	UG	Technology	TL	s3	13	No grade (part of a course)
DS2	17-18 spring	Tr	MS	Technology	TL	s1	14	No grade (part of a course)
DS3	18-19 fall	Eng	SW	History	TL	s1	36	No grade (part of an event)
DS4	18-19 fall	Tr	MS	Technology	TL	s1	10	No grade (part of a course)
DS5	18-19 fall	Tr	UG	Technology	DC	s5	5	No grade (part of a course)
DS6	18-19 spring	Tr	MS	Technology	TL	s1	13	No grade (part of a course)
DS7	19-20 fall	Eng	UG	Technology	TL	s3	31	Graded (part of a course)

[a]: *English (Eng); Turkish (Tr)*

[b]: Undergraduate (UG); Master's (MS); Student Workshop (SW)

[c]: Theoretical lecture (TL); Design class (DC);

[d]: s1 (Classroom lecture given by a distant lecturer using classroom's data show/projector screen); s3 (Distant connection to an online theoretical web lecture); s5 (Design review using a web-based platform with screen sharing feature)

Data Analysis and Evaluation

In this study, 117 of 122 collected responses were used. Although the teaching method potentiality was initially intended to be investigated, data collected from DS5 were excluded due to the limited participation. Therefore, statistical analyses on respondents' comparative assessments of online design studios (Q8) were not computed. Assessment of the data collected through Q10, the open-ended question for participant feedback and comments, were also excluded since they were previously evaluated in another study (Altintas Kaptan et al., 2021).

The data collected were analyzed using IBM SPSS Statistics 27 software. Initially, descriptive statistics were utilized for simpler data interpretation. Subsequently, parametric tests (i.e., independent samples t-tests and ANOVA) and non-parametric tests (i.e., Mann-Whitney U test and Kruskal Wallis) were carried out to determine any significant relationship between evaluation themes and influencing factors. The statistical significance (alpha) level accepted to determine a relevant relationship was 0.05. Whenever a significant relationship was observed, boxplot graphs were leveraged for a detailed assessment of the change in responses.

ANALYSES AND FINDINGS

The distribution of influencing factors covered in Q1-Q6 is presented in Figure 2. Accordingly, a relatively homogenous distribution among course variance has been achieved in distant lecture (DL) level, participants' prior acquaintance with the lecturer, and grading policy; whereas, a dominance favoring one variant can be observed in other cases. The DL method, which could expectedly impact respondents' evaluation, is not presented here since all distant lectures covered in this study were theoretical. Regarding participants' age, the habitual differences of age cohorts as referred to in generations were followed instead of certain age intervals. The exact year ranges that comprise certain generations vary according to different researchers—demographers. In this study, the age range defined by Pew Research Center (Dimock, 2019) had been used. Hereunder, participants born between 1965-1980 are grouped within Generation X. The accepted birth range for Millennials and Generation Z is between 1981-1996 and 1997-2012, respectively. All calculations are based on the age data provided on the online session day.

Figure 2. Descriptive analysis of influencing factors (frequency and percentage distribution)

Descriptive statistics on each statement article of Likert-scale questions are provided in Table 4. The responses to Q7e, Q7f, Q7g, and Q7h are fewer in number as those were conditional questions, where respondents are to answer if they met the specified criteria. A remarkable point observed relating to Q9d and Q9b is that attendees mostly agree (%45.2) with article Q9d, demonstrating their approval of DL advantages regarding being free from location-dependent restraints. Still, article Q9b suggests there is a considerable proportion of participants (%31.3 and %11.3) who reported a preference for attending a classical-classroom lecture.

Table 4. Descriptive analysis of Likert-scale assessment statements including frequency (f) and percentage values (%)

Question No	Statement		Responses* Strongly disagree - 1	Disagree - 2	Neutral - 3	Agree - 4	Strongly agree - 5	Undecided - 6	Total # of responses
Q7a	"Distant lecture was not different from the other in general"	f	7	36	30	32	12	0	117
		%	6.0	30.8	25.6	27.4	10.3	0.0	
Q7b	"Distant lecture technique did not have any positive or negative effect on my understanding the subject"	f	12	48	26	17	9	3	115
		%	10.4	41.7	22.6	14.8	7.8	2.6	
Q7c	"I felt comfortable in asking my questions during the distant lecture"	f	7	13	12	35	38	7	112
		%	6.3	11.6	10.7	31.3	33.9	6.3	
Q7d	"I could easily concentrate on the lecture without distraction during the distant lecture"	f	8	18	24	38	27	0	115
		%	7.0	15.7	20.9	33.0	23.5	0.0	
Q7e	"To get to know the lecturer previously did not have any effect on my understanding the subject or feeling comfortable during the distant lecture, etc."	f	6	9	14	14	5	4	52
		%	11.5	17.3	26.9	26.9	9.6	7.7	
Q7f	"Not to get to know the lecturer previously did not have any effect on my understanding the subject or feeling comfortable during the distant lecture, etc."	f	1	7	6	23	24	1	62
		%	1.6	11.3	9.7	37.1	38.7	1.6	
Q7g	"To attend a classical lecture of the lecturer previously did not have any effect on understanding the subject, or feeling comfortable during the distant lecture, etc."	f	3	8	13	11	6	1	42
		%	7.1	19.0	31.0	26.2	14.3	2.4	
Q7h	"Not to attend a classical lecture of the lecturer previously did not have any effect on understanding the subject, or feeling comfortable during the distant lecture, etc."	f	1	6	14	24	21	4	70
		%	1.4	8.6	20.0	34.3	30.0	5.7	
Q9a	"If there is any other distant lecture/design studio, I want to attend it"	f	5	7	22	33	40	4	111
		%	4.5	6.3	19.8	29.7	36.0	3.6	
Q9b	"If the same lecture/design studio is given both at the classical classroom environment and as distant lecture, I prefer to attend the distant one"	f	11	33	23	17	24	2	110
		%	10.0	30.0	20.9	15.5	21.8	1.8	
Q9c	"If there is a master's degree programme with some distant courses, presence of distant courses does not affect my opinion/wish about this programme"	f	7	17	22	34	20	10	110
		%	6.4	15.5	20.0	30.9	18.2	9.1	
Q9d	"I found distant lecture/studio advantageous since it allows following the course wherever I want, even at home."	f	6	8	15	21	47	2	99
		%	6.1	8.1	15.2	21.2	47.5	2.0	

*: The numbers following the response options indicate the values used for each in the box-plot diagrams.

Parametric and non-parametric tests conducted demonstrate that, of the ten factors hypothesized to affect e-Learning outcomes (Table 2), only seven were found to be in significant relation with the evaluation themes (effective e-Learning components) for further investigation (Figure 3). The identified diffractions and relations in the respondents' opinion are further elaborated and presented together with the descriptive analysis results in the following subsections, which are organized as per designated evaluation themes.

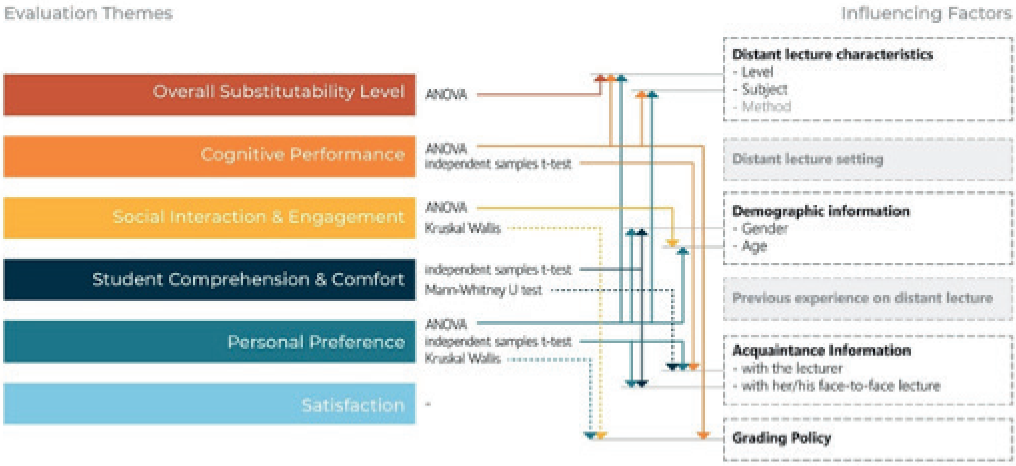

Figure 3. Significant relations network based on parametric and non-parametric tests

Overall Substitutability Level

Overall substitutability level (Q7a) indicates similarity and interchangeability levels of online and face-to-face courses in general. The response distributions in Table 4 and Figure 4 indicate that the ratio of respondents finding online sessions different from a face-to-face class is similar to those finding no difference (i.e., 36.8% and 37.7% respectively), yet, those strongly disagree are slightly greater than those strongly agree. Conversely, almost one-quarter of the respondents reported being neutral (25.6%) to the statement.

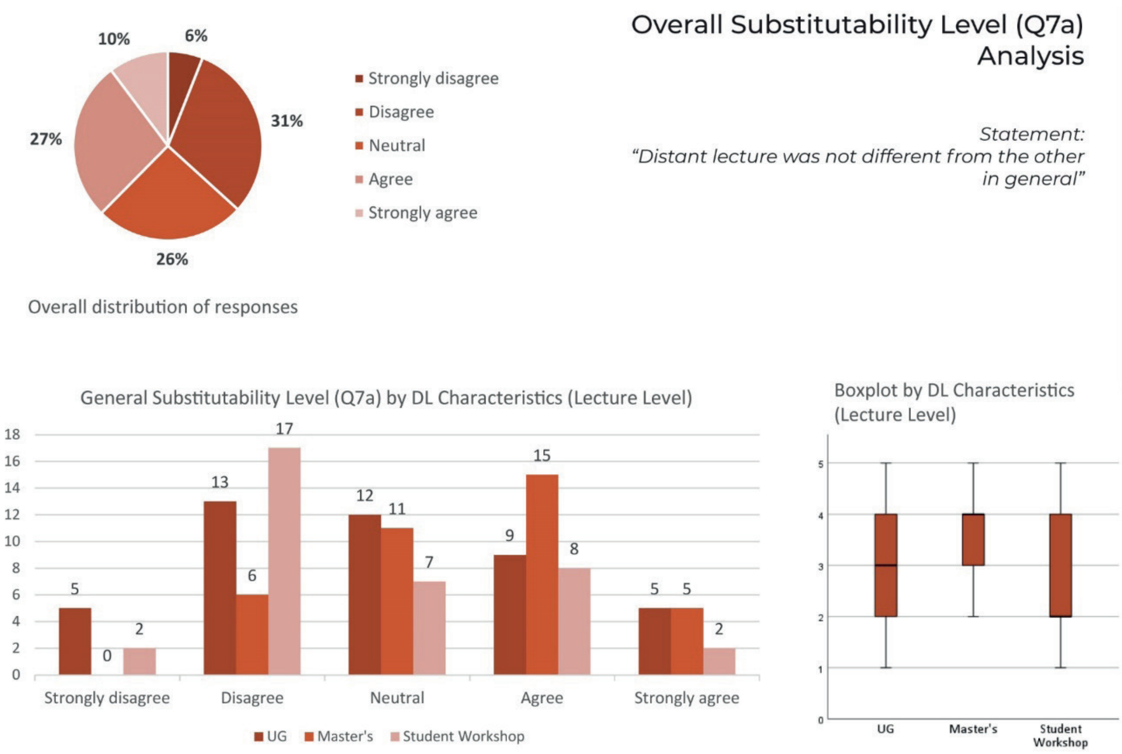

Figure 4. Overall substitutability level (Q7a) by DL Characteristics (Lecture Level)

Regarding the significant relation found between overall substitutability level and DL level, the box-plot diagram demonstrates the variation in the interquartile range (IQR) of responses and medians by DL level. The responses are more concentrated here, IQR is narrower and median value is at 'agree' for the master level, while it is at 'neutral' for the undergraduate level, and at 'disagree' for the student workshop with a wider IQR, specifically with more dispersed results. Accordingly, the overall response patterns indicate students of master level lecture consider DL as a substitute for face-to-face lecture, whilst workshop attendees mostly acknowledge a distinction between instructional formats (face-to-face vs. distant). Students of the undergraduate lecture, contrarily, were neutral on the investigated issue.

Cognitive Performance

Cognitive performance attempts to identify participants' mental abilities regarding understanding (Q7b) and concentration (Q7d). The response distribution given in Table 4, Figure 5 and 6, indicate that majority of participants (52.1% as the summation of 'strongly disagree' and 'disagree') report on the possible positive or negative impact of distance education on their understanding. Conversely, relating to concentration, over half of participants (56.5% as the total of 'agree' and 'strongly agree') declared they could stay focused during online lectures.

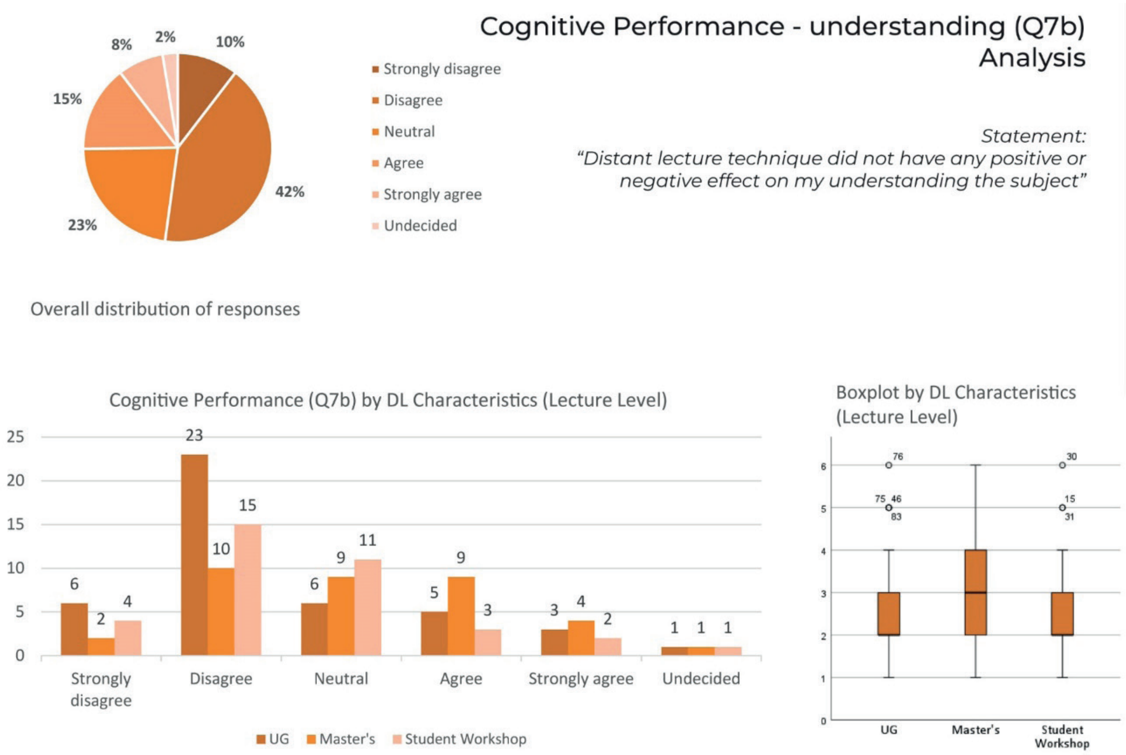

Figure 5. Cognitive performance – understanding (Q7b) by DL characteristics (Lecture Level)

Referring to the significant relation detected between understanding and DL level, the overall response patterns observed through box-plot diagramsshow that master students follow a neutral trend with a median value at 'neutral' and IQR extending to 'agree'. Yet, the median is at 'disagree' both for undergraduate level lectures and the student workshop with an IQR reaching just to 'neutral'. Apparently, undergraduate students and workshop attendees have experienced certain impacts of DL techniques on their understanding. Although, whether this effect is positive or negative is not addressed within the scope of this question, pairwise comparison of each participant's response to Q7d indicates that the effect may be positive for undergraduate students, since 78% of those who strongly disagreed or disagreed responded either as strongly agree or agree to not having a concentration problem. Yet, it is the opposite for workshop attendees, since 58% among strongly disagreed or disagreed stated a concentration problem.

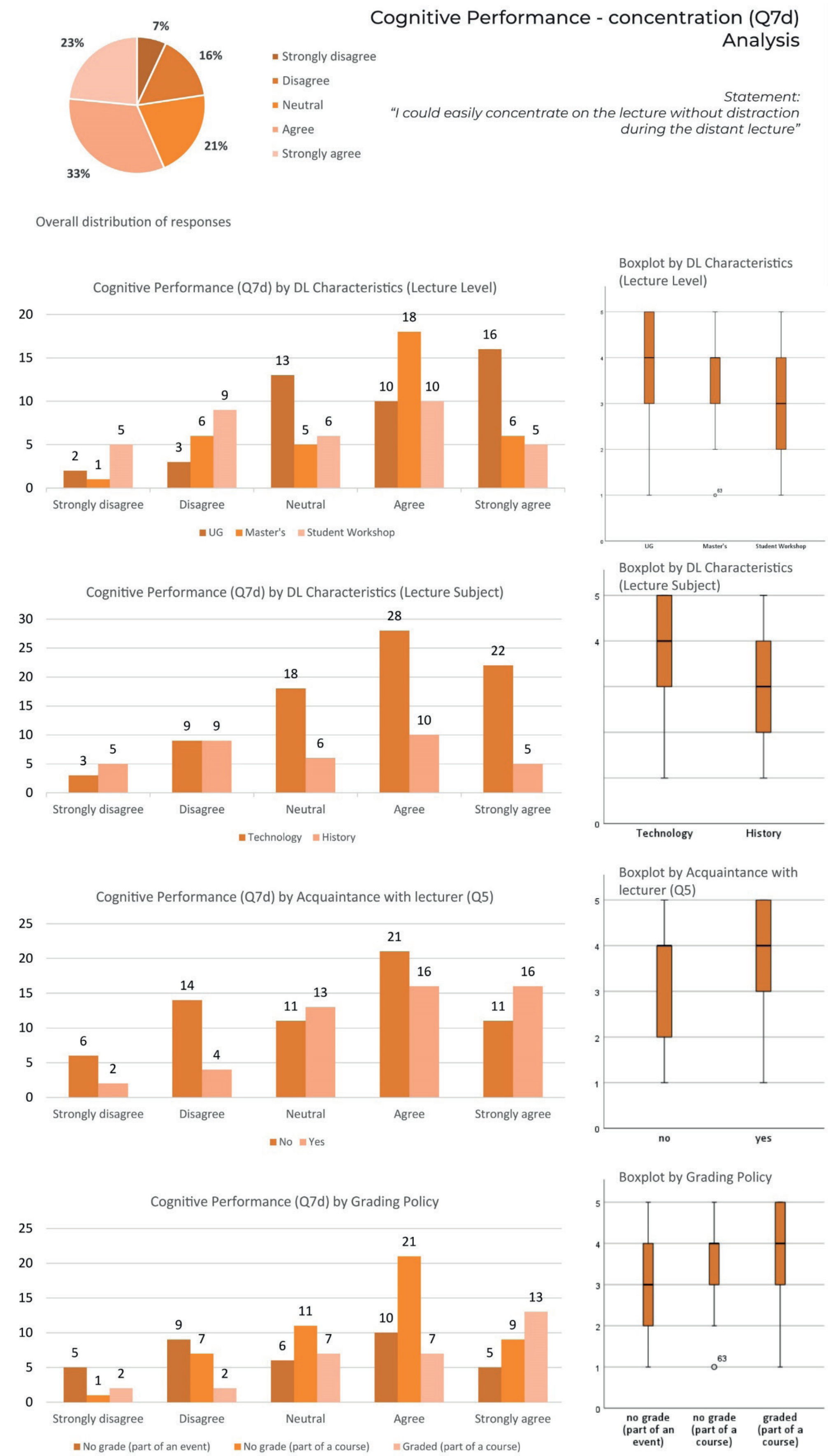

Figure 6. Cognitive performance – concentration (Q7d) by DL characteristics (lecture level and subject), acquaintance with the lecturer, and grading policy

Apropos of concentration, significant relations were observed with DL level, DL subject, acquaintance with lecturer, and grading policy. For DL level, half of master students (50%) state they could easily concentrate during DL without any distraction, and the median is at 'agree'. Undergraduate students' responses follow a similar trend with a median at 'agree' but IQR is wider, reaching 'strongly agree', indicating that concentration was not considered a significant problem among undergraduate students. However, workshop attendees' responses present a different pattern with a median value at 'neutral', and a ranging IQR between 'disagree' and 'agree'. Accordingly, balanced distribution between 'disagree' by 26% and 'agree' by 29% is observed, whereas slightly fewer responses were 'neutral' (17%). The overall response pattern signifies relative concentration issues to some extent. This concentration problem during the workshop may stem from the large hall in which DL (i.e., workshop lecture) was broadcasted to a large audience, namely due to session setting and its technical possibilities.

Based on DL subject, lectures of technology can be considered less prone to concentration and focus difficulties, with a median at 'agree' while 23% of respondents reported 'neutral' on the investigated issue. Participants of the history lecture, however, expressed more scattered views; 'disagree' by 26%, 'neutral' by 17%, and 'agree' by 29%, where median value is at 'neutral'. These findings imply that depending on lecture subject, participants' concentration levels may alter, thereby, student-interactive lectures that demand active participation may be opted for. Audience involvement needs to be encouraged specifically to make lectures more engaging.

Regarding participants' acquaintance with the lecturer, a slight effect on concentration has been observed. In both cases; i.e., participants who are previously acquainted with the lecturer and those who are not, most responses approved the statement, with a median value at 'agree', however, the distribution of views differs. For those with no previous acquaintance with the lecturer, IQR lower limit extends to 'disagree', where 22% of responses concentrated on 'disagree'. The majority of respondents with a previous acquaintance with the lecturer expressed their approval of the statement by 63% (as in summation of 'agree', and 'strongly agree'), and IQR upper limit for those extends to 'strongly agree' relatedly. This slight difference among the IQR range of two groups suggests that previous acquaintance with the lecturer enhances students' concentration in online lectures, supported by the higher ratio of negative responses (i.e., total of 'disagree' and 'strongly disagree') by those without an acquaintance versus those acquainted (32% and 12% respectively).

Relating to effects of grading policy on concentration, median value is at 'neutral' for the ungraded lecture as part of an event, and the response ratios for 'disagree', 'neutral' and 'agree' scales are 26%, 17%, and 29% respectively. Meanwhile, median for the respondents from ungraded lecture as part of a semester-long course is at 'agree', and those who reported to 'agree' with the statement have a higher ratio of 43%. The median of responses from participants attending a graded lecture as part of a course is also at 'agree', but with a considerable concentration around 'strongly agree' by 42% and 'agree' by 23%; besides, unlike others, its IQR extends to 'strongly agree'. Therefore, it could be argued that grading policies of online lectures may have an impact on participants' concentration; such that grading of participation and performance during a lecture can actually have a positive influence on students.

Social Interaction and Engagement

Social interaction & engagement (Q7c) refers to communication and involvement among participants and lecturer in an online environment. The response distribution given in Table 4 and Figure 6 indicates that over half of participants (65.2% as the total of 'strongly agree' and 'agree') reported feeling comfortable asking questions in an online learning environment.

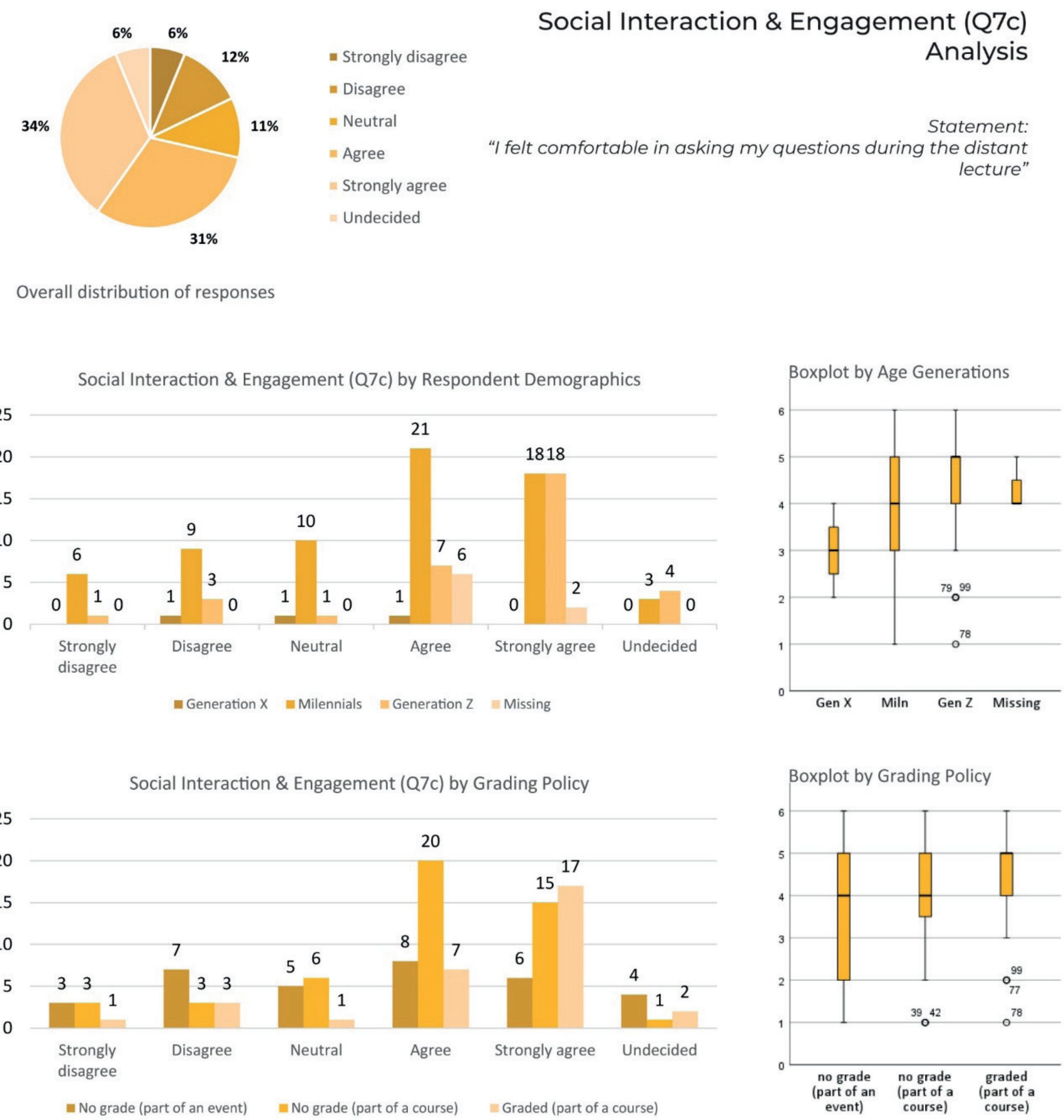

Figure 7. Social interaction & engagement (Q7c) by respondent demographics (generations) and grading policy

Regarding the significant relation between social interaction & engagement and generations, the total number of Generation X participants are too small to make any coherent comments. Between Millennials and Generation Z, a variance was observed clearer in box-plot diagrams; median value is at 'agree' for the Millennials with an apparent distribution of views towards neutral and disagreement whereas, it is at 'strongly agree' for the Generation Z with a narrower IQR, indicating that the latter group is more comfortable in in asking questions, in other words in interaction and engagement.

Based on grading policy and involvement, no considerable difference was spotted regarding social interaction and engagement among respondents of ungraded lecture as part of an event, where nearly a homogenous distribution among options were observed. In other two cases (ungraded and graded lectures as part of a semester-long course), general view of the participants was on the positive side, indicating no major issues with feeling comfortable in asking questions during DL. However, a slight distinction among cases is noted here; where the median value is at 'agree' for ungraded lectures as part of semester-long course whereas, it is at 'strongly agree' for the graded lecture with a slightly narrower IQR. These indicate that the grading policy of DL may create a positive impact on students to involve and participate in online lectures.

Student Comprehension and Comfort

Student comprehension & comfort investigates the ability to understand the lecture and to manage social anxiety in an online environment based on several conditions; previous acquaintance with the lecturer (Q7e) or no previous acquaintance (Q7f), and previous attendance to a classical-classroom lecture of the lecturer (Q7g) or no previous attendance (Q7h). The articles discussed in this section were responded by a limited number of participants due to the question prerequisites.

The response distributions of Q7e and Q7f given in Table 4 and Figure 8 indicate that the opinions of respondents with previous acquaintance with the lecturer (Q7e) were more dispersed (e.g. 17% 'disagree', 27% 'neutral' and 27% 'agree') whereas, those of with no previous acquaintance with the lecturer (Q7f) were more concentrated. Nearly their three-quarter (75.8% as the total of 'strongly agree' and 'agree') reported no effect of previous acquaintance on their comprehension and comfort, indicating that their understanding or confidence levels in DL was not dependent on being acquainted. The general opinion among respondents with previous acquaintance with the lecturer was also in support of the statement however, with a slight hesitation.

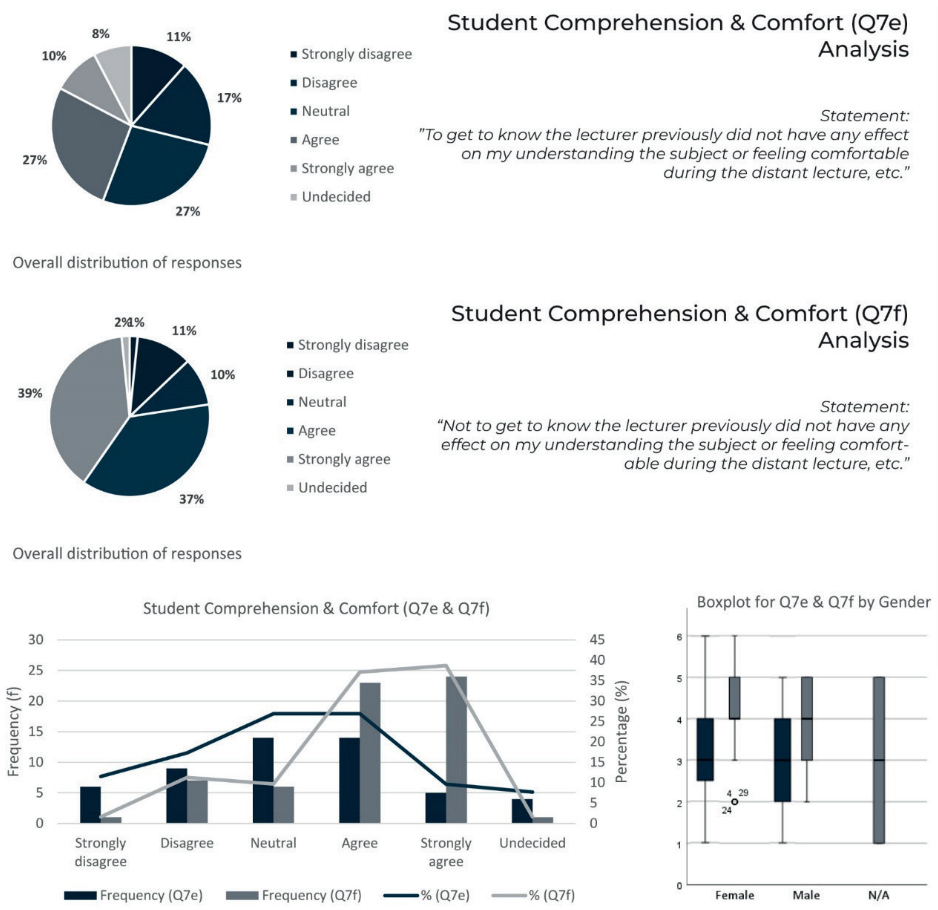

Figure 8. Student comprehension & comfort comparative analysis (Q7e – Q7f) and evaluation by respondent demographics (gender)

Relating to the significant difference detected between student comprehension & comfort and gender, findings indicate that median value for participants with previous acquaintance with the lecturer is at 'neutral' for both females and males. Whilst, it is at 'agree' for participants with no previous acquaintance, again for both genders. Yet, IQR of responses vary slightly gender-wise for both with and without previous acquaintance. The IQR lower limit is observed to extend to 'disagree' for male participants who are previously acquainted with the lecturer and to 'neutral' for male participants who are not whereas, their respective lower limits for female participants do not extend nearly as much comparatively. This slight difference among the IQR range of genders provides an insight that prior acquaintance or lack of acquaintance may be an issue for males rather than females.

The response distributions of Q7g and Q7h given in Table 4 and Figure 9 show that the responses from participants with prior attendance to a classical classroom lecture of the lecturer (Q7g) distributed almost evenly among 'disagree', 'neutral', and 'agree' (i.e., 19.0%, 31.0% and 26.2%, respectively). Whereas, among those without any prior attendance (Q7h), over half of the participants (64.3% as the total of 'strongly agree' and 'agree') reported no effect on their comprehension and comfort during DL, with a tendency towards approval of the statement that says their understanding or feeling comfortable in DL was not relevant with the state of prior attendance. The general opinion among respondents who have attended a classical-classroom lecture was also in support of the statement however, with a slight hesitation.

Regarding the significant difference detected between student comprehension & comfort and gender, findings indicate that median value for participants with a prior attendance to a classical lecture of the lecturer is at 'neutral' for both females and males, whilst for those with no prior attendance, it is at 'agree' for female and at 'neutral' for male participants. Nonethless, IQR of responses vary considerably gender-wise among both groups. For female participants who have previously attended a classical-classroom lecture of the lecturer, IQR is wider with a lower limit extending to 'disagree' whereas, for male participants with previous classroom attendance, IQR is narrow and concentrates between 'neutral' and agree'. In the case of no prior attendance, eventhough IQRs have the same width, their concentration ranges are different for female and male participants, i.e., ranges between 'agree' to strongly agree', and between 'neutral' to 'agree' respectively. These differences among genders provides an insight that prior attendance to a classical-classroom lecture of the lecturer may be an issue for females rather than males.

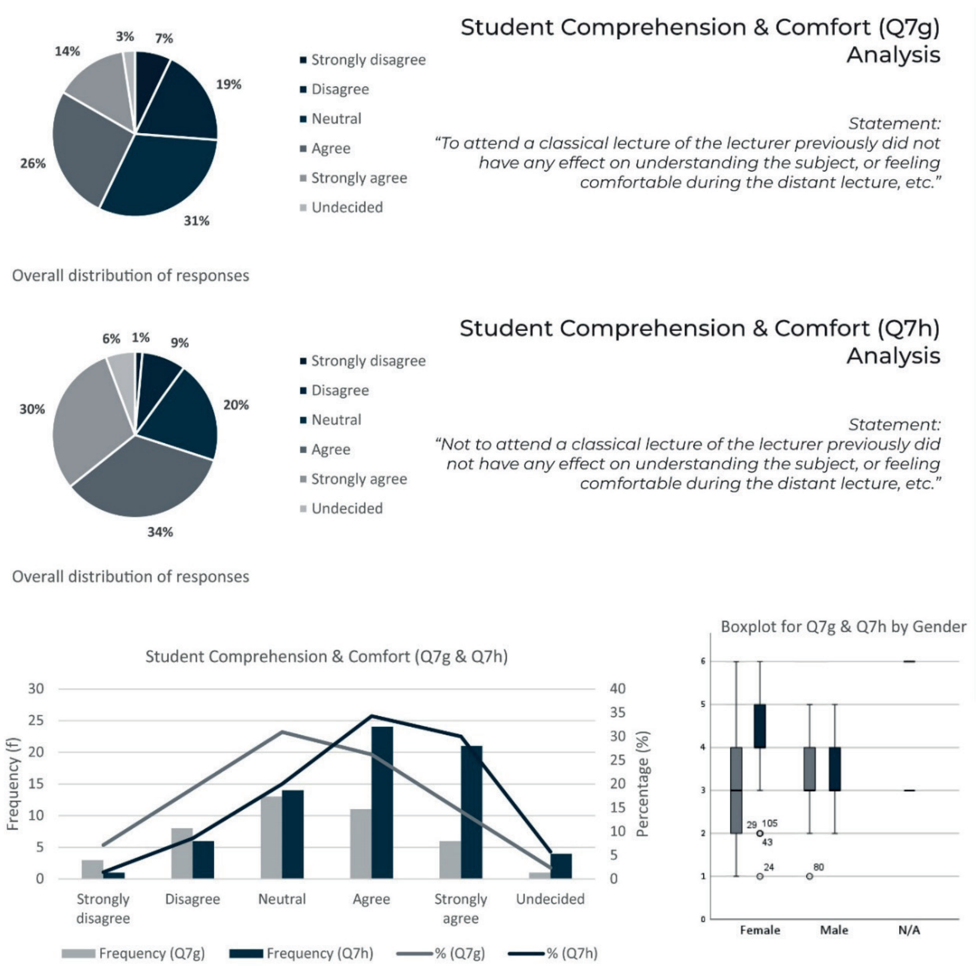

Figure 9. Student comprehension & comfort comparative analysis (Q7g – Q7h) and evaluation by respondent demographics (gender)

Personal Preference

Personal preference, as the name suggests, indicates the particular opinion or choice a person might prefer distinguished from others. This issue is assessed relative to participants' tendency towards attending other online lecture possibilities in future (Q9a), preferred delivery method (face-to-face vs. distant) for the lecture attended (Q9b), and choice on selecting a master's degree programme with distant courses included (Q9c).

The response distribution of tendency towards attending another online lecture in future (Q9a) shown in Table 4 and Figure 10 indicates that over half of the participants (65.8% as the total of 'strongly agree' and 'agree') reported being willing to attend any possible distance course in future. Regarding its significant relation to grading policy, in-depth analysis demonstrates that, although the medians of the responses from no grade lectures are both at 'agree', the IQR of ungraded as part of a semester-long course is wider, and extends to 'strongly agree'. This might imply an increased willingness compared to the ungraded as a part of an event. Graded lecture, however, revealed a more noticeable emphasis of positive reactions for future possibilities, 67% of respondents expressed their willingness to attend any other DL in future by marking 'strongly agree', and in turn the resulting median is at 'strongly agree'. These results indicate that the grading of class participation has a positive impact which increases their willingness to attend future DL/studio possibilities.

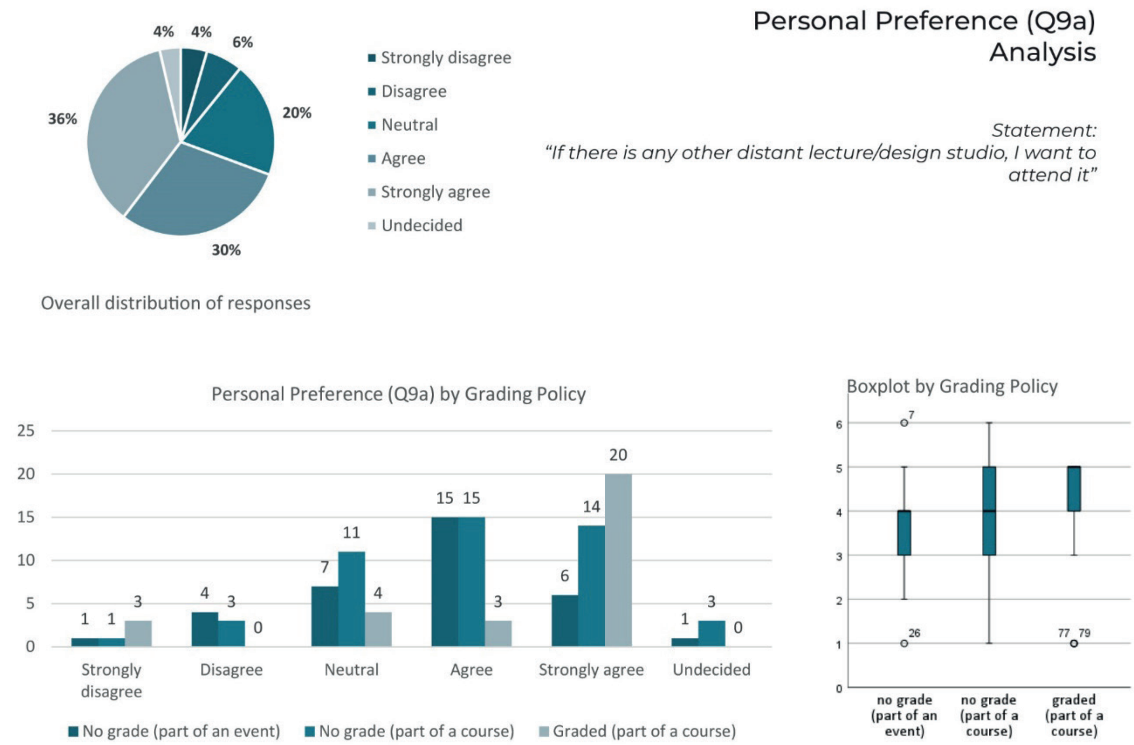

Figure 10. Personal preference to attend a future DL/studio (Q9a) by grading policy

The response distribution of preferred delivery method (face-to-face vs. distant) for the lecture attended (Q9b) given in Table 4 and Figure 11 initially suggests no prominent tendency since responses distribute almost equally among those oppose and those approve the statement given (44% and 41% respectively). However, parametric and non-parametric tests conducted revealed certain significant relations and diffractions for DL level, DL subject, respondent demographics (age in generations), grading policy, acquaintance with the lecturer, and attendance to a classical-classroom lecture of the lecturer.

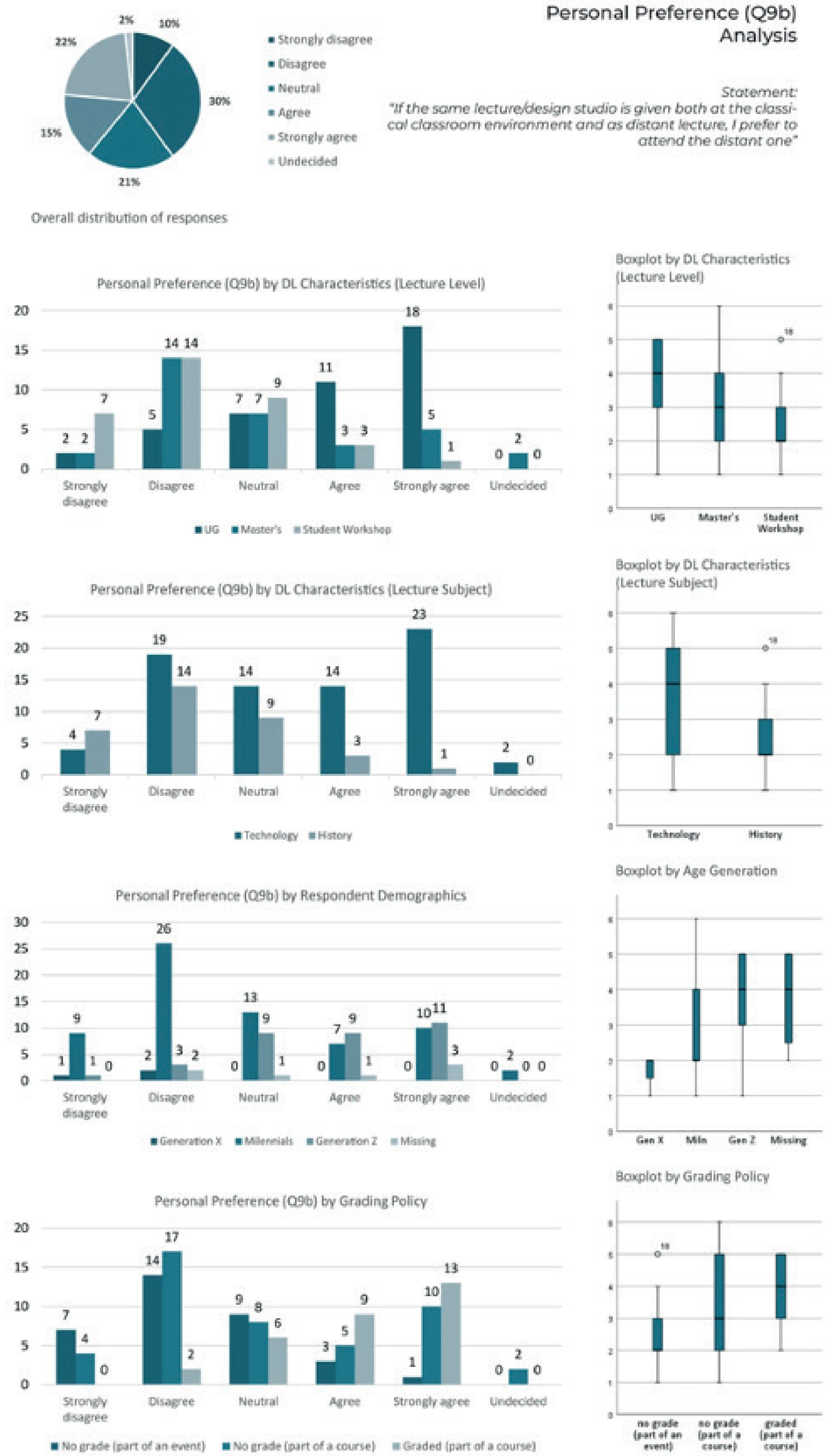

Figure 11. Personal preference regarding course delivery method (Q9b) by DL characteristics (level and subject), respondent demographics (age in generations), grading policy, acquaintance with the lecturer, and attendance to a classical-classroom lecture of the lecturer

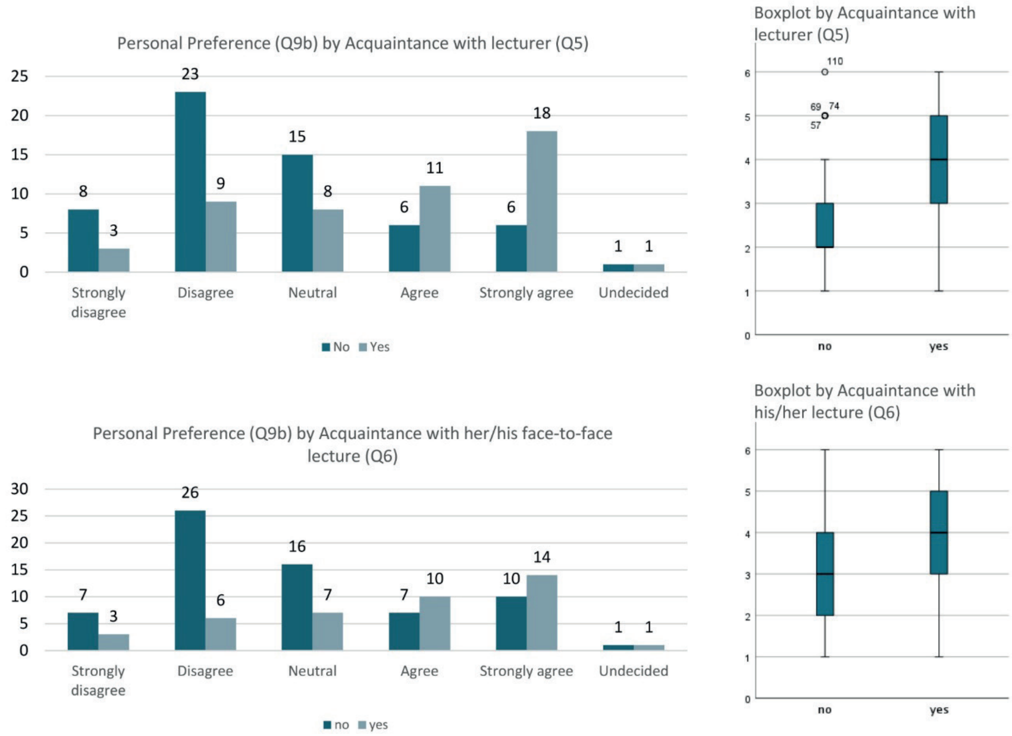

Figure 11-continued. Personal preference regarding course delivery method (Q9b) by DL characteristics (level and subject), respondent demographics (age in generations), grading policy, acquaintance with the lecturer, and attendance to a classical-classroom lecture of the lecturer (continued)

Responding to personal preference (Q9b), undergraduate students are likely to attend a distant one, even when a face-to-face option is offered, with a median at 'agree'. In contrast, for master students and workshop attendees, there is a tendency to favor a classical-classroom environment over a distant one, with medians at 'neutral' and 'disagree' respectively. Based on the overall response patterns and IQR ranges, seniority and experience levels of respondents may be cited as a reason for this variance in preference.

Apropos of DL subject, personal preference of history lecture participants indicates if both instructional formats are provided, they would opt for the face-to-face one, since the majority of them expressed reluctance for a distant option (41% 'disagree', and 21% 'strongly disagree'). This presents an identical pattern to that of workshop attendees with a median at 'disagree', because the only history lecture conducted was during the student workshop, addressing the same group of respondents. The resulting IQR range between 'neutral' to 'disagree'. Nevertheless, responses among technology lecture participants yield a balanced distribution between 'disagree' to 'strongly agree', suggesting a slightly more tendency towards distant one with a median at 'agree'. The overall patterns of responses suggest that, with a comparatively expanding IQR, students of technology lectures hold quite different opinions about their preference whereas, history lecture attendees seem to reach a consensus on favoring the face-to-face instruction format.

In reaction to personal preference, responses from all generations are spread unevenly, suggesting considerably distinct tendencies when both instructional formats are offered. Generation X was excluded from this in-depth examination due to its low number of respondents. The overall response patterns observed through box-plot diagrams indicates that Generation Z participants favor a possible distant option, with IQR ranging from 'strongly agree' to 'neutral'. Whereas Millennials reported a significant response concentration around 'disagree' by 39% with a resulting median at 'disagree', indicating that they favor more the face-to-face option.

Regarding the grading policy of lecture attended, participants of a graded course prioritize to attend a distant one when both instructional formats are offered; 30% agree and 43% strongly agree. In contrast, for students of an ungraded lecture, there is a tendency to favor a classical-classroom environment over a distant one (disagree by 41% for ungraded as part of an event and 37% for ungraded as part of a semester-long course). Still, median value is at 'disagree' for the for the former, 'neutral' for the latter. This overall response pattern reveals dissensus of ungraded lecture participants' preference, based on the attended lecture's being part of a one-off event or a semester-long course. Nevertheless, DL's grading policy may have a positive impact on performance efficiency which could explain why participants of a graded course prefer to attend a distant one.

Interestingly, a substantial difference was observed with personal preference reactions on previous acquaintance with the lecturer. The overall response patterns reveal participants who have not met the lecturer before tend to attend a face-to-face lecture if both instructional formats are available for the same lesson. It is the otherwise for those who met before. As demonstrated in the box-plot diagrams, median value is at 'disagree' for the respondents who have not met the lecturer before and at 'agree' for those who have. The results indicate the previous acquaintance with the lecturer may have a considerable impact on participants' future tendencies in attending an online lecture.

Finally, personal preference responses were also analyzed based on previous attendance to a classical-classroom lecture of the lecturer. Participants who have not participated prioritize attending a face-to-face lecture more if both instructional formats are available, with a median at 'neutral'. Those participated, on the other hand, favor more the distant one with a median at 'agree'. These findings suggest that, similar to acquaintance with the lecturer, previous attendance to a face-to-face lecture of the lecturer does actually affect the participants' future tendencies in attending online lectures.

DISCUSSION

The components of an effective e-Learning were nominated in this as overall substitutability level, cognitive performance, social interaction and engagement, student comprehension and comfort, personal preference, and learners' satisfaction. Remarkably, in regards to learners' satisfaction, none of the nine potential factors investigated that are expected to influence learner experience had significant effect on participants' satisfaction (i.e. $p > 0.05$). Among these factors, findings also showed no statistically significant difference between the groups of 'DL setting' and 'previous experience on DL' for the selected components of effective e-Learning. Yet, this might be due to the uneven distribution of responses.

Parametric and non-parametric tests conducted verifies that out of ten potential factors hypothesized, nine were analyzed and seven were proved to be significant to affect e-Learning effectiveness based on the respondents' assessments (Table 5). Investigating the impact of subdivisions among each evaluation theme by its determined significant influencing factor, diffractions for varying features surfaced as potential components of impact as well. These potential sub-influencing factors are also given in Table 5 as potential sub-factor (PS). However, the identified sub-factors were reserved for further inquiry and not covered in this research because they are thought to be subject to statistical bias due to relatively small sample population per group and/or nonhomogeneous distribution within each group.

Table 5. Significant relations matrix and potential subdivisions that needs further research

Theme			Potential factors									
			DL level (Le)	DL Subject (Su)	DL Method (Me)	DL Setting (Se)	Participants' gender (Ge)	Participants' age (Ag)	Previous experience (Ex)	Acquaintance with lecturer (Al)	Acquaintance with face-to-face class (Af)	Grading policy (Gr)
Overall substitutability level	Q7a	Primary	○									
		PS*					PS_{Le}	PS_{Le}				PS_{Le}
Cognitive performance	Q7b	Primary	○									
		PS*					PS_{Le}	P_{Le}		PS_{Le}		
	Q7d	Primary	○	○						◘		○
		PS*					PS_{Le}	PS_{Le}, PS_{Al}, PS_{Gr}		PS_{Le}		
Social interaction and engagement	Q7c	Primary						○				•
		PS*	PS_{Ag}				PS_{Ag}	PS_{Gr}				
Student comprehension and comfort	Q7f	Primary					◘			■		
		PS*	P_{Ge}									PS_{Ge}
	Q7h	Primary					◘					
		PS*	PS_{Ge}							PS_{Ge}		PS_{Ge}
Personal preference	Q9a	Primary										•
		PS*					PS_{Gr}	PS_{Gr}		PS_{Gr}		
	Q9b	Primary	○	○				○		◘	◘	○
		PS*	PS_{Al}, PS_{Af}				PS_{Le}, PS_{Gr}	PS_{Le}		PS_{Ag}		PS_{Su}, PS_{Ag}, PS_{Al}

○: significant relation found by ANOVA

◘: significant relation found by independent samples t-test

• : significant relation found by Kruskal Wallis

■ : significant relation found by Mann-Whitney U test

*: The indices following PS indicate the associated factors using the abbreviations given in the title row.

Course structure and content design, together with other course-related subscales i.e., management, structure, and quality, were acknowledged by several researchers to have a notable contribution to successful e-Learning implementation and perceived e-Learner satisfaction (Bolliger and Martindale, 2004; Eom et al., 2006; Sun et al., 2008; Raspopovic et al., 2014; Mtebe and Raphael, 2018). Significant findings on course characteristics related variables of this study revealed the following;

- DL level is found to be a factor in the student's opinion on the overall substitutability level (Q7a) of distant lectures. The higher the level at which the course was taught, the more they thought it was a substitute for the face-to-face lecture. Concerning understanding (Q7b) and concentration (Q7d) referring to cognitive performance, master's students mostly thought that their understanding performance of the subject was affected neither positively nor negatively by the distance learning techniques, with almost no concentration problems. Undergraduate students, on the other hand, thought that their understanding performance was affected. Yet, it was most likely positive, since the ease of concentration without any distraction was referred to more in comparison to master's students. Regarding the preference for attending a DL if both instructional formats are available (Q9b), undergraduate students are observed to be more interested in distant options than neutral master students.

- DL subject is found to be a determinant of concentration levels (Q7d), where votes for ease of concentration were higher in favor of technology when compared to that of history. The impact of subject is also apparent in personal preference for attending a DL if both instructional formats are available (Q9b); respondents of technology courses showed more interest in distant lectures as opposed to those who attended a history course.
- Grading policy, i.e. grading of the lecture is observed to create a positive impact on students' comfort perception of involvement and asking questions in online lectures (Q7c). A possible impact of grading policy on concentration (Q7d) surfaced, but the additional considerable difference observed between whether the DL is part of a semester-long course or not indicated a coupled situation, thus, further surveys seem beneficial to be concrete regarding its effect. The impact of grading policies on personal preference for attendance to a future DL (Q9a) indicates that respondents' interest in future distant opportunities are positively affected by grading of class participation. Grading policy had a varying impact on personal preference concerning course delivery method (Q9b); attendees of a graded lecture show interest in attending a DL if both instructional formats are available as opposed to others. Attendees of an ungraded lecture as part of a semester-long course reported neutral on this issue and participants of an ungraded lecture as part of an event were likely to prefer face-to-face lectures.

Influence of student/learner dimension on e-Learning effectiveness, which is generally investigated through gender effects in literature, has been a highly referred aspect (e.g., Valory and Lord, 2000; Eom et al., 2006; Sun et al., 2008; Frimpon, 2012; Bhuasiri et al., 2012; Seters et al., 2012; Raspopovic et al., 2014; Kerzic et al., 2019). In addition to gender-specific characteristics, age cohorts were acknowledged as an influencing factor in this study, and findings related to both revealed the following;

- Referring to the relationship between the gender-wise comparison of being acquainted with the lecturer and student comprehension & comfort (Q7e-Q7f), a slight difference in the response distribution suggests that, in understanding the subject or feeling comfortable during DL, prior acquaintance, or lack of acquaintance, may be an issue for males rather than females. On the contrary, in regards to the effect of previous attendance to the lecturer's classical-classroom lecture on the student's comprehension & comfort (Q7g-Q7h), previous attendance may have more impact on female respondents' understanding of the subject or feeling comfortable during DL.
- The impact of age cohorts on social interaction and engagement (Q7c) signifies that Generation Z is much more comfortable communicating in distant lectures than Millennials. Similarly, Generation Z respondents prioritize attending a DL if both instructional formats are available (Q9b) whereas, Millennials reported the direct opposite.

Previous acquaintance with the instructor or prior attendance to her/his classical-classroom lectures, addressed as a prospective contributing factor in this study, has no foundations in literature. Survey results show that acquaintance with the lecturer has no substantial impact on concentration level (Q7d) though, views approving ease of concentration were increased slightly in favor of those who had met the lecturer before. Prior acquaintance with lecturer had also positive effects on respondents' tendency for attending a DL if both instructional formats are available (Q9b). Similarly, findings indicate that prior attendance to a classical-classroom lecture of the lecturer positively contributes to respondents' preference in attending an online lecture instead of its face-to-face counterpart (Q9b).

CONCLUSION

Findings of this study, which aimed to identify success factors in synchronous e-Learning through the architectural students' viewpoint, revealed that opinions for the overall substitutability level of distant vs. face-to-face lectures and cognitive performance in regards to understanding were directly associated with DL level. On the other hand, views on cognitive performance in regards to concentration were found to be affected by more than one factor; i.e., DL level, DL subject, prior acquaintance with the lecturer, and grading policy. Participants' comfort in social interaction and engagement was observed to be primarily driven by the respondents' age cohorts and grading policy of the lecture. Students' views on comprehension performance and overall comfort level in an online environment, which were queried via conditional questions, were observed to be influenced by respondent gender only. Finally, personal preference regarding participants' tendency to attend a possible online lecture in future was primarily driven by grading policy whilst, their preference in regards to the preferred delivery method (face-to-face vs. distant) for the lecture they attended was influenced by multiple factors. In particular, DL level and subject, respondents' age cohorts, grading policy, prior acquaintance with the lecturer, and previous attendance to a traditional face-to-face lecture of the lecturer were observed as stimulating aspects of personal preference in the preferred delivery method.

Fully or blended online education, considering the opportunities it provides, will most likely remain a part of architecture education even when the pandemic is over. This study contributes to e-Learning in architecture by unveiling some success factors in its effective implementation from the viewpoint of students and introducing the significance of prior acquaintance with the lecturer and previous attendance to a traditional face-to-face lecture by the lecturer on effectiveness. The results indicate the possibility of several diffractions affecting the evaluation themes however, these potential sub-factors were reserved for further inquiry and excluded from the scope of this study.

Practical Implications

The results acquired show that graduate students approve of the substitutability potential of online courses to replace face-to-face lectures. In consideration of the learners' maturity and experience, postgraduate programs are more likely to achieve success when organized in distance education. Another inference derived from the survey results was the effects of DL subject on learners' concentration levels and preference in attending different instructional formats. This result indicates that course subject and content should be taken into account in distant education planning, and decisions on online learning/teaching methods should be made course-by-course basis. Another important result derived from this study was the significance of previous acquaintance with the instructor or prior attendance to her/his classical-classroom lectures, which suggests that the positive effect of meeting face-to-face is not to be neglected. It is recommended that in the planning of online lectures, the first introduction and encounter should be face-to-face.

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THE INSTRUCTOR PARAMETERS OF TRANSITION TO FULLY ONLINE LEARNING

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ABSTRACT

Online learning has an old background and is an efficient method if applied correctly. However, during the pandemic period, it has been faced with a negative perception due to the wrong practices brought about by the mandatory and rapid transition. During this pandemic term, most educational institutions have offered support in this process to explain the process to both their students and instructors. This study examined XXX University instructors' perspectives regarding the emergency remote teaching period in terms of their professional experience, discipline area, online instruction experience, and whether they received training in online instruction. Quantitative research methods were used in the study. An online instructor's emergency remote teaching perspective scale has been developed and used as a data collection tool. A significant difference has been found in the discipline areas, online instruction experience, and participation in training program. From the results of the research, the need to support the instructors according to the needs specific to the disciplines has been revealed, and it is recommended to investigate the relationships between self-competency for online teaching and the perception of institutional support in depth.

Keywords: Online learning, higher education, clustering, instructor perspective.

INTRODUCTION

Online learning has been widely preferred all around the world, especially during and after the Covid-19 pandemic. Even if online learning is an efficient method in certain situations, during and after the pandemic it has been used at almost all education levels. This imperative and rapid shift has resulted in many negative experiences (Adedoyin & Soykan, 2020; Sharadgah & Sa'di, 2020). However, studies in the field of online learning show that the harmonious interaction of each component in the online learning process brings with it an effective learning experience. Instructors, students, the system, content, institution, and their interaction are the main components of online learning. Anderson's (2008) model also shows these components and their associated subcomponents (Figure 1).

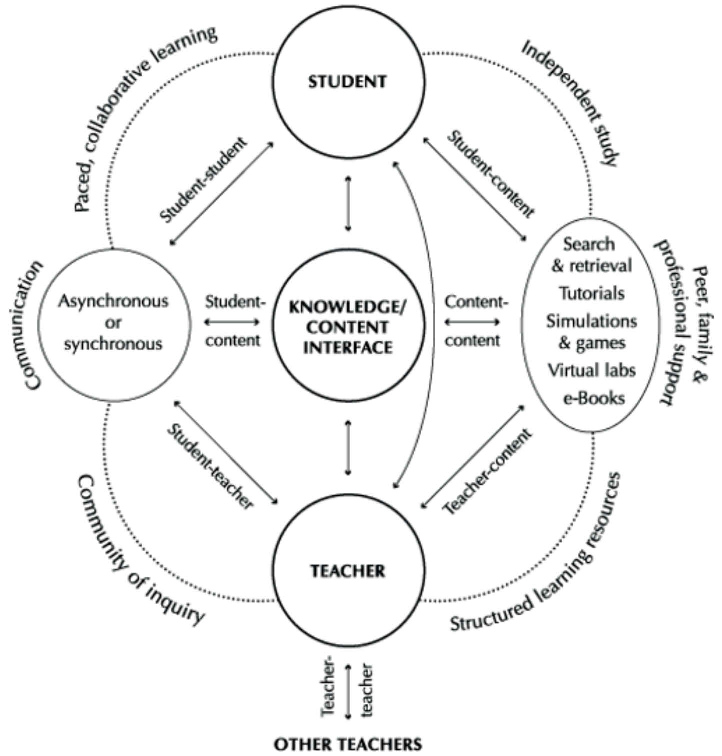

Figure 1. A model of online learning showing types of interaction (Anderson, 2008)

Previous studies about distance education have focused more on students and institutional structures than on instructors (Martin, 2022; Martin, Sun, & Westine, 2020). Research findings examining instructors' perceptions of the online learning process have focused on creating community (Berry, 2019), lack of support (administrative, personnel, pedagogical and technological) (Kulal & Nayak, 2020; Martin et al, 2019), roles or functions (designer, facilitator, developer, etc.) (Martin, Kumar & She, 2021).

Online learning is a planned and systematic process, so it is an efficient method when the stakeholders are ready for this in terms of infrastructure, experience, motivation, preparation, and readiness. However, during the pandemic, a large group of instructors experienced online learning for the first time. As such, it is vital to investigate their experiences during this process. Gulinna, Xie, and Korkmaz (2022) found that teachers did not like teaching online during the pandemic. Thus, understanding the basics and the underlying cause of this situation is critical for supporting an effective online learning experience.

Online learning is a complete process with instructional design process -analysis, development, implementation, and evaluation- support systems and services. During the pandemic, most of the instructors and institutions were unprepared for or inexperienced with online learning. For this reason, a new concept arose – emergency remote teaching (ERT) – to classify the process experienced with online learning (Hodges, Moore, Lockee, Trust & Bond, 2020). In addition to online learning and distance education studies, researchers have found several problems that instructors experienced during the ERT term. These problems are lack of information communication technologies literacy abilities (Almazova, Krylova, Rubtsova & Odinokaya, 2020; van der Spoel, Noroozi, Schuurink & van Ginkel, 2020), experience with online instruction (Gulinna et al., 2022; Joshi, Vinay & Bhaskar, 2021; Shambour, & Abu-Hashem, 2022; van der Spoel et al, 2020); technical support (Kamisli & Akinlar, 2022; Samifanni & Gumanit, 2021, Verma, Campbell, Melville & Park, 2020); communication efficiency (Sari, & Nayir, 2020; Sepulveda-Escobar & Morrison, 2020); and content-related issues (Karakaya, 2021; Sedaghatjou et al., 2021; Xie, Rice & Griswold, 2021).

The importance and necessity of the instructional design in which instructors use online learning methods also emerged during the ERT process. It was especially necessary to create efficient instructional design implementations for application-oriented content (Ilgaz & Yildirim, in press). However, this sudden and rapid shift to online learning has been more challenging for some disciplines. Application-oriented discipline areas such as health sciences and engineering experienced more difficulty during ERT (Sedaghatjou et al., 2021; Verma, Campbell, Melville & Park, 2020; Xie & Rice, 2021). Gulinna et al. (2022) emphasized that academics in different disciplines have different instructional and assessment design needs, so creating specified training programs based on their needs is essential for supporting them.

The area of discipline is another important dimension during the online learning process (Bolliger & Martin, 2021; Khan, Kambris & Alfalahi, 2022; Martin et al., 2021). Becher (1994) defined four discipline areas for higher education. The first is hard-pure, which consists of physics, mathematics, chemistry, and similar majors. The second is soft-pure, which consists of history, philosophy, anthropology, etc. The third is hard applied, which consists of majors like engineering, medical sciences, and dentistry. The fourth is soft applied, which consists of education, law, and social sciences. The soft-applied disciplines focus more on the practical implementation of protocols or procedures (Redmond, Devine & Bassoon, 2014). Previous discipline-based studies investigated student behaviors (Finnegan, Morris & Lee, 2008), instructional design of math courses (Smith, Torres-Ayala & Heindel, 2008), engagement of K-12 science classes (Jaber, Dini, Hammer & Danahy, 2018) and student performance and participation (Vo, Zhu & Diep, 2020).

Each discipline area has its own teaching methods and strategies. The needs of learners can be met efficiently with a well-designed course in an online learning environment. The common point of previous discipline-based studies is they were conducted before the pandemic. So, this means that the instructors – regardless of which discipline area – are motivated and ready for the online learning process. The critical point is taking into consideration these dimensions for the duration of the pandemic, as during this period instructors were not ready or motivated for online learning. Shambour and Abu-Hashem (2022) compared to 187 university lecturers of various disciplines and teaching experiences in traditional learning and online learning environments during the pandemic by academic majors, and they could not find a significant difference. Machajewski, Steffen, Romero Fuerte and Rivera, (2019) investigated the patterns of course tools used by faculty members. While some faculties under the medical discipline used all the tools (grade center, announcement, assignment, assessments, discussions, etc.) included in the online learning system, the engineering faculty mostly used complementary tools. Therefore, it is important to conduct discipline-based research from the perspectives of instructors regarding the period of the pandemic.

PURPOSE OF THE STUDY

In line with the possibilities of ERT, it does not make much sense at the first stage to expect instructors' experiences to be multi-dimensional. Because, considering that in ERT, the teachers try to transfer their face-to-face habitus to the online environment (Hodges et al., 2020), it may be expected that the skills of using online learning systems in terms of the teaching and measurement methods they are accustomed to and the institutional support for these skills will be important. This study examined XXX University instructors' self-competency and institutional support regarding the emergency remote teaching period in terms of their professional experience, discipline area, online instruction experience, and whether they received training in online instruction. Accordingly, answers to the following research questions were sought:

1. Is there any difference in self-competency for ERT and institutional support in terms of the time spent in the profession?
2. Is there any difference in self-competency for ERT and institutional support in terms of having previous experience in online learning?
3. Is there any difference in self-competency for ERT and institutional support in terms of participation in the training program?
4. Is there any difference in self-competency for ERT and institutional support in terms of the discipline areas (hard-pure, soft-pure, hard-applied, soft-applied, and others)?
5. How do instructors' experiences differ in terms of their self-competency and institutional support?

METHOD

A quantitative research design was used in this study to determine instructors' perspectives based on several variables. Regarding this design descriptive statistics and unsupervised machine learning (clustering) were used during the research. For data collection a "Online Instructor's Emergency Remote Teaching Perspective Scale" developed. For this development process validity and reliability studies have been conducted.

The Context and Sample

After the World Health Organization (WHO) declared that COVID-19 was a pandemic and the Higher Education Council decided to transition to online learning, XXX University became one of the first universities to move all of its courses online at every level. Initially, several quick and compact system training sessions were planned and streamed to all instructors. At the end of the Spring 2020 semester, a detailed online instructor certificate program was applied to the instructors. This program consisted of theoretical and practical information about the foundations of learning and distance education, instructional design, assessment and evaluation techniques, communication tools and usage, visual design, etc.

In this regard, the study was conducted among the instructors at XXX University. The questionnaire was open to all instructors on a volunteer basis. The sample included 1571 instructors working at XXX University in the 2020-2021 Fall Semester. Before the data collection process, Ethical Approval was taken from the University Commission. The demographic variables have been presented in Table 1.

Table 1. Demographic data of the participants

Variables		Frequency (f)	Percent (%)
Gender	Female	646	50.8
	Male	625	49.2
Age	22-32	45	3.5
	33-43	439	34.5
	44-54	419	33.0
	55-64	328	25.8
	65+	40	3.1
Title	Professor	550	43.3
	Associate Professor	257	20.2
	Assistant Professor	136	10.7
	Research Assistant	76	6.0
	Teaching Assistant	252	19.8
Time spent in the profession	2 and less	129	10.1
	3-10	283	22.3
	11-18	238	18.7
	19-26	206	16.2
	27-34	284	22.3
	35-42	114	9.0
	43+	17	1.3
Experience in online instruction	Yes	352	27.7
	No	919	72.3
Participation to training program	Yes	885	69.6
	No	386	30.4
Discipline area	Hard pure	118	9.3
	Soft pure	224	17.6
	Hard applied	449	35.3
	Soft applied	236	18.6
	Other	238	18.7

Data Collection and Analysis

The Scale Development Process

The current scales (Bangert, 2016; Bigatel et al., 2012; Gay, 2016) related with online instructors have been identified in a detailed way. Also after reviewing these scales the items were prepared in consultation with student affairs, instructional designers, content development specialists, and system administrators who interacted with online instructors during the pandemic. An item pool was created to reflect the interaction of the instructor and the institution during emergency remote teaching education. So the first version of the scale was designed as 19 items and a 5-point Likert-type, and the ranges from 1 – strongly disagree, to 5 – strongly agree. In order to examine the construct validity of the scale explatory factor analysis has been conducted and also expert opinions have been gathered for content and face validity process. Validity and reliability studies were conducted on the data obtained from 300 participants (randomly selected) of whole data by using IBM SPSS Statistics 20. Due to the Kaiser-Meyer-Olkin Measure (KMO) of Sampling Adequacy was .770 and Bartlett's Test of Sphericity was significant ($p < 0.05$), data set results can be used for exploratory factor analysis (Table 2).

Table 2. KMO and Bartlett's test of sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.770
Bartlett's test of sphericity	Approx. Chi-Square	1031.192
	df	36
	Sig.	.000

As a result of the exploratory factor analysis, the scale was finalized as 9 items and 2 dimensions (Appendix 1). The scale items and factor loadings, total explained variance has been presented in Table 3. Based on these results, the six of nine items in a single factorial structure, which explained 33.721% of the total variance. And the other dimension has explained 27.424% of the total variance. The finalized version of the scale showed high reliability overall, and in both dimensions (Table 4).

Table 3. Factor loadings and explained variance

Factors	Items	Factor Loading	Total Variance Explained		
			Total	% of Variance	Cumulative %
Institutional support	Item 1	.777	3.035	33.721	33.721
	Item 2	.768			
	Item 3	.699			
	Item 4	.675			
	Item 5	.670			
	Item 6	.656			
Self-competency for ERT	Item 7	.917	2.468	27.424	61.145
	Item 8	.893			
	Item 9	.878			

Table 4. Reliability statistics

Dimensions	Items (N)	Cronbach Alpha
Self-competency for ERT	3	.88
Institutional support	6	.80
Overall	9	.76

Data Analysis

After scale development, descriptive statistics, non-parametric analyses (due to the normality assumption has not been validated), and clustering analyses were conducted on the data obtained from 1271 participants (remaining from whole data). Cluster analysis is an unsupervised machine-learning technique that allows for the division of a dataset into subsets (called clusters) so that data points in the same cluster are as similar as possible, and data points in different clusters are as unique as possible (Fan, Matcha, Uzir, Wang, & Gasević, 2021). In this study a cluster analysis has been applied to instructors' self-reported data to gain insight into both their different experiences during the pandemic and their views of the current situation. Thus, by describing the characteristics of clusters with unique experiences during the pandemic, steps can be taken to determine instructors' needs.

FINDINGS

RQ1: Is there any Difference in Self-Competency for ERT and Institutional Support in Terms of the Time Spent in the Profession?

A Kruskal Wallis H Test analysis was applied to determine whether there was a significant difference in the perceptions of the participants regarding the online learning process in terms of the time spent in the profession. According to the analysis results, no significant difference ($p > .05$) was found for this research question (Table 5).

Table 5. The Kruskal Wallis H test results of time spent in the profession

	Time	N	Mean Rank	df	X2	p
Self-competency for ERT	2 and less	129	634.50	6	7.126	.309
	3-10	283	622.99			
	11-18	238	599.27			
	19-26	206	626.47			
	27-34	284	665.81			
	35-42	114	680.75			
	43+	17	695.62			
Institutional Support	2 and less	129	661.37	6	4.173	.653
	3-10	283	659.02			
	11-18	238	615.78			
	19-26	206	609.17			
	27-34	284	638.45			
	35-42	114	625.65			
	43+	17	696.97			

RQ2: Is there any Difference in Self-Competency for ERT and Institutional Support in Terms of Having Previous Experience in Online Instruction?

The Mann-Whitney U test was applied to determine whether there was a significant difference in terms of having prior experience in the online instruction process. According to the results of this analysis, there was a significant difference ($U = 143785.500$, $p < .05$) in the institutional support dimension, and it was determined that instructors who had previous experience in online instruction had a more positive perception of institutional support and more specifically about system usage (Table 6).

Table 6. The Mann-Whitney U test results of previous online instruction experience

	Experience	N	Mean Rank	Sum of Ranks	U	p
Self-competency for ERT	Yes	352	651.84	229446.50	156169.500	.333
	No	919	629.93	578909.50		
Institutional Support	Yes	352	687.02	241830.50	143785.500	.002*
	No	919	616.46	566525.50		

Note. *$p<.05$

RQ3: Is there any Difference in Self-Competency for ERT and Institutional Support in Terms of Participation in the Training Program?

The Mann-Whitney U test was applied to determine whether there was a significant difference in the perceptions of participants of the online learning process according to their participation in the training program. According to the results of the analysis, there was a significant difference (U= 144145.00, p< .05) in the institutional support dimension, and it was determined that the instructors participating in the training program had a more positive perception of the institutional support (Table 7).

Table 7. The Mann-Whitney U test results of participation to the training program

	Participation	N	Mean Rank	Sum of Ranks	U	p
Self-competency for ERT	Yes	885	636.67	563457.00	170208.000	.920
	No	386	634.45	244899.00		
Institutional Support	Yes	885	666.12	589520.00	144145.000	.000*
	No	386	566.93	218836.00		

*Note. *p<.05*

RQ4: Is there any Difference in Self-Competency for ERT and Institutional Support in Terms of the Discipline Areas?

A Kruskal Wallis H Test analysis was applied to determine whether there was a significant difference in the perceptions of the participants regarding the online learning process in the context of their disciplines (hard-pure, soft-pure, hard-applied, soft-applied, and others). According to the results of the analysis, there was a significant difference in self-competency for online teaching (X^2=15.970, p< .05). According to the results of the pairwise comparisons made with the Mann-Whitney U test, the study found that this difference was between hard-pure and other disciplines (Table 8). Hard-pure disciplines include theoretical sciences such as physical chemistry and mathematics. Considering that the courses in these disciplines are mostly based on lectures and theoretical evidence is formulated, it can be considered normal that the self-competency of the instructors working in these disciplines regarding online teaching is lower than in other disciplines. Because they may be less accustomed to online teaching than other disciplines.

Table 8. The Kruskal Wallis H test results of discipline areas

	Discipline areas	N	Mean Rank	df	X2	p
Self-competency for ERT	Hard pure	118	507.49	4	15.970	.003*
	Soft pure	224	648.82			
	Hard applied	449	648.27			
	Soft applied	236	643.95			
	Other	238	640.66			
Institutional Support	Hard pure	118	612.54	4	7.607	.107
	Soft pure	224	608.39			
	Hard applied	449	651.86			
	Soft applied	236	594.43			
	Other	238	668.96			

*Note. *p<.05*

RQ5: How do Instructors' Experiences Differ in Terms of Their Self-Competency and Institutional Support?

A hierarchical cluster analysis was applied to determine the differences in the experiences of the instructors. Ward method and Euclidean distance were used for cluster analysis. While determining the number of clusters in a sample, the cluster with the highest average Silhouette (S) value was selected. This value's range is between -1 and 1, and if the result is closer to 1 this indicates a better clustering (Aranganayagi & Thangavel, 2007). However, it does not allow for an in-depth examination of these experiences. For this reason, the method applied in the research determined the number of clusters by researchers' subjective decisions to reveal dissimilar experiences (Figure 2), and then examined participants' experiences with an average Silhouette value or higher (Figure 3).

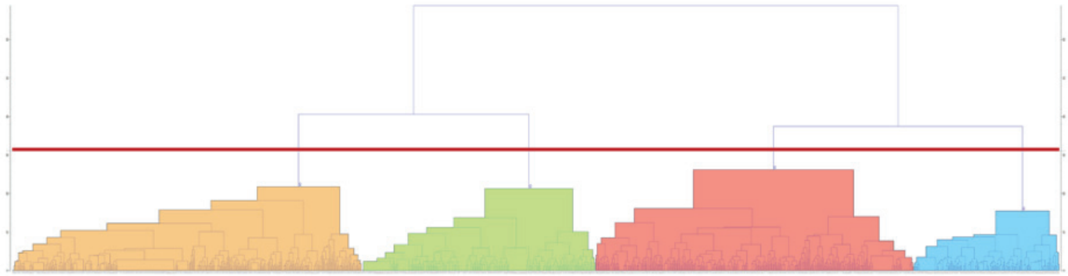

Figure 2. Hierarchical clustering – Dendrogram

According to Figure 2, the researchers divided the sample into 4 clusters. After this clustering, Silhouette values calculated separately for each participant are shown in Figure 3. In the next step, 232 participants with a Silhouette value of 0 and below were excluded from the analysis (S <= 0, *n* = 232).

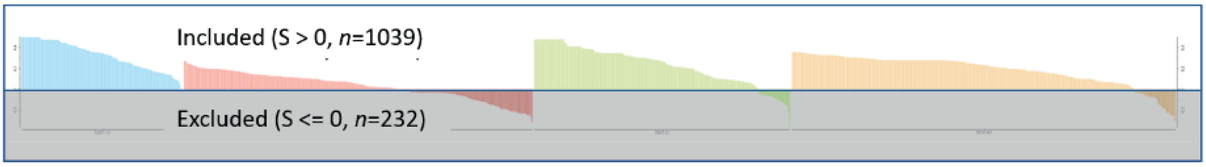

Figure 3. The participants' silhouette distances

An examination of the average self-competency for online teaching perception and the perception of institutional support according to the clusters revealed that different clusters had varying experiences. Accordingly, C3 and C4 have significantly lower self-competency for online teaching perceptions than C1 and C2 (Figure 4; F = 1244.174; p=.000). C3 and C1 have significantly lower perceptions of institutional support compared to C2 and C4 (Figure 5; F=649.666; p=.000).

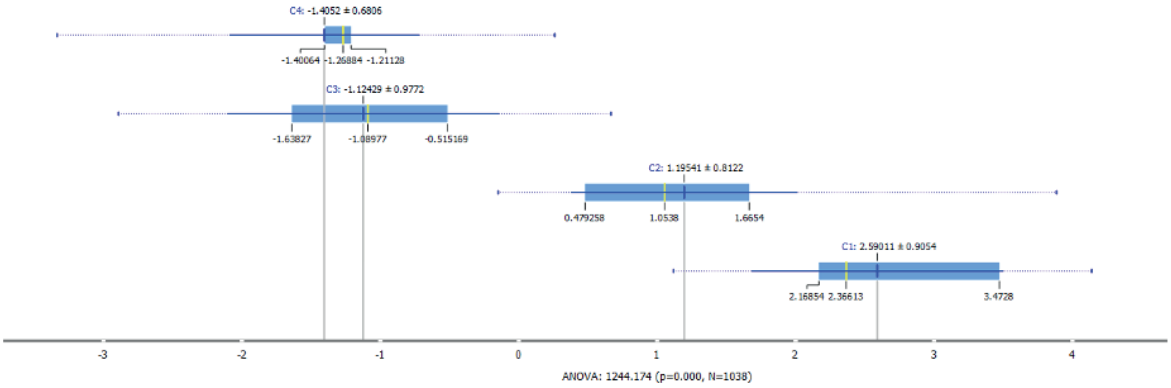

Figure 4. Perception of self-competency according to clusters

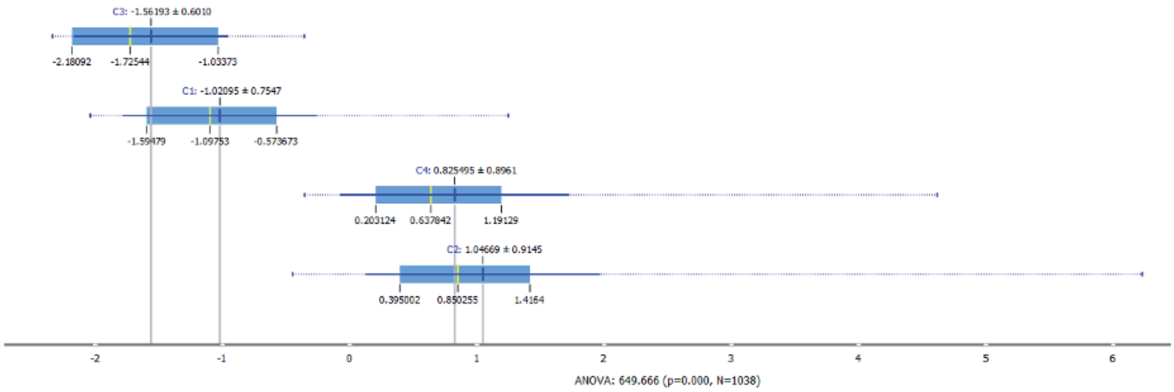

Figure 5. Perception of institutional support according to clusters

DISCUSSIONS AND CONCLUSION

The current study, which prioritizes instructors' interactions with the online learning system and the institution, has focused on instructors' perspectives regarding their experience, discipline area, online instruction experience, and whether they received training about online learning.

In this study, there was no significant difference in the perspectives of instructors on the online learning process in the context of their years of experience in the profession. Contrary to the findings of Shambour and Abu-Hashem (2022) and Zalat, Hamed, and Bolbol (2021), this result shows that newer instructors considered themselves competent and institutional support was sufficient in the online learning process. Furthermore, there have been studies showing that elderly instructors with more time in the profession use systems more effectively and have a more positive perspective on online learning than their younger colleagues (Akdemir, 2008; Kerr-Sims & Baker, 2021; Moralista & Oducado, 2020).

In addition to experience in the context of the time spent in the profession, the study showed that teachers who had witnessed institutional support regarded their previous online teaching experiences more positively. Based on their previous experiences it shows that they know that their needs will be met in terms of both system and institution. Also, parallel with the findings of this study, previous studies have found that people with prior online teaching experience had a more positive experience compared to those without (Bolliger & Halupa, 2022; Cutri, Mena & Whiting, 2020; Mishra, Gupta & Shree, 2020).

Previous studies about online learning have also shown that providing support by training instructors is of crucial importance. Allen and Seaman (2011) showed that many institutions in the USA provide training to instructors who teach online. Institutional support to instructors became increasingly crucial during the sudden shift required with the onset of the pandemic (Bonk, 2020; Hodges et al., 2020). This study found that instructors who participated in the detailed training program in online instruction were aware of the support provided by the institution and had a more positive perception of it. Although similar results were obtained in studies conducted during the pandemic, this study emphasizes the importance of comprehensive training programs for both system use, content development, and assessment processes (Caliskan et al., 2020; Kamisli & Akinlar, 2022; McGee, Windes & Torres, 2017). Such support or training programs provided by institutions are also a necessity in terms of creating quality online learning experiences. While previous studies in the literature emphasize the importance of this training (Joshi, Vinay & Bhaskar, 2021), this study showed the instructors participating in the training program have a higher perception of institutional support than others. The training program has been prepared on subjects such as evaluation and quality assurance, course technologies, course facilitation, course assessment, and course design. In general, we may expect that the self-competence perceptions of the instructors participating in the training program would also be significantly higher. However, no significant difference was found in this study. Considering that there is not enough time for instructors to reinforce the acquisition of these skills on subjects such as course assessment and course design during the pandemic process, we may still consider it normal for instructors to have a lack of skills. So, instructors who lack prior knowledge of different assessment strategies or teaching techniques experienced difficulties during this process. As Bolliger and Martin (2021) stated, the components that instructors and instructional designers consider important differ. Such support or training programs provided by institutions are also a necessity in terms of creating quality online learning experiences.

Disciplines are the other component of this study. According to the research results, instructors in the hard-pure fields of physics, mathematics, chemistry, biology etc., consider themselves less competent in terms of online learning than those in other disciplines. When compared to instructors in other disciplines, they need more improvement in their skills in system usage, content development and assessment-evaluation areas. For example, instructors in hard-pure fields may have had more difficulties in adapting to the online learning system, as this discipline is generally evaluated with experiments and open-ended questions. Another finding was presented by Gulinna et al. (2022), that those who taught arts, humanities, and social sciences courses were more likely to use various forms of assessments compared to instructors who taught online courses in science, technology, engineering, and mathematics (STEM). Sedaghatjou et al. (2021) found that STEM teachers were not concerned about adapting to new technology for their classes. This may be due to their confidence in their knowledge and skills to adapt to new technologies. Of course, a deeper analysis is needed to explain this result, but when compared to applied disciplines, pure disciplines can be considered as having less implementation. As a result, instructors in the pure disciplines regard themselves more competent compared to those who work in applied disciplines. Previous studies have shown that for online learning, it is important to organize one-on-one mentoring and needs-driven trainings, taking into account instructors' discipline areas (Kerr-Sims & Baker, 2021; Martin, et al., 2021; Schmidt, Tschida & Hodge, 2016).

An examination of the clusters according to the average scores in terms of self-competency and perception of institutional support reveals that each cluster has distinctly different characteristics (Figure 6). For example, C1's perception of institutional support is high but self-competency is low. In this context, this finding may be helpful in explaining the low perceptions of the instructors who did not attend the training regarding system usage. In an emergency, when instructors are left alone with a system that they have not experienced before, institutional support alone, therefore, is insufficient for the sustainability of online teaching. Conversely, C4 has a low perception of institutional support but a high perception of self-competency. This finding can be interpreted in two ways. On the one hand, instructors with high self-competency perceptions may not need institutional support. On the other hand, institutional support may not have been provided with the instructors' needs at different levels of self-competency in mind. C2 has a high perception of both self-competency and institutional support. It can be stated that they have ideal profile features for the trainers in this group. However, the reasons behind the low perception of both self-competency and institutional support in C3 are open to debate regarding variables such as student and instructor motivation.

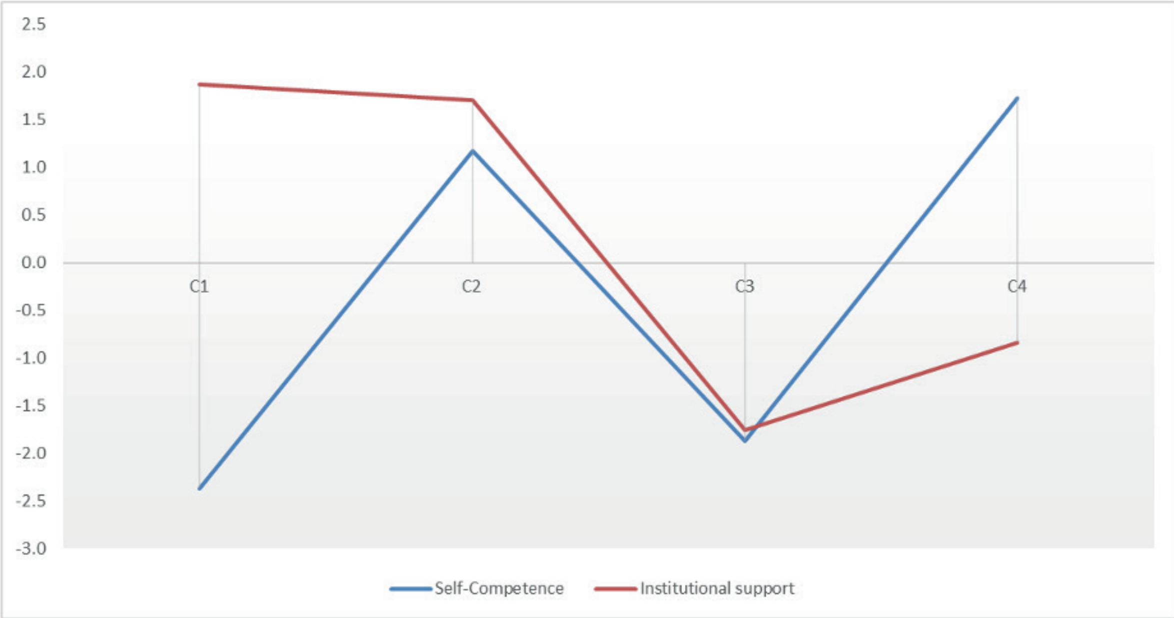

Figure 6. Comparison of clusters in terms of mean self-competency and perception of institutional support

While both the availability and quality of education were high regarding studies in the field of online learning, comparisons with face-to-face education are ill-founded due to the large volume of first-time applicants during the pandemic. In fact, the process experienced during the pandemic was called "emergency remote teaching" to prevent this comparison, but it was still subject to criticism due to wrong practices (Hodges et al., 2020; Naidu, 2022). There is no doubt that these criticisms will disappear only with the spread of better practice examples. Although it is not possible to consider online learning processes independently of technological developments, they will become more efficient and widespread in the future, both in the context of applied and pure disciplines, with the spread of technologies such as augmented reality, virtual reality, extended reality, and haptic technologies and their effective integration into courses. Submitting discipline-based instructional design, and secure and reliable assessment strategy examples for instructors in applied fields will make a significant contribution to increasing their knowledge and skills (Bozkurt et al., 2020). Despite the disruptive effects of the epidemic, many institutions have had the possibility to develop or revise their systems with this rapid shift (Ilgaz & Yildirim, in press).

As a result, this study took a general picture by examining the self-competency of instructors for online teaching and the perception of institutional support in the pandemic period, according to various variables such as discipline and training programs. From the results of the research, the need to support the instructors according to the needs specific to the disciplines has been revealed, and it is recommended to investigate the relationships between self-competency for online teaching and the perception of institutional support in depth.

Limitations and Suggestions

Instructors' self-competency for online teaching and perceptions of institutional support are among the main components of online teaching and learning. However, studies in the last 10-15 years seem to focus more on student engagement (Martin et al., 2020). The self-competency dimension discussed in this study is related to the dimension of course technologies as laid out by Martin et al. (2020). Institutional support is only a sub-category of the organizational dimension. Accordingly, the perspectives of the instructors in this study were limited to only these two dimensions.

An online teaching process can be associated with instructors' self-competency, evaluation and quality assurance, course technologies, course facilitation, course assessment, course design, and development from a macro perspective (Martin et al., 2020). The training program offered to the instructors also includes these subjects. Therefore, instructors' experiences with these issues can guide online teaching. Accordingly, it is false to say that institutional support cannot be provided in a way that considers instructors' needs at different levels in terms of self-competency. Therefore, there is a need for an in-depth investigation of the relationships between the perception of institutional support and self-competency. In this case, each cluster can be handled separately with an in-depth investigation of the method of intervention to be made regarding the quality of online learning. At the first stage, instructors in each cluster (C1, C2, C3, C4) can be asked about the reasons for their perceptions of institutional support and self-competency.

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APPENDIX

Online Instructor’s Emergency Remote Teaching Perspective Scale’s Items

Items	Turkish	English
Item 1	Sanal/canli sinif sistemini kolay bir sekilde kullanabiliyorum.	I can easily use the virtual/live classroom system.
Item 2	Ogrenme yonetim sistemini kolay bir sekilde kullanabiliyorum.	I can easily use the learning management system.
Item 3	Ogrenme yonetim sistemi, ogrencilerimin basarilarini degerlendirmede cesitli olcme-degerlendirme yontemlerini (coktan secmeli test, odev, akran degerlendirme) kullanmama olanak saglamaktadir.	The learning management system allows me to use various assessment and evaluation methods (multiple choice test, homework, peer assessment) to evaluate the success of my students.
Item 4	Ogrenme yonetim sisteminin kullanilmasina yonelik olarak hazirlanan bilgilendirme ve egitim kilavuzlarini/videolarinin yararli oldugunu dusunuyorum.	I think that the training guides/videos prepared for the use of the learning management system are useful.
Item 5	Uzaktan egitim faaliyetlerinin teknik ve idari acidan yurutulmesinden sorumlu olan Uzaktan Egitim Merkezi’nden / Acik ve Uzaktan Egitim Fakultesi’nden ihtiyac duydugum anda kolaylikla yardim alabiliyorum.	I can easily get help when I need it from the Distance Education Center / Faculty of Open and Distance Education, which is responsible for the technical and administrative execution of distance education activities.
Item 6	Ogrenme yonetim sistemi, ogretim faaliyetlerimi surdurebilmem acisindan gereksinimlerimi karsilamaktadir.	The learning management system meets my needs in order to continue my teaching activities.
Item 7	Uzaktan ogretimde dijital icerik gelistirme konusunda bilgi ve becerilerimin gelistirilmesi gerektigini dusunuyorum.	I think that my knowledge and skills on digital content development in distance education should be improved.
Item 8	Sistemlerin etkin kullanimi konusunda bilgi ve becerilerimin gelistirilmesi gerektigini dusunuyorum.	I think that my knowledge and skills on the effective use of systems should be improved.
Item 9	Uzaktan ogretimde olcme-degerlendirme konusunda bilgi ve becerilerimin gelistirilmesi gerektigini dusunuyorum.	I think that my knowledge and skills about assessment and evaluation in distance education should be improved.

DIALOGIC-INTERACTIVE MEDIA IN ONLINE LEARNING: EFFECTIVENESS IN SPEAKING SKILLS

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ABSTRACT

The online learning process necessitates the utilization of diverse and creative learning resources by teachers. Nevertheless, a preliminary analysis revealed that Whatsapp, Zoom, and PowerPoint continue to dominate the learning media landscape. The usage of these media has not been able to aid educators in developing dialogic exchanges in the learning process, particularly when it comes to the acquisition of language. On this basis, the objective of this research is to build dialogic-interactive media in language learning to enhance students' speaking abilities in online learning. This is Research and Development (R&D) utilizing the Plomp Development paradigm (Preliminary Research, Prototyping Phase & Assessment Phase). In the Assessment Phase, researchers tested the products that had been developed to determine the practicality and effectiveness of the developed media. The research instruments are in the form of questionnaires, observation sheets and tests. The research subjects were students of MTsN 1 Padang. The results showed that dialogic-interactive media was effective in increasing students' speaking skills in online learning.

Keywords: Interactive media, dialogic approach, speaking skills, online learning, distance learning.

INTRODUCTION

In recent years, due to the COVID-19 pandemic, face-to-face learning has suddenly been transformed into online learning (Means & Neisler, 2020). The rapid global epidemic of COVID-19, which was labeled a pandemic by the WHO, prompted a number of institutions and universities to temporarily close (Baloran, Hernan, & Taoy, 2021). Consequently, tremendous growth in online education has occurred during the COVID-19 epidemic in response to the necessity for social separation [3]. Such situations have prompted educational institutions throughout the globe to mandate that teachers use online teaching methods (Dhawan, 2020). In an effort to continue education in the COVID-19 age, the adopted policy is online learning using a variety of platforms, including e-learning, WhatsApp Group, Google Classroom, zoom meetings, and others (Chinmi, Marta, Haryono, Fernando, & Goswami, K., 2020; Henry, Hinshaw, Al-Bataineh, & Bataineh, 2020). The existence of this platform is considered to be able to assist the implementation of the learning process in various educational institutions(Ritonga, Lahmi, Saputra, Mursal, & Nofrizaldi, 2022). Therefore, the COVID-19 outbreak has triggered the current outbreak of online learning (Wotto, 2020; Adarkwah, 2021).

Online education has grown extremely popular in the educational setting (Adarkwah, 2021). Due to the fact that the 21st century is the era of technology and all nations are attempting to optimize their level of technology, the use of an online distance education system has become a requirement to combat issues that can interrupt education (Kibici & Sarikaya, 2021). Online learning has become a concept that is being tested day by day in education and represents technology in education (Herguner, Yaman, Sari, Yaman, & Donmez, 2021). Online learning is the most dynamic and engaging type of available learning possibilities, providing a well-designed, interactive and supportive learning environment with a range of technology and digital resources with a student-centered approach (Aoki, 2010; Karakis, 2022). Multiple venues, e-learning, blended learning, entirely online, and extra online resources can constitute online learning (Rice & Dykman, 2018). In addition, online learning is also stated as "distance learning"(Isaac, Aldholay, Abdullah, & Ramayah, 2019).

In the current study, online learning is defined as any TV or web-based application or streaming used to continue the learning process in response to the shift in learning to online means due to school closures, both public and private (Ziadat, 2021). Online learning is a technology-enhancing method that offers students the opportunity to practice at their own pace to develop skills and to educate themselves regardless of geographic location, socioeconomic situation, and/or biographical factors (Lwin, Sungtong, & Auksornnit, 2022). Online learning can be done by using digital tools to give some instructions to others with the internet (Clark & Mayer, 2016). In this globalized and digital era, governments, educational institutions, and businesses are progressively promoting online learning, and the shift from traditional classrooms to distant and online learning is continuing (Aldhafeeri & Khan, 2016).

Learning in one of the most important of these systems is communication (Rawat, 2016), in which teachers have to monitor student progress by ensuring that the right to acquire knowledge operates even if they are not face to face in class (Ritonga et al., 2022). Studies in the field of online learning show that the quality of interaction is a major factor in learning satisfaction (Kuo, Walker, Schroder, & Belland, 2014). While interaction is the most critical criterion for online learning, many students desire to make contact with their peers, teachers, and counselors (Drouin & Vartanian, 2010; Erdogmus & Cakir, 2022). Students consider interaction in the classroom important for learning (Amir et al., 2020). Fostering and maintaining various types of interactions among participants is very important in an online learning environment because interactions play a key role in influencing the quality and success of online education. With the spread of distant education, the lack of social interactions between persons is expanding, indicating a growing need for interactive relationships between students and teachers (Sun & Chen, 2016).

Developing these information/communication skills, which are crucial at all times and stages of life, is only achievable through an excellent education (Tunagur, Kardas, & Kardas, 2021). Communicative competence includes knowledge and expectations regarding who should or should not speak in certain situations, when to speak and when to remain silent, with whom one can converse, how one can converse with people of different statuses and roles, and appropriate behavior in various contexts, among other things (Tomak, 2021). For this purpose, the teacher should organize the class for speaking activities in such a way that useful input can be obtained and enable two-way communication as speaker and listener (Yang, 2007; Ozenc, Orhan-Karsak, & Ozenc, 2021).

Speaking, which is described as the capacity to vocally communicate one's ideas and thoughts, is one of the language abilities that individuals utilize most frequently while communicating with their surroundings in daily life (Bulut & Karasakaloglu, 2021). Speaking is a language skill that allows individuals to communicate. Through communicative actions, humans express needs, wants, ideas, and more. For this reason, speaking in one's native language and in the target language is a very important skill (Gunes & Sarigoz, 2021). Studies show that speaking is very important in demonstrating proficiency in language, which is the key to interaction. Developing students' speaking skills and competencies is very important in facilitating interaction and communicative abilities (Arroba & Acosta, 2021). Thus, students should be given the opportunity to practice speaking during class hours (Rao, 2019).

Speaking is the most difficult of the four language abilities because it requires simultaneous utilization of available linguistic information (Baykara & Aksu Atac, 2021). Based on these statistics, it can be concluded that speaking abilities are the most challenging for students, followed by listening, writing, and reading (Kaya, 2021). In verbal contact, individuals can engage in every oral meeting by constructing meaning in accordance with their objectives, communication goals, and the message the speaker wishes to express (Green, 2013); Thus, speaking is more unexpected than writing because thoughts are typically not planned in advance and flow with the pace of speech (Duque-aguilar, 2021). Therefore, there should be a greater emphasis on speaking and listening abilities (Kaya, 2021). Conversation requires both speaking and listening in order for individuals to interact with one another. Consequently, these two skills are combined or utilized as a multi-layered activity (Wulandari, Piscioneri, & Ikram, 2021).

The importance of speaking skills is related to the development of thinking (Ozenc et al., 2021). This causes speaking skills to be one of the passports of success in work. A professional will have strong communication skills (Kumar, 2021). Moreover, speaking skills have a very important place in every area of life. Thus, individuals need to learn to speak accurately for a developed society, and students need to be raised as good speakers (Ozturk-Pat & Yilmaz, 2021). Students who are successful, socialize, and can communicate easily with others experience an increase in speaking skills (Kumar, 2021).

The speaking exercise is the most challenging for kids. In this scenario, it is reasonable to conclude that the communicative orientation of the curriculum is insufficient for developing students' skills (Yolcu & Dimici, 2021). This is exacerbated by the COVID-19 pandemic, since learning is undertaken online and contact is restricted to electronic means. In this setting, teachers must be able to effectively use pedagogical approaches and online instructional tools to fulfill their students' learning objectives (Bolliger & Martin, 2018). As an alternative to traditional language instruction, online learning might utilize a dialogical approach.

As common metaphors for complex relationships, language and dialogue are part of the conditions that mediate the boundary between similarity and difference. Dialogic relationships are not limited, integrating continuously in all aspects of difference (Dennis, 2020). Although word is frequently used more loosely, dialogue's etymology clearly distinguishes it from acts such as debate, discussion, and conversation (Maele, 2020). Dialogic pedagogical framework (Nystrand, 2006), provide a structure for bringing school-based content into dialogue with students' lives (Stewart, Hill, & Lindstrom, 2020). Dialogue—between students and students and between students and teachers—is very important in education with teachers having an important role in the process (Winters, 2021). Thus, dialogue creates opportunities for students to enhance ideas through shared and open co-formation for learning both with and from students (Han & Hyland, 2015; Tanis, Sensoy, & Atay, 2020).

Bakhtin is the originator of the concept of dialogical discourse, which has been addressed by several others (Bakhtin, 1981; Barwell, 2018). This is frequently viewed as the antithesis of a "limited, authoritative, and impersonal style in which classroom discourse does not permit students to join and explore their interests, concerns, and ideas"(Kumpulainen & Rajala, 2017; Pearcy, 2020). The broad definition of dialogic teaching is "teaching and learning through, through, and as discussion"(Kim & Wilkinson, 2019). Dialogic teaching is a pedagogical technique that utilizes the power of discussion in the classroom to engage students' prior knowledge, stimulate their thinking, deepen their learning, and broaden their perspectives (Shongwe, 2021). Due to its emphasis on the active and continual participation of students in classroom conversations, dialogic instruction is lauded as the method most likely to produce the finest educational outcomes (Alexander, 2020). In Britain, France, India, Russia, and the United States, this teaching method has been offered as a new pedagogical strategy (Worku & Alemu, 2021).

Dialogic learning aspects include: dialogic teaching must be intentional; study; can be assessed; according to its adherence to routine principles and practices with a dialogical quality (Rapanta, Garcia-mila, Remesal, & Goncalves, 2021). Dialogic pedagogy entails interconnected activities that are reciprocal, collaborative, and supportive in the present, and purposeful and cumulative over time (Alexander, 2008); it involves supportive class relations and a dialogical value orientation (Shields-lysiak, Boyd, Iorio, & Vasquez, 2020). Teachers who apply this information should be able to stimulate their students' thinking, permit them to respond by reflecting, and assist them in building bridges between their prior knowledge and future facts (Gillies, 2015). It also focuses on fostering communication through genuine exchanges. There is a real interest in the perspectives of the interlocutor, and attempts are made to assist participants in sharing and cooperatively constructing meaning (Gander & Wintle, 2020).

Dialogic communication is defined as "a form of communication based on a priori internal acceptance of each other as values in themselves and assuming an orientation to the individual uniqueness of each subject" (Eremeeva & Khamisovna, 2020). In this view, the interaction of social friends in educational settings and dialogic speech in this contact are regarded as a tool for reorganizing the mind and regulating the inner mental activities (Devos, 2017; Comoglu & Dikilitas, 2020). To begin with, a dialogical relationship promotes and relies on equality among the participants. All answers as well as all questions should be taken seriously. This is back-and-forth dialogue is important as much as any temporary conclusion is reached (Coulter & Herman, 2020). This includes organizing participation so that all students have an opportunity to speak, posing questions, criticizing the answers of others, presenting new topics, and offering modifications to the discussion process (Robyn M Gillies, 2020; Reznitskaya & Gregory, 2013).

Although many studies recognize the benefits of a dialogical approach to teaching for student learning, its implementation in the classroom is difficult (Worku & Alemu, 2021). Obviously, the definition of dialogical instruction in theory and practice frequently diverge (Pearcy, 2020). It is a time-consuming, often messy form of pedagogy, and the emphasis on collaboration and willingness to modify one's perspective given contrasting evidence is not a regular feature of most classrooms (Asterhan, Howe, Lefstein, Matusov, & Reznitskaya, 2020). Research compiled by Reznitskaya & Gregory (2013) shows that the dominant form of discourse in schools "remains largely monologic", dominated by the voice of the teacher (Reznitskaya & Gregory, 2013). This is complicated by the rise of the COVID-19 epidemic, which makes it impossible to determine what instructors do to foster a dialogical style or how they might facilitate student involvement, conversation, and communication (Pearcy, 2020). To overcome this, a dialogical approach can be taken to support the online learning process by utilizing interactive media.

By utilizing language-learning technologies that enable interaction between teachers and students, educators can enhance their pedagogical practices (Musling, Ismail, Darmi, Kamaruddin, & Jaffar, 2022). Through the theory of interactive learning, the media have the potential to impart value (Agrawal & Ghosh, 2014). Technology can be implemented in the form of interactive multimedia to enhance student engagement and learning results (Komalasari, 2019). Supported by text, image, video, audio, and animation services, interactive multimedia offers dynamic and interactive presentations with active learning tools (Rukayah, Andayani, & Syawaludin, 2022). The structure of student interaction and the assignment of communicative and cooperative tasks are effective means of fostering positive relationships for the acquisition of learning goals (Cihan & Yildirium, 2014). Interactive media indicates the ability to improve student engagement through two-way dialogue between students and teachers or between students and the media itself (Rukayah et al., 2022). Consequently, while interacting directly with students, teachers are able to build engaging, dynamic, and interactive learning environments through the use of ICT that is continually evolving (Roemintoyo, Miyono, Murniati, & Budiarto, 2022). Interactive multimedia was chosen as an innovative kind of learning material due to its high level of interactivity and ability to capture students' attention during the learning process (Guan, Song & Li, 2018).

Some academics suggest that interactive multimedia utilized in education can generate greater levels of interest, motivation, involvement, stimulation, and critical thinking than traditional learning methods (Nurtanto, Sofyan, & Pardjono, 2020). Involving the audience in the learning process, keeping them aware and thinking, assessing their knowledge, providing feedback on the presentation, and helping the presenter learn from the audience are all advantageous for the instructor. Interaction with the audience, especially with students, increases their self-assurance and spontaneity (Zayapragassarazan & Mohapatra, 2021). Self-efficacy can create and strengthen learners' confidence in their capacity to acquire content in a digital environment when learners engage in more active contact with such content (Arnab et al., 2021). According to this explanation, interactive learning settings provide excellent learning outcomes, and interactive environments promote students' participation, questioning, and discussion skills (Kasimoglu & Celik, 2021).

In order for teachers to effectively use media, the selection of media must be tailored to student characteristics, such as student situations (Widodo, Prihatiningsih, & Taufiq, 2021). Individuals of Generation Z would rather spend their time determining how they can acquire information, how to analyze information, and how they may benefit from knowledge than memorizing information (Sanalan & Taslibeyaz, 2020). In addition, it must also consider the situation when the learning is carried out. In this study, learning is done online, so the selection of media and integrating dialogical learning needs to be considered so that learning can achieve the expected goals. Based on this, the purpose of this research is to develop interactive-dialogic learning media in language learning to improve speaking skills in online learning.

METHOD

The purpose of this Research & Development (R&D) is to produce a product through a series of stages. This research was conducted to develop a product in the form of Dialogid-Interactive media in online learning which is used in language learning to improve speaking skills. The development model used in this study is an adaptation of the existing model, namely the Plomp model (2013). This model consists of three stages, namely Preliminary Research (needs analysis), the prototyping stage (product design), the assessment stage (product trial) (Plomp & Nienke, 2013). This research produces learning media based on a syntax model that is innovated in advance according to the needs and learning situations of students. The product is adapted to my current learning curriculum, namely the text-based 2013 Curriculum. The research was conducted during online distance learning. Learning is done synchronously and asynchronously. Synchronous learning is carried out using the google meet application and asynchronous learning using media developed with the Ispring application. In addition, the evaluation was carried out using a google form.

Participants

The product testing was place at MTsN 1 Padang. The selection of these schools was based on the following criteria: children were registered as State Junior High School/MTs students in Padang City; they were responsive to innovation; they could develop strong collaboration; and they had enough research infrastructure and resources. Based on the criteria selected as the subject of a limited trial and a large-scale trial, it is shown in table 1.

Table 1. Test subject

Free trial class	Total subject
Control class	30 students
Experiment class	30 students

Data Collection and Analysis

The trial was carried out from October to December 2021. The trial schedule was adjusted to the school curriculum so that the product developed was suitable for use at that time, namely in news text learning which was carried out in odd semesters. The research instruments were questionnaires, observation sheets, and tests. In this study, descriptive data analysis approach was utilized to characterize the learning model's validity, practicality, and effectiveness of the learning model.

This research use descriptive data analysis technique, which describes the validity and practicality of the data. In the meantime, the effectiveness data in the form of student learning outcomes were analyzed using SPSS 17 to determine the results. The devices utilized for data collection in this investigation are detailed in Table 2.

Table 2. Research instrumen

Type of data	Data source	Data collection tools
Preliminary research	Teacher & student	Interview guide sheet; questionaire
Prototype phase	Validator	Questionaire
Assessment phase	Teachers & student	Questionaire, Observasion sheet, test

The Scale

The data of this research is to determine the value of the validity, practicality, and effectiveness of the product. First, validity. Validity data will be obtained through validation results by expert validators and self-validation. The data collected is then tabulated. The results of tabulation of each indicator are searched for the percentage with the formula used for data analysis validity as follows.

$$P = \frac{\Sigma score\ each\ item}{max\ score} \times 100\%$$

The data that will be collected from the product validation results are categorized according to the following table 2.

Table 3. Product validity category

Achievement level	Category
81—100	Very valid
61—80	Valid
41—60	Quite valid
21—40	Not valid
0—30	Invalid

After the product is valid, then a trial is carried out to determine the practicality and effectiveness of the product. Second, Practicality. The implementation of the learning process will be observed by the observer. Observers fill out observation sheets about the learning process with the model to be developed. In addition, the practicality test also analyzes the questionnaires that have been filled out by teachers and students. The collected practical data are then tabulated. The result of tabulation of each bill is searched for the percentage with the following formula.

$$P = \frac{\Sigma score\ each\ item}{max\ score} \times 100\%$$

The data that will be collected from the product practicality results are categorized according to the following table 3.

Table 4. Product validity category

Achievement level	Category
81—100	Very valid
61—80	Valid
41—60	Quite valid
21—40	Not valid
0—30	Invalid

Third, effectiveness. Analysis of the effectiveness of the learning model through experimental research with the type of Pretest-Postest Control Group Design. The measuring instrument for this experimental research uses an attitude assessment sheet, and a skill test (performance test). Student mastery is measured based on individual mastery obtained by students. Statistical analysis using SPSS. Statistical calculation stages are described as follows.

Normality test

The purpose of this normality test is to determine whether the sample data is normally distributed or not. Analysis of the normality test in this study used the Lilliefors test. The hypothesis of the normality test in this study is to accept H0 if the value of Lcount < Ltable, this means that the research sample data comes from a normally distributed population.

Homogeneity Test

The analysis of the homogeneity test in this study used the Levene test. The hypothesis of the homogeneity test in this study is to accept H0 if the value of Fcount <Ftable, this means that the variance of the research sample in the experimental and control classes is homogeneous.

T-test

The basis for making decisions on the Independent Sample T Test is as follows. (1) If Sig. (2 tailed) > 0.05 then H0 is accepted or Ha is rejected, which means that there is no difference in the average student learning outcomes between the experimental class and the control class. (2) If Sig. (2 tailed) < 0.05 then H0 is rejected or Ha is accepted

FINDINGS

The findings of this study include the Preliminary Research, Prototyping Phase, and Assessment Phase. The explanation of the research results is described as follows.

Preliminary Research

This stage is carried out to determine the needs of students and the learning situation. The results of the research at this stage were collected through a questionnaire filled out by teachers and students. Based on the results of the study, it was concluded that current learning (at the time the research was conducted), was carried out remotely online by utilizing technological devices and applications that could support the learning process. Based on the results of observations, it is concluded that the media used is dominated by the use of WhatsApp, YouTube, Google Classroom, and Zoom Meeting applications. The learning process that is difficult to do in online learning is learning to speak. Based on the questionnaire filled out by the teacher regarding learning speaking skills, it can be concluded as follows. (1) Speaking skill is the most difficult skill to learn compared to other language skills. (2) Interactive media are rarely used in the learning process even though it is done online. (3) Some teachers still have minimum knowledge of interactive media. (4) The teacher agrees that using interactive media can support the speaking learning process. (5) Students' speaking skills need to be developed because online learning makes students rarely speak. Based on the results of the analysis, it can be concluded that it is necessary to provide solutions to language learning to improve speaking skills. One of the alternatives offered is to develop learning media, because for distance learning, media is one of the important things used to support the learning process.

Based on the results of student analysis conducted by distributing questionnaires about learning to speak online, it can be concluded as follows. (1) Teachers do not employ a variety of instructional media to teach speaking skills. Students concur that the use of interactive learning tools can make speaking simpler. Thanks to the usage of learning media, (3) students can easily continue speaking. (4) Learning media are beneficial and can boost pupils' speaking confidence. According to student opinions evaluating the existing speaking learning process, teachers' utilization of learning media is not yet ideal. While students asserted that the learning media could assist kids in learning to speak, experts disagree. The results of student responses indicate that students are still uncertain about the utility of learning media, which may be a result of their teachers' insufficient usage of these tools. Interactive learning media can favorably influence the learning process if they are effectively tied to the learning process and content. If the media is well-designed, pupils will receive regular feedback, making learning more effective. Additionally, it assists pupils in attaining the needed competencies (Atmazaki, Ramadhan, Indriyani, & Nabila, 2021a).

Based on the curriculum study, the following is determined: (1) The 2013 curriculum was utilized in the production of interactive-dialogic media to enhance students' learning activities and communication skills. (2) The text used in learning to be utilized as a trial model is a news text; this text was chosen because it aligns with the learning objectives, namely presenting data, information in the form of news orally and in writing by focusing on structure, language, or oral features (pronunciation, intonation, expression, kinesthetic).

(3) The researched concepts include comprehension, elements, structure, linguistic characteristics of news writings, processes for producing news texts, and oral reading of news texts.

Prototype Phase

This step is performed to produce a product prototype for generating dialogic-interactive media in online learning to enhance high school students' speaking skills. Before generating learning media, a model that will be incorporated (as learning syntax) into learning media is created. Integrated dialogical-interactive learning syntax, namely introduction, interactive setting, everyday talk, learning talk, teaching talk, presenting; questioning; extending (Atmazaki, Ramadhan, Indriyani, & Nabila, 2021b). The syntax of the model can be seen in Figure 1. After the model is designed, then the learning media is developed using the i-Spring application. Snippets of learning media can be seen in Figure 2.

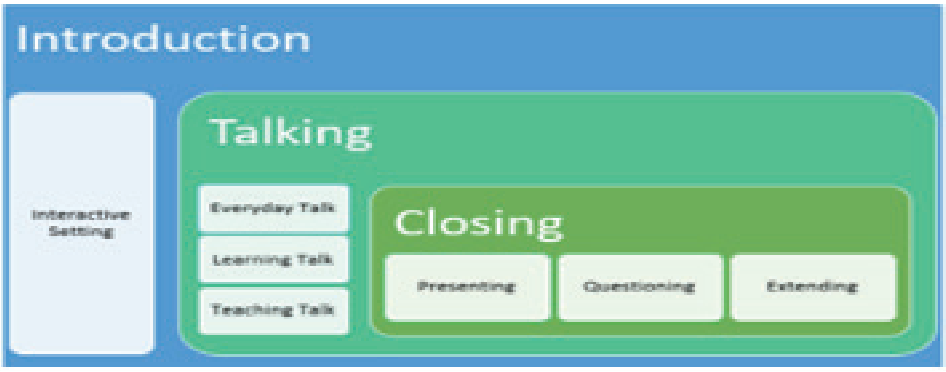

Figure 1. Dialogic-interactive media syntax

Figure 2. Learning media snippets

After the learning media is designed, then validation is carried out in two ways, namely self-validation and expert validation. The results of the validation can be seen in table 5.

Table 5. Validation result

Validation	Validation result (%)	Category
Self-evaluation	90.84	Very valid
Expert validation	90.05	Very valid

Assessment Phase

Learning media that have been declared valid, then tested in the field. The trial was conducted at MTsN 1 Padang. . The experiment was conducted in 2 classes, namely the control class and the experimental class. In the control class, the learning process was carried out as usual, while the experimental class was treated using the developed Dialogic-Interactive media. The learning process was carried out for four meetings for learning activities and once for testing effectiveness. The trial was carried out when distance learning was implemented, namely when the Omicron COVID-19 variant was endemic in Indonesia.

The trial was conducted with Indonesian language teachers. To find out the practicality of the learning media developed, the teacher assesses the learning activities by filling out a questionnaire that has been provided by the researcher. The questionnaire was filled out after the learning process was completed. The practicality of learning media is useful to determine whether the learning media designed is a practical medium to use in learning Indonesian. The practicality questionnaire contains statement items which were developed based on practicality indicators, namely ease of use and can be studied within the allotted time. In addition, practicality is also seen based on the learning process activities carried out. The results of the practicality of learning media can be seen in the following table 6.

Table 6. The result of the practicality test of the learning media

Rated aspect	Validation result (%)	Category
Practicality by teachers	91.46	Very practive
Practicality by students	87.38	Very practive
Learning activity	87.78	Very practive

The effectiveness of the learning media developed is the final stage of the assessment. Effectiveness can be seen from three assessments, namely the assessment of student knowledge through cognitive tests, assessment of attitudes, and students' speaking skills. Cognitive tests are carried out by assessing students' knowledge of the material being studied, namely news text material. This test is focused on the ability to understand reading. Furthermore, attitude assessment is carried out by observing student attitudes during the learning process. Observations were made by the teacher because they were more objective. Finally, the assessment of student skills is carried out by assessing students' speaking skills, namely conveying news orally. The test is carried out after students take part in the learning process using the developed learning media. The effectiveness value is described as follows.

First, the knowledge test is related to the competence of students' knowledge of the material being studied. The material studied is news text. Based on the results of the research found, the value is described with descriptive data. The research subjects were 60 students (30 students for the experimental group and 30 students for the control class). The data on the results of the cognitive assessment of students during the learning conducted at MTsN 1 Padang for the experimental class was "80.33" with the predicate "B", while for the control class it was "68.67" with the predicate "C". Based on these data, it was concluded that the knowledge test score of the experimental class was higher than that of the control class. So it can be concluded that the media developed is effective to increase the cognitive value of students.

Second, attitude assessment is related to students' attitudes during the learning process. Student attitude assessment aims to measure and determine aspects of attitude competence that are integrated in learning. The attitude assessment carried out for learning Indonesian includes honest, disciplined, responsible, and active attitudes. Based on the results of the analysis of student attitude assessment, it was concluded that the average value of student attitudes when learning using the developed learning media was 85.5% with the predicate "A".

The analysis was continued by assessing the students' ability in speaking skills. The instrument used to collect data was a performance test sheet consisting of context, instructions, and an assessment rubric. The final test was given with the aim of knowing the effectiveness of the learning media developed by looking at the differences in student learning outcomes who were taught by Dialogic-interactive media (experimental class) with classes whose learning was using other learning media (Power Point) (control class). The results of the analysis of student learning outcomes in the experimental class and control class can be seen in the following table 7.

Table 7. Learning outcomes

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Learning_outcomes	Experiment Group	30	**82.43**	7.229	1.320
	Control Group	30	**70.23**	9.637	1.759

Based on student learning outcomes, it shows that the average value of learning outcomes in the experimental class taught by dialogic-interactive media is higher than the control class. Furthermore, before testing the hypothesis, the requirements analysis test is carried out first. Test requirements analysis carried out is normality test and homogeneity test. The normality test was carried out using SPSS 17. The results of the normality test can be seen in the following table 8.

Table 8. Normality test results

Tests of Normality							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning_outcomes	Experiment Group	.213	30	**.001**	.917	30	.023
	Control Group	.190	30	**.007**	.889	30	.005

a. Lilliefors Significance Correction

Based on the output table above, the df value (degrees of freedom) for the experimental class group and the control class group are 30 students each. This means that the number of data samples for each group is less than 50, so to determine the normality of the data using the Shaporo-Wilk technique. Based on the Shapiro-Wilk technique, Sig. for the experimental class of 0.001 and for the control class of 0.007. Because Sig. both groups <0.05, so as a basis for decision making in the normality test, it can be concluded that the student learning outcomes data for both groups are normally distributed. Therefore, the independent sample t test was then carried out using the SPSS 17 test results, which can be seen in the following table.

Table 9. Idependent samples test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Learning_ outcomes	Equal variances assumed	2.976	**.090**	5.55	58	**.000**	12.200	2.199	7.797	16.603
	Equal variances not assumed			5.55	53.79	**.000**	12.200	2.199	7.790	16.610

Based on the output table above, it is known that the significance value (Sig) based on the Levene test is 0.090 > 0.05; so, it can be concluded that the variance of the control class and the experimental class is the same or homogeneous. The basis for making decisions on the Independent Sample T Test is as follows. (1) If Sig. (2 tailed) > 0.05 then H0 is accepted or Ha is rejected, which means that there is no difference in the average student learning outcomes between the experimental class and the control class. (2) If Sig. (2 tailed) < 0.05 then H0 is rejected or Ha is accepted, which means that there is a difference in the average student learning outcomes between the experimental class group and the control class group.

Based on the output table "Independent Sample Test" in the "Assumption of the same variance" it is known that the value of Sig. (2-tailed) of 0.000 < 0.05, so that as a basis for decision making in the independent sample t test, it can be concluded that H0 is rejected or Ha is accepted, which means that there is a difference in the average student learning outcomes between the experimental class groups using the media.

DISCUSSIONS AND CONCLUSION

Based on the findings of the study, it was determined that dialogic-interactive media improved students' speaking skills when online learning occurred. According to Budiarto, Rejekiningsih, and Sudiyanto (2021), information technology in education has the ability to provide favorable outcomes in the context of globalization. They outline numerous requirements for integrating technology into education. Students' opinions regarding the incorporation of technology into the learning process were inversely linked to their use of learning media, which was limited to the print module, according to the findings. Students desire to create interactive multimedia as a learning medium due to the needs of technologically literate students and efforts to maximize the use of school equipment. It has been demonstrated that including interactive media into the learning process improves students' capacities. In accordance with this, Ninghardjanti, Huda & Dirgatama (2022) discovered that students' perceptions of interactive media-based mobile learning, particularly the media originality focus indicator, became a factor of efforts to enhance student learning outcomes.

This is evident from past research. Astuti, Wihardi, & Rochintaniawati (2020) are building an educational website that employs interactive information to aid students in understanding human body-related science concepts. The findings revealed that through using educational websites, students felt motivated and had a positive learning experience. Another study, conducted by Shahzad, Nadeem, & U-Nisa (2021), examined the effects of software development design on students and the influence of interactive multimedia environments on graduate-level students' learning habits. The results indicate that multimedia education software should contain instruction in various forms, such as text, graphics, audio, and visuals, but should also provide a learning environment that provides learners with numerous opportunities to explore, discover, and relate concepts so that they can increase their knowledge using their own strategies and satisfy their inner curiosity

Roemintoyo, Miyono, Murniati, & Budiarto (2022) are producing learning-appropriate, interactive multimedia products. The outcomes of this project are interactive multimedia products that are appropriate for high school education, particularly in the fields of crafts and entrepreneurship. The results indicated that the development of interactive multimedia as an innovation of learning media in the digital era is suitable for use in high school educational activities. Correspondingly, Sofowora (2013) investigates the possibility of using popular social interactive media in classrooms in developing countries. The results showed that social interactive technology was effective in changing the image of the school, so that its effectiveness in the classroom was to increase flexible, creative and interactive learning. Furthermore, Syawaludin, Gunardi & Rintayati (2019) describes the development of interactive multimedia based on augmented reality to improve students' critical thinking skills. The results showed that after using the media in learning, it was effective in increasing students' critical thinking skills.

Based on some of these studies, it shows that the use of interactive media is effective in improving students' learning abilities when used in the learning process. Interactive media developed by various kinds of innovations from various researchers. In this study, interactive media was developed with a dialogical approach. Shongwe (2021) explores how and to what extent his teaching reflects a dialogical teaching approach. Dialogic teaching is defined as a pedagogical approach supported by five specific principles that can be applied through various possible speaking strategies to achieve continuous participation of learners and thereby increase the meaning of meaningful learning. Leta, Ayele & Kind (2021) to explore content knowledge (CK) of Ethiopian secondary school physics teachers and implementation of Dialogic (DT) teaching. The results showed that none of the teachers fully implemented dialogic teaching in their classrooms. They recommend using DT for teachers in the learning process. Furthermore, content knowledge and teacher training in dialogical teaching can encourage the implementation of dialogic teaching.

Gonzales & Kokozos (2019) discuss a dialogical strategy to reducing prejudice, with a focus on intergroup discussion in K-12 public schools. Also included are evidence-based metrics and practices educators can employ to enhance intergroup dialogue competence and foster a more dialogical climate in their schools and classrooms. Garcia-Carrion, Gomez, Molina & Lonescu (2017) changing schools through dialogical learning and involving research-based schools that implement Success Educational Actions (SEA). It is founded on transformative theory and socially responsive research and provides evidence-based arguments and practical knowledge for effective implementation that draws on egalitarian connections and community-wide communication. Based on serendipity and contingent scaffolding, Anwaruddin (2019) proposes a dialogical approach to pedagogy. This study advocates employing a dialogical strategy that may prove beneficial for language instructors and teacher educators.

Based on this explanation, it was found that using interactive media and a dialogical approach in the learning process was effective in improving students' learning abilities. The use of these media in this study is used in online learning, so that the media developed can be useful if assisted with other media that are synchronous. Budhyani, Candiasa, Sutajaya, and Nitlasih (2022) investigated the impact of blended learning with synchronized and asynchronous settings on self-efficacy and student accomplishment in the basic design. Google Meet is the medium utilized for synchronous learning. Blended learning with synchronized and asynchronous settings had a favorable influence on students' self-efficacy and learning achievement in basic design, making learning more fun and conducive.

This research is driven by a learning setting that occurs online, hence posing a number of issues for language acquisition. The difficulties of dialogic and participatory communication is one of these issues. While language acquisition must be able to be demonstrated vocally and in writing. Speaking skills are one of the language skills that are difficult to teach online. Therefore, an alternative that can be done to support the learning process is to use a variety of learning media and innovations. The learning media is dialogic-interactive media. The products that have been developed are validated and tested in the classroom. Based on the results of the study indicate that the product developed is valid, practical and effective to use in learning Indonesian, especially in learning to speak. This learning media is expected to be an alternative for teachers in learning Indonesian. Although this media was tested during the COVID-19 pandemic, this media can be used in online learning, even though the method used is blended learning or hybrid learning. For further researchers, they can develop learning media by integrating other models that adapt to the needs of teachers and students.

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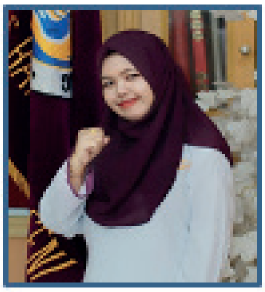

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PROGRAM EVALUATION IN OPEN AND DISTANCE LEARNING: THE CASE OF OPEN EDUCATION SYSTEM CALL CENTER SERVICES ASSOCIATE DEGREE PROGRAM

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ABSTRACT

In this study, it is aimed to evaluate Anadolu University Open Education Faculty Call Center Services Associate Degree Program, which is carried out through open and distance education, according to learner views within the framework of Stufflebeam's Context, Input, Process, Product (CIPP) Evaluation Model and to make suggestions for the development of the program. In the study in which Exploratory Sequential design, one of the mixed method research designs, was used; "Anadolu University Call Center Services Associate Degree Program Evaluation Questionnaire" was prepared to collect quantitative data. The questionnaire was applied online to learners who graduated from Anadolu University Open Education Faculty Call Center Services Associate Degree Program. Semi-structured interview questions were used to collect qualitative data. In the interpretation of quantitative data, percentage and frequency tables, mean and standard deviation values were used to compare and interpret the average score that can be obtained in the four dimensions (Context, Input, Process and Product) in the measurement tool and the average scores of the participants in these dimensions. In addition, the mean score values obtained in the sub-dimensions were analyzed and interpreted in terms of gender, age, marital status and employment status variables. Descriptive analysis method was used to analyze the qualitative data. The results revealed that the program objectives were determined in accordance with the expectations of the learners, learning resources were designed in accordance with the objectives, learning activities were carried out in accordance with the expectations of the participants and learning outcomes were achieved in the program.

Keywords: CIPP (Context, Input, Process, Product) Evaluation Model, exploratory sequential design, open and distance learning, program evaluation.

INTRODUCTION

Education, on the one hand, reveals the stimulating and invigorating power existing in human beings and makes it functional, and on the other hand, it enables people to create ideals and to discover methods that can be adapted to various value judgments and life styles by developing alternatives on the way to their ideals (Bilhan, 1991). In all educational activities, whether formal or non-formal, it is aimed to achieve the objectives determined in line with a program prepared and planned in advance (Howard, 2007). Undoubtedly, achieving these goals is possible through qualified education practices. Quality of education has become an important strategy of higher education today (Davlatmirzayevich, 2022).

Educational programs should be designed from a multidimensional perspective; not only subject-based, but also the needs of society and the individual, and the applicability of the program should be taken into consideration (Yager, 2001). Although an education program is prepared according to scientific principles, whether it has the desired quality can be decided after the program is implemented and the outcomes are evaluated. This situation reveals the necessity of evaluating the implemented curricula. Evaluation is necessary for the planning and continuous development of programs at any level (Bilen, 1999). According to Gungor and Yilmaz (2002), the main purpose of curriculum evaluation is to determine whether the learning activities serve the purpose, whether they have negative aspects, deficiencies and unexpected results and to redesign the curriculum by evaluating them. This process is as valid for open and distance education as it is for formal education.

In order to open a new program in open and distance education, many components need to be systematically designed and put into practice. Bilgic, Dogan, and Seferoglu (2021) stated these components as "legislation, program structure, instructional design, assessment and evaluation, communication and interaction, support dimension, technical dimension, and program evaluation". According to Donmez (2018), the educational process in open and distance learning systems consists of material design and development, production and distribution, operations management, learner support system and networked learning subsystems, and evaluation. In a successful distance education process, instructional design can only be realized through the successful implementation of various stages of design, development, implementation and evaluation. However, educational programs that are thought to be successfully implemented also need evaluation. Because new needs arising from changing conditions can be determined through evaluation. Therefore, educational programs should be evaluated and developed at regular intervals and program outcomes should be continuously improved (Evans, 2003).

Evaluation in open and distance learning is carried out to guide decision makers, program coordinators and other practitioners in line with an overall goal of improving service delivery and learner satisfaction (Miriam&Offat, 2015). For this reason, it is very important in terms of the quality of education that the programs in open and distance education systems are evaluated regularly in all dimensions and their deficiencies, if any, are eliminated. In addition, the responsibilities of institutions to provide information to both learners and the public about their investments, learning methods, assessment methods and educational activities have increased (Garrett, 2016). In line with these developments, the Higher Education Quality Assurance System and the Higher Education Quality Board were put into practice in Turkiye with the additional article 35 of the Higher Education Law No. 2547 (Additional: 18/6/2017-7033/18 art.) (Council of Higher Education, 2018). Program evaluation studies are important to guarantee the quality of the education provided and to ensure accreditation.

PURPOSE OF THE STUDY

In this study, it was aimed to evaluate Anadolu University Open Education Faculty Call Center Services Associate Degree Program based on learner opinions within the scope of Stufflebeam's "Context, Input, Process, Product (CIPP)" model and to determine suggestions for improving the program. In this context, answers to the following questions were sought:

- "Are the objectives of the program determined in accordance with the needs of the learners? (Context)"
- "Are the learning resources in the program designed in accordance with the objectives? (Input)"
- "Are the learning activities in the program carried out in accordance with the expectations of the learners? (Process)"
- "Are the learning outcomes achieved in the program? (Product)"
- "Do learners' views on the program differ according to gender, age, marital status and employment status?"
- "What can be done to improve the program?"

LITERATURE

Program Evaluation

One of the important components of the education process is well-designed education programs. The basic features expected to be present in an education program are determined as "functionality, flexibility, compatibility with the general views and expectations of the state and society and applicability, scientificity, fitness for purpose and economy" (Isman & Eskicumali, 2006; Karacaoglu, 2011; Aydiner, 2016). These functions are briefly as follows:

- *Functionality:* Content and applications are in line with social life, usable and appropriate to current conditions,
- *Flexibility:* Organizing the subjects and activities by taking into account the socio-economic characteristics of the target group and the learners' interests, needs and social environment,
- *Compatibility with the Trends and Expectations of the State and Society:* Reflecting the ideals and philosophy of the society in which it exists,
- *Applicability:* Combining functionality and flexibility,
- *Scientificity:* Taking into account scientific developments, new learning-teaching methods and techniques,
- *Purposefulness:* Being based on the cultural values of the society and realizing the determined educational objectives,
- *Economic relevance:* Being economical in terms of objectives, content, learning-teaching methods and assessment techniques.

It is widely accepted that an educational program consists of objectives, content, learning-teaching process and evaluation elements. (Demirel, 2012). The functionality of an education program designed in line with these elements depends on the evaluation of this program according to appropriate methods and the use of the results obtained as data for development studies (Ozdemir, 2009; Guven & Ileri, 2006). Because there is a need to evaluate the program in order to identify various problems that may occur during the implementation phase and to eliminate these problems. Bloom, Madaus & Hastings (1971) state that it is not possible to make a decision about the teaching situation without evaluation and define the purpose of evaluation as collecting and judging the evidence that reveals to what extent the determined goals have been realized and the degree of realization. The success of an educational program depends on the evaluation of that program with appropriate methods and the use of the results to improve the program as well as a good design and implementation method. For this reason, "evaluation" is very important in determining the faulty aspects of all educational programs, if any, and in revising these aspects. In addition, the digital age we are in has revealed the need for different and new education programs and necessitated some changes in existing programs. New educational technologies and the ease of access to these technologies have increased the interest in open and distance education and eliminated geographical boundaries. This situation has both increased the number of learners and created a heterogeneous learner population. Program evaluation has an important function in determining whether the programs applied to the masses with different characteristics meet the educational needs of the masses and whether the desired level of learning is achieved.

Program evaluation should focus on the extent to which learners achieve learning outcomes, the extent to which they are satisfied with the quality of instruction, the extent to which they are able to make use of learning materials, and the unexpected situations that arise at the end of the program (Inglis, 2003).

Program evaluation is done to ensure that the training program is updated, improved or maintained. In this way, the continuity of the program is ensured. In addition, program evaluation provides information on what can be done to improve the program, as well as providing insight into the efficiency and effectiveness of the current program as a result of its implementation (Klenowski, 2010). Criteria are determined before the evaluation. The data obtained through the program evaluation conducted in line with the determined criteria are analyzed and the results obtained by interpreting the findings are shared with decision makers. These results provide decision-makers with information not only about the success of the program but also about the success of the participants and even the implementers of the program (Ornstein & Hunkins, 2009). Based on these definitions, it can be said that the evaluation process of a program is very important and necessary for the success of the program.

Program Evaluation Approaches and Stufflebeam's Context, Input, Process and Product (CIPP) Evaluation Model

When the literature is examined, it is seen that curriculum evaluation approaches are generally classified in different ways as "curriculum evaluation philosophies, ideologies, designs, and types of curriculum evaluation". Program evaluation approaches are classified into four categories as "objectivist, subjectivist, pluralist and utilitarian" in terms of their philosophies; into five categories as "separatist, factualist, managerial, relativist and utilitarian" in terms of their ideologies; into six categories as "goal-based, management-oriented, beneficiary-oriented, expert-oriented, deliberative, and participant-oriented" in terms of their design; and finally into three categories as "according to the role of the evaluator, according to the type of evaluation, and according to the system dimensions" in terms of their types (Aygoren & Er, 2018).

There are many program evaluation models developed based on the approaches mentioned above. Bates' "Access, Cost, Instructional Function, Interaction, Organizational Issues, Innovation and Speed (ACTIONS)" model; "Accountability, Effectiveness, Impact, Institutional Context, Unanticipated Outcomes (AEIOU)" model developed by Fortune, Keith, Sweeney and Sorensen; Kirkpatrick's Four Level Model, the Logic Model, also called the Theory of Change; and Stufflebeam's Context, Input, Process and Product (CIPP) model are among the prominent evaluation models in the literature.

In this study, Stufflebeam's "Context, Input, Process and Product (CIPP)" model, which is one of the evaluation models considered according to system dimensions in terms of its types, was used. In this model, the main purpose of evaluation is not to prove but to improve (Stufflebeam, 2003). Stufflebeam defined evaluation as a process that needs to be repeated continuously and thus contributed to decision management-centered evaluation. The continuous collection of information about different dimensions of the program helps practitioners to make the right decisions about the functioning of the program. Stufflebeam's model has four basic dimensions: context evaluation, input evaluation, process evaluation and product evaluation (Demirel, 2012).

Context Evaluation: In context evaluation, which is also referred to as needs assessment, where program components and program objectives are analyzed, opportunities, problems and needs in the defined environment are evaluated. In this dimension, the strengths and weaknesses of the program are determined by focusing on the consistency of the objectives with the needs and the extent to which these objectives meet the needs (Stufflebeam, 2003). The main purpose of contextual evaluation is to define the program framework, to identify expected and existing situations, and to investigate the reasons for this situation by focusing on opportunities and unmet needs, if any (Ornstein & Hunkins, 2009).

Input Evaluation: This is the dimension in which the resources required for the objectives and the knowledge of how to use these resources are tested. In the input dimension, answers are sought to questions related to various elements of the program such as "Are the objectives determined in accordance with the current situation?", "Are the objectives consistent with the objectives of the program?", "Are the teaching strategies appropriate to the objectives?", "Is the scope consistent with the general objectives and specific objectives?". According to these answers, it is aimed to determine the changes needed in the program. In this dimension, it is also evaluated what resources (tools, materials or personnel) are necessary to realize the objectives of the program and whether the strategies and methods to be used in implementation are applicable (Stufflebeam, 2003).

Process Evaluation: Decision-makers are given feedback by checking the extent to which the teaching practices planned in the program are carried out in a planned and effective manner. In addition, information is also provided about decisions that are faulty or need to be changed, if any. In this dimension, it is also aimed to gradually evaluate the extent to which participants or practitioners fulfill their roles (Kayhan & Gurol, 2019). In summary, the process of reporting how the participants evaluate the quality of the process and how the planned program is actually implemented, identifying unexpected problems in implementation and taking measures to address them are carried out (Stufflebeam, 2003).

Product Evaluation: This is the dimension in which data are collected about the learning outcomes in the program and the determined and achieved learning outcomes are compared. In this dimension, unexpected results are also identified and it is determined whether the program should be continued in its current form or information is collected to improve the program (Usun, 2016).

Call Center Services and Anadolu University Open Education System Call Center Services Associate Degree Program

Call centers are centers that enable institutions and businesses to interact with their stakeholders (customers, suppliers, dealers, etc.) through other communication tools such as telephone, web, fax, e-mail. Call center services include processes such as meeting customer calls by a center (Kohen, 2002), initiating the necessary transactions in line with the needs of the customer, directing the call to different units when necessary, and making external calls (Celik & Uzmez, 2014). Call services is a sector that allows individuals or groups who want to communicate with many businesses serving in various fields to use different communication tools and where many experts work together (Dean, 2002; Mentese & Es, 2017). In addition, call center services have interactive voice response technology and can serve customers around the clock (Kocabas, 2017). The Call Center Services Association (CCSA), on the other hand, defines the call center as "a communication management system in which people, technology, business processes and strategy are carried out in coordination with the people and/or institutions that the institutions are in contact with and through various communication channels" (CCSA, 2022).

The history of the call center sector, which is known to have existed institutionally in Turkiye since the 1990s, is examined in four stages (Kohen, 2020):

1. *Pre-1996 "The period of taking the broken product to the store":*

   This is the period when both consumers and businesses had low levels of awareness about call center services. In this period, problems related to the product or service purchased were tried to be solved through face-to-face communication. In this period, companies such as DHL, Cine5, Citibank and Arcelik were among the companies that could use call center services to a limited extent.

2. *1996-2001 "Uprising and learning period":*

   During this period, awareness of call centers increased and sectoral development began, led by GSM companies and banks. In particular, the focus on customer relationship management, customer continuity, segmentation and analysis of customer data etc. increased. Foreign call centers operating in Turkiye such as La Mer (Vodatech), Global Bilgi, CMC and Metis (Teleperformance) were established in this period.

3. *2002-2008 "Ownership period":*

   This is the period in which businesses grasped the importance of call centers, internalized their role in customer satisfaction and made various investments. Although the technologies required for call center services were not available in Turkiye in this period, it was understood that Turkiye had the infrastructure to answer calls from abroad and investments were made in this direction.

4. *2009-2014 "Growth and expansion period":*

   This period, during which the number of outsourced and in-sourced call centers increased and the expansion from big cities to Anatolia began, is considered to be a period of growth and expansion for call centers in Turkiye. The introduction of call center services, especially in the public sector, had a positive impact on the development in this area.

Anadolu University Open Education System has been renewing itself according to technological developments and social needs since the day it was founded and includes various programs. In the Open Education System, there are 52 programs at 9 undergraduate and 43 associate degree levels within the Open Education Faculty, 8 undergraduate programs at the Faculty of Economics and 5 undergraduate programs at the Faculty of Business Administration.

The Call Center Services Associate Degree Program in Anadolu University Open Education System was opened in 2009 and has 1232 active learners today. To date, 1193 learners have graduated from the program. The aim of the program is to train human resources who know the basic principles, processes and management of the call center sector, communicate effectively and create customer loyalty. In parallel with the development of the call center sector in our country, the need for qualified personnel is also increasing. For this reason, it is aimed to provide the opportunity to be employed in the sector through distance education for those who are interested in the sector and who want to specialize professionally by receiving education in this field.

METHOD

In the study, sequential exploratory design, one of the mixed method research designs, was used. The aim of mixed methods research is to use two different designs in a way to complement each other in the research. In this way, the strengths and weaknesses inherent in quantitative and qualitative methods are integrated to reach more reliable results (Creswell, 2021). In this design, quantitative data on the researched topic are first collected and analyzed. Then, qualitative data are used to clarify and/or expand the data obtained. After the qualitative data are analyzed, the findings are interpreted together (Creswell, 2021; Creswell & Plano Clark, 2018). In this study, quantitative data were collected first and then qualitative data were collected. The quantitative data were analyzed statistically and qualitative data were analyzed descriptively. The findings obtained with qualitative data were utilized to explain the quantitative data results.

The Study Group

The study group of this research consisted of graduates of Anadolu University Open Education Faculty Call Center Services Associate Degree Program. A link to the quantitative measurement tool was sent to 1,193 graduates of the program since its inauguration and 104 graduates responded to the measurement tool. The distribution of the respondents is given in Table 1.

Table1. Distribution of Quantitative Measurement Tool Participants

		F	%
Gender	Female	55	52,9
	Male	49	47,1
Age	22-25	15	14,4
	26-29	15	14,4
	30-33	20	19,2
	34 and older	54	51,9
Marital Status	Single	33	31,7
	Married	71	68,3
Employment Status	Employed	64	61,5
	Unemployed	40	38,5

Graduates were asked to provide an e-mail address if they wished to participate in the semi-structured interview. Interviews with 6 graduates who volunteered for semi-structured interviews were conducted via Zoom application. The information of the graduates who participated in the interviews is given in Table 2.

Table 2. Graduates who participated in the semi-structured interview

Participant	Position/Industry
P1	Team Leader/Private Sector
P2	Operations Manager/Private Sector
P3	Unit Manager/Public
P4	Unit Manager/Private Sector
P5	Customer Representative/Public
P6	Team Leader/Private Sector

All of the participants whose information is given in Table 2 work in public institutions or private sector companies providing call center services.

Data Collection Tools and Process

Quantitative and qualitative data collection tools were utilized in the study. "Anadolu University Call Center Services Associate Degree Program Evaluation Questionnaire" was prepared to collect quantitative data. The questionnaire was collected in four dimensions by associating it with Stufflebeam's "Context, Input, Process and Product" model within the framework of program outcomes and field competencies and finalized by taking the opinions of three experts. In the measurement tool, there were 10 items in the context sub-dimension, 8 items in the input sub-dimension, 12 items in the process sub-dimension and 10 items in the product sub-dimension, totaling 40 items.

Quantitative data were collected between February 1-28, 2022. The survey link created through Google Form was sent to the e-mail addresses of the graduates of the program. The graduates were asked to answer the items prepared on a 5-point Likert scale between 1 and 5 as "1 - Strongly disagree", "2 - Disagree", "3 - Neutral", "4 - Agree", "5 - Strongly agree". Two reminder SMS messages were sent to the graduates to answer the measurement tool and 104 graduates participated in the study.

Semi-structured interviews were used as a qualitative data collection tool. The graduates were contacted via e-mail and interviews were conducted through online meetings. Six graduates working in the call center sector in the positions of operations manager, team leader, unit manager and customer representative participated in the interviews. In these interviews, the graduates were asked "Was the program sufficient to meet your expectations and needs? Explain." and "What can be done to improve and develop the program? What are your suggestions?" questions were asked. The interviews were conducted on May 23-30, 2022 by appointment through the Zoom application and were recorded for later analysis with the consent of the participants. Interview sessions lasted between 35 and 80 minutes.

Data Analysis

In the study, quantitative data were analyzed using SPSS 20.0 program. Skewness and kurtosis values were examined to determine whether the data were normally distributed or not, and skewness and kurtosis values were found to be -1.199 and 1.159, respectively. When skewness and kurtosis values are between -1.5 and +1.5 or -2.00 and +2.00, the distribution is considered normal (Tabachnick & Fidell, 2019). In the interpretation of the data, percentage and frequency tables, mean and standard deviation values were used to compare and interpret the average score that can be obtained from the "Context, Input, Process and Product" dimensions in the measurement tool and the average scores of the participants in these dimensions. The mean score values obtained from the sub-dimensions were examined in terms of gender, age, marital status and employment status variables; one-sample t-test was used to test the score differences according to gender, marital status and employment status variables, and one-way analysis of variance (ANOVA) was used for the age variable. Qualitative data were analyzed using descriptive analysis. The 15 themes that emerged at the end of the interviews were grouped under 4 categories based on the findings obtained from the quantitative data and the literature. Interview findings were interpreted within the framework of these categories and themes.

Validity and Reliability of Data Collection Tools

Confirmatory factor analysis was used to determine the validity of the quantitative data collection tool developed by taking expert opinions. In the process of developing the quantitative measurement tool, it was aimed to measure the items in 4 sub-dimensions as "Context, Input, Process and Product". Two different factor structures were tested to determine whether the items in the measurement tool work in line with the related purposes. The first of these structures is that the factors are 4 separate sub-dimensions, while the other is a second-order structure that accepts that the factors are united in a single factor of the general perception of the Call Center Services Associate Degree Program. The fit statistics obtained from confirmatory factor analyses are given in Table 3.

Table 3. Fit Statistics Table for Confirmatory Factor Analyses

Model	RMSEA	CFI	TLI	SRMR
Segregated 4-factor structure	0,082	0,946	0,942	0,091
Quadratic structure	0,096	0,926	0,921	0,091

The results given in Table 3 show that the 4 independent factor structure measures the data obtained in this study at an acceptable level. Although it is possible to collect 4 factors under one factor of the measurement tool, it should be taken into consideration that the fit is within the acceptable validity limit. Considering the fit statistics, it was evaluated that it was more appropriate to use 4 independent factor structure in this study. The findings regarding the reliability of the measurement tool are presented in Table 4.

Table 4. Findings Regarding the Reliability of the Measurement Tool

Dimension	Alfa
Context	0,899
Input	0,952
Process	0,921
Product	0,910
General	**0,964**

When the results in Table 4 are examined, it is seen that the reliability coefficients of the sub-dimensions and the measurement tool are between 0.899 and 0.952. When this coefficient approaches 1, it is accepted that the internal consistency of the items in the measurement tool is high (Yang & Green, 2011). The results in Table 4 revealed that the data collection tool was reliable.

In order to ensure the validity of the qualitative data collection tool, the prepared questions were presented to two experts and the questions were finalized in line with the suggestions. The interviews were recorded and kept for reuse if needed. For reliability, support was obtained from two measurement and evaluation experts to ensure coding reliability (intercoder reliability) in the analysis of the interviews. The similarities and differences between the researcher and the three coders were expressed numerically and coding reliability was calculated. For coding reliability, Miles and Huberman's (1994) formula "Reliability = agreement/agreement + disagreement" was used. According to this formula, the coding reliability was found to be 86.6%. It is accepted that a reliability coefficient above 70% is sufficient.

FINDINGS

Under this heading, findings related to context, input, process and product dimensions are presented.

Findings on Context Dimension

Within the scope of the question "Are the objectives of the program determined in accordance with the needs of the learners?", 10 items were included in the context sub-dimension. The lowest score that can be obtained from this dimension is 10 and the highest score is 50. Since the value in the middle of these scores is 30, an individual who thinks that the objectives of the program are determined in accordance with the needs of the learners is expected to get an average of 30 points from this dimension. The mean score of the participants on the context dimension ($\bar{X}$=38,058) is higher than the expected mean score for this dimension ($\bar{X}$=30). A one-sample t-Test was conducted to test whether the observed mean being higher than 30 was statistically significant and the results are given in Table 5.

Table 5. t-Test Table for Context Dimension Score

Sub Dimension	N	Average	SS	T	df	p*	Mean Difference
Context	104	38,058	,77407	50,139	103	,000	8,058

*p<0,05

According to Table 5, the participants' mean score (38,058) for the items in the context dimension was statistically significantly higher than the expected score ($t=50,139$; $p<0,05$). Accordingly, it can be said that the objectives of the program were determined in accordance with the needs of the participants. The t-Test results comparing the scores obtained in the context dimension according to gender are given in Table 6.

Table 6. t-Test Table Comparing the Scores Obtained in the Context Dimension According to Gender

Group	N	Average	SS	T	Df	p
Female	55	3,7400	,74227	-,917	102	,361
Male	49	3,8796	,80957			

p>0,05

According to Table 6, there was no statistically significant difference between the context dimension mean scores of women and men. Accordingly, women and men have the same opinion about determining the program objectives in accordance with the needs of the participants. The t-Test results comparing the scores obtained in the context dimension according to marital status are given in Table 7.

Table 7. t-Test Table Comparing the Scores Obtained in the Context Dimension According to Marital Status

Group	N	Average	SS	T	Df	p
Single	33	3,7667	,92523	-,350	102	,727
Married	71	3,8239	,69948			

p>0,05

According to Table 7, there was no statistically significant difference between the scores of married and single participants in the context dimension. Accordingly, single and married participants have the same opinion about determining the program objectives in accordance with the needs of the participants. The t-Test results comparing the scores obtained in the context dimension according to employment status are given in Table 8.

Table 8. t-Test Table Comparing the Scores Obtained in the Context Dimension According to Employment Status

Group	N	Average	SS	T	Df	p
Employed	64	3,7672	,81105	-,641	102	,523
Unemployed	40	3,8675	,71661			

p>0,05

According to Table 8, there was no statistically significant difference between the context dimension scores of the employed and unemployed participants. Accordingly, employed and unemployed participants have the same opinion about the determination of program objectives in accordance with the needs of the participants. Analysis of Variance (ANOVA) was conducted to test whether the mean scores of the participants on the context dimension showed a significant difference depending on age and the results are given in Table 9.

Table 9. Analysis of Variance Table for the Distribution of the Scores Obtained in the Context Dimension According to Age

Age	N	Average	SS	Coefficient of Variance	KT	sd	KO	F	p
22-25	15	3,7000	,94944	Between Groups	,901	3	,300	,494	,687
26-29	15	3,9800	,53479	Within Group	60,815	100			
30-33	20	**3,8900**	**,72104**	**Total**	**61,717**	**103**			
34 and older	54	3,7556	,80462						
Total	**104**	**3,8058**	**,77407**						

$p>0,05$

According to Table 9, as a result of the analysis of variance, no statistically significant difference was observed in the mean context dimension scores of the participants according to age. Accordingly, it can be said that participants of different ages have the same opinion about determining the objectives of the program in accordance with their needs ($F=0,494$, $p>0,05$).

Findings on Input Dimension

Within the scope of the second question of the study, "Are learning resources designed in accordance with the objectives?", 8 items were included in the input sub-dimension. The lowest score that can be obtained from this dimension is 8 and the highest score is 40. Since the value in the middle of these scores is 24, an individual who thinks that learning resources are designed in accordance with the objectives is expected to get an average of 24 points from this dimension. In order to test whether the observed mean of the research group being greater than 24 ($\bar{X}=37,73$) is statistically significant, one sample t-Test was performed and the results are given in Table 10.

Table 10. t-Test Table for Input Dimension Scores

Sub Dimension	N	Average	SS	T	df	p*	Mean Difference
Input	104	37,73	,95729	38,656	103	,000	36,28

$^*p<0,05$

According to Table 10, the mean score of the participants for the items in the input dimension (37.73) was statistically significantly higher than the expected score ($t=38.656$; $p<0.05$). Accordingly, it can be said that learning resources in the program are designed in accordance with the objectives. The t-Test results comparing the scores obtained in the input dimension according to gender are given in Table 11.

Table 11. t-Test Table Comparing the Scores Obtained in the Input Dimension According to Gender

Group	N	Average	SS	T	Df	p
Female	55	3,7114	,92605	,933	102	,353
Male	49	3,5357	,99248			

$p>0,05$

According to Table 11, there is no statistically significant difference between the scores of male and female participants on the design of learning resources in accordance with the objectives in the program. The t-Test results comparing the scores obtained in the input dimension according to marital status are given in Table 12.

Table 12. t-Test Table Comparing the Scores Obtained in the Input Dimension According to Marital Status

Group	N	Average	SS	T	Df	p
Single	33	3,6250	1,00972	-,025	102	,980
Married	71	3,6303	,93933			

p>0,05

According to Table 12, there was no statistically significant difference between the views of married and single students on the design of learning resources in accordance with the objectives in the input dimension. The t-Test results comparing the scores obtained in the input dimension according to whether they were employed or not are given in Table 13.

Table 13. t-Test Table Comparing the Scores Obtained in the Input Dimension According to Employment Status

Group	N	Average	SS	t	Df	p
Employed	64	3,5059	,94108	-1,660	102	,101
Unemployed	40	3,8250	,96194			

p>0,05

According to Table 13, there was no statistically significant difference between the opinions of those who were employed and those who stated that they were not employed regarding the design of learning resources in accordance with the objectives. Analysis of Variance (ANOVA) was performed to test whether the mean scores of the participants regarding the input dimension showed a significant difference according to age and the results are given in Table 14.

Table 14. Analysis of Variance Table for the Distribution of the Scores Obtained in the Input Dimension According to Age

Age	N	Average	SS	Coefficient of Variance	KT	sd	KO	F	p
22-25	15	3,6417	1,04140	Between Groups	2,314	3	,771	,838	,476
26-29	15	3,9417	,54047	Within Group	92,075	100			
30-33	20	3,4250	1,18682	**Total**	**94,389**	**103**			
34 and older	54	3,6134	,93203						
Total	**104**	**3,6286**	**,95729**						

p>0,05

According to Table 14, as a result of the analysis of variance, no statistically significant difference was observed in the mean input dimension scores of the participants according to their age. Accordingly, the opinions of the participants from different ages on the design of learning resources in accordance with the objectives in the input dimension are similar (F=0,838, p>0,05).

Findings on Process Dimension

Within the scope of the third question of the study, "Were learning activities conducted in accordance with learner expectations?", 12 items were included in the process sub-dimension. The lowest score that can be obtained from this dimension is 12 and the highest score is 60. Since the value in the middle of these scores is 36, an individual who thinks that learning activities are carried out in accordance with learner expectations is expected to get an average of 36 points from this dimension. The average of the scores obtained from the process dimension ($\bar{X}$=38,12) is higher than the average score expected from the measurement tool in this dimension ($\bar{X}$=36). In order to test whether this score difference is statistically significant, one sample t-Test was conducted and the results are given in Table 15.

Table 15. t-Test Table for Process Dimension Scores

Sub Dimension	N	Average	SS	t	df	p*	Mean Difference
Process	104	38,13	,74802	51,988	103	,000	38,13

*p<0,05

According to Table 15, it was observed that the difference between the mean scores obtained from the process sub-dimension ($\bar{X}$=38.13) and the expected mean score ($\bar{X}$=36) was statistically significant (t=51.98; p<0.05). Accordingly, it can be said that learning activities in the program were carried out in accordance with the expectations of the participants. The t-Test results comparing the scores obtained in the process dimension according to gender are given in Table 16.

Table 16. t-Test Table Comparing the Scores Obtained in the Process Dimension According to Gender

Group	N	Average	SS	t	df	p
Female	55	3,8258	,72494	,179	102	,858
Male	49	3,7993	,78042			

p>0,05

According to Table 16, there is no statistically significant difference between the scores of women and men regarding the execution of learning activities in the program in accordance with their expectations (p>0.05). It can be said that women and men have the same opinion on this issue. The t-Test results comparing the scores obtained in the process dimension according to marital status are given in Table 17.

Table 17. t-Test Table Comparing the Scores Obtained in the Process Dimension According to Marital Status

Group	N	Average	SS	T	df	p
Single	33	3,8157	,87021	,022	102	,983
Married	71	3,8122	,69074			

p>0,05

According to Table 17, there was no statistically significant difference between the scores of married and single participants regarding the execution of learning activities in accordance with their expectations. The t-Test results comparing the scores obtained in the process dimension according to employment status are given in Table 18.

Table 18. t-Test Table Comparing the Scores Obtained in the Process Dimension According to Employment Status

Group	N	Average	SS	T	df	p
Employed	64	3,6992	,76544	-2,044	102	,044
Unmployed	40	3,9958	,68976			

*p<0,05

According to Table 18, there was a significant difference between those who were employed and those who were not employed in terms of the execution of the learning activities in the program in accordance with the expectations in favor of those who were not employed (p<0.05). The mean score of the process dimension of the participants who were not employed was significantly higher than the participants who were employed. Analysis of Variance (ANOVA) was performed to test whether the mean scores of the participants regarding the process dimension showed a significant difference depending on their age and the results are given in Table 19.

Table 19. Variance Analysis of the Distribution of the Scores Obtained in the Process Dimension According to Age

Age	N	Average	SS	Coefficient of Variance	KT	sd	KO	F	p
22-25	15	3,6556	,86423	Between Groups	,714	3	,569	,418	,740
26-29	15	3,8889	,53421	Within Group	56,918	100			
30-33	**20**	**3,7375**	**,85638**	**Total**	**57,632**	**103**			
34 and older	54	3,8642	,73371						
Total	**104**	**3,8133**	**,74802**						

p>0,05

According to Table 19, there is no statistically significant difference between age groups regarding the execution of learning activities in the program in accordance with the expectations of the participants. In other words, the opinions of the participants of different ages that the learning activities in the program are carried out in accordance with the expectations are similar (F=0,416, p>0,05).

Findings on Product Dimension

Within the scope of the fourth question of the study, "Have the learning outcomes been achieved in the program?", 10 items were included in the product sub-dimension. The lowest score that can be obtained from the product sub-dimension is 10 and the highest score is 50. Since the value in the middle of these scores is 30, an individual who thinks that learning outcomes are achieved in the program is expected to get an average of 30 points from this dimension. The average of the scores obtained from the product dimension ($\bar{X}$=41,11) is higher than the average score expected for this dimension ($\bar{X}$=30). The results of the one-sample t-Test conducted to test whether this difference is statistically significant are given in Table 20.

Table 20. t-Test Table for Product Dimension Scores

Sub Dimension	N	Average	SS	t	df	p*	Mean Difference
Product	104	41,11	,71678	58,484	103	,000	41,11

*p<0,05

According to Table 20, it was observed that the difference between the average score obtained from the product sub-dimension ($\bar{X}$=41,11) and the expected average score ($\bar{X}$=30) was statistically significant (t=58,48; p<0,05). Accordingly, it can be said that the expected learning outcomes were achieved in the program. The t-Test results comparing the scores obtained in the product dimension according to gender are given in Table 21.

Table 21. t-Test Table Comparing the Scores Obtained in the Product Dimension According to Gender

Group	N	Average	SS	T	df	*p
Female	55	3,9636	,73317	-,271	102	,026
Male	49	4,2755	,66725			

*p<0,05

According to Table 21, there was a significant difference between the groups in terms of achieving the learning outcomes in the program (p<0.05). Accordingly, it can be said that men have more positive opinions than women in terms of achieving learning outcomes in the program. The t-Test results comparing the scores obtained in the product dimension according to marital status are given in Table 22.

Table 24. t-Test Table Comparing the Scores Obtained in the Product Dimension According to Marital Status

Group	N	Average	SS	T	df	p
Single	33	4,1303	,91634	,190	102	,849
Married	71	4,1014	,60980			

p>0,05

According to Table 22, there was no statistically significant difference between the scores of married and single participants in terms of achieving the learning outcomes in the program. It can be said that both groups have the same opinion on this issue. The t-Test results comparing the scores obtained in the product dimension according to employment status are given in Table 23.

Table 23. t-Test Table Comparing the Scores Obtained in the Product Dimension According to Employment Status

Group	N	Average	SS	T	df	p
Employed	64	4,1266	,74796	,286	102	,775
Unmployed	40	4,0850	,67237			

p>0,05

According to Table 23, there was no statistically significant difference between the scores of those who were employed and those who were not employed in terms of achievement of learning outcomes in the program. Analysis of Variance (ANOVA) was conducted to test whether the participants' scores on the product dimension showed a significant difference depending on age and the results are given in Table 24.

Table 24. Variance Analysis of the Distribution of the Scores Obtained in the Product Dimension According to Age

Age	N	Average	SS	Coefficient of Variance	KT	sd	KO	F	p
22-25	15	4,1200	,51018	Between Groups	1,171	3	,517	,755	,522
26-29	15	4,1867	,52217	Within Group	51,747	100			
30-33	20	4,2900	,75247	Total	52,918	103			
34 and older	54	4,0204	,79536						
Total	**104**	**4,1106**	**,71678**						

p>0,05

According to Table 24, there was no statistically significant difference in the scores of the product dimension according to the participants' age. In other words, the opinions of the participants of different ages that the learning outcomes were achieved in the program were similar (F=0,755, p>0,05).

Findings on Semi-structured Interviews

In the study, the opinions and suggestions of 6 graduates working in the positions of operations manager, team leader, unit manager and customer representative in the call center sector were obtained through semi-structured interviews about whether the program applied has any deficiencies and what can be done to improve the program, if any. The opinions and suggestions of the participants were collected and interpreted in 15 themes under 4 categories determined by taking into consideration the literature and the findings obtained with the quantitative measurement tool. The findings are given in Table 25.

Table 25. Opinions of the Graduates Participating in the Interviews Regarding the Improvement of the Program

Category	Theme	Program Evaluation Dimension
Learning Resources	Course content Up to dateness of courses New courses needed	Context Input
Learning Activities	Examination Internship Technical trip Practical lessons	Process Product
Recognition	Scope of work and professional competence University-industry cooperation	Context Process Product
Expectations	Technology dimension Theoretical dimension Implementation aspect Individual predisposition Communication and foreign language proficiency	Context Process Product

According to Table 25, it was seen that the opinions and suggestions of the participants regarding the development of the program were concentrated in the context, process and product dimensions. These opinions and suggestions are explained below under category headings.

Learning Resources: Participants' views on learning resources were categorized under three themes: the content of the courses, the timeliness of the courses and the new courses needed. Participants mentioned the lack of content, especially in the technical dimension, regarding the content of the courses. They emphasized that the existing content is more theoretical and oriented towards academic progress. They stated that in the sector where the practical skills of the employees are more important, the courses should also have practical content. Some participants drew attention to the fact that vocational courses such as communication and presentation techniques, statistics, programming, sales techniques, office programs should be given with more practical content. As a justification, they pointed out that the structuring of vocational course contents in accordance with the sector plays an important role in the careers of sector employees. Some of the participants stated that the current course contents are not up-to-date enough due to the dynamic structure of the sector. They emphasized the necessity of updating the course contents in the program, especially in line with the developments in the technological field.

The most common theme in the learning resources category was the courses needed in the field. All of the interviewed participants pointed to the lack of courses covering the technical dimension of the program. They also said that it would be more beneficial to conduct some technical courses as applied online courses. They mentioned that some courses that will enable graduates to take managerial positions in the sector are not included in the program and stated that the addition of these courses will contribute to the graduates of the program in this process.

Learning Activities: Participants' views on learning activities were grouped under four themes: exams, internships, technical trips and application courses. Emphasizing the diversification of the program in terms of evaluation, the participants stated that the exam application was intended to finish the program, but the questions asked in some courses were very difficult. The participants found the e-campus system quite successful as a learning environment and stated that they mostly benefited from the exam questions in the system. However, they stated that candidates who start working in the sector are mostly evaluated on simulations, so it would be more effective to make such an evaluation in the program, at least in courses with technical content. They suggested asking questions based on scenarios in exams and diversifying the evaluation with applications such as homework and projects in some courses. They also said that the e-campus system has a structure in which these practices can be carried out. The opinions of the participants regarding the internship practice were that the internship is very necessary for the field but cannot be done due to the procedures and that this problem should be solved by the universities and the internship practice should be implemented. They stated that internship would be a very useful practice, especially in issues of critical importance for both the sector and the learners, such as minimizing the dropout rate, preventing loss of time and cost, and ensuring that candidates graduate from the program with a good command of the system by obtaining detailed information about the sector and job description.

Another issue that the participants drew attention to was the technical trip. They emphasized that the technical trip, which is nowadays practiced especially by quantitative departments, is important for the learners in the program to learn about the sector and experience the working environment.

One of the most emphasized issues by the participants was practical courses. Since the sector's field of activity involves mostly technical and technological skills, the lack of practical courses is overcome with in-service trainings after starting to work in the sector. Although some of the trainings are project-based, it is important for companies to complete the basic skills required by the sector during the training process provided in the program in terms of both cost and employing qualified personnel.

Recognition: The recognition category identified for the development of the program was examined under the themes of "Scope of work and professional competence, University-Sector cooperation". Participants are already working in the sector and one of their most common complaints is the public perception of the sector. Professionally, they complained that customer representative is still perceived as a job that consists only of answering incoming phone calls rather than a profession. They emphasized that the learners in the program and the public should be adequately informed about the profession that the candidates will have when they graduate. They also stated that the sector is very dynamic and has a structure in which career steps are operated faster than in other sectors.

One of the issues emphasized by the participants working in the private sector was to ensure university-industry cooperation. Participants emphasized the importance of cooperation in determining the courses and contents of the program. Another issue is that the training provided is not sufficient in terms of practice, especially for customer representatives who answer calls. Organizations have to provide training to the personnel they hire beforehand. The training provided is comprehensive and covers general information as well as the project. If universities determine the scope and content of the training they provide together with the sector and provide the desired competencies in the candidate, candidates graduating from the program may have an advantage over other candidates. In addition, there were participants who stated that the role of the management staff working in the sector as instructors in some applied courses would prevent the deficit in the technical field. Stating that they expect an increase in interest in the sector, especially in the sector where the work-from-home model can be applied, the participants emphasized that better-equipped graduates will be advantageous in recruitment. They also stated that thanks to the university-industry cooperation, the rate of job dropout will decrease and more experienced personnel will work in the sector. In addition, this cooperation is also important in terms of the scope of work and professional competence discussed in the previous theme. Candidates enrolled in the program will learn where and what tasks they will perform when they graduate, what competencies they need to have, shape their expectations and draw a clearer path for themselves after graduation.

Expectations: In this category, the opinions and suggestions of the participants were grouped under the themes of "Technology dimension, Theoretical and practical dimensions, Individual predisposition, Communication and language proficiency". All participants pointed out that the technological dimension was particularly lacking in the program and stated that the program should be updated in line with technological developments. They also pointed out the importance of technical courses due to the prevalence of jobs requiring technical skills in the sector. Participants think that the program is theoretically sufficient in general, but some theoretical information should be added, especially for learners who prefer this department for a career. Participants stated that the sector includes practical work as well as theoretical knowledge, but there are no practical courses in the program. They stated that applied courses should be carried out in the program. They also frequently mentioned the internship issue and stated that internship would be a complementary application in the program.

The participants stated that those working in the call center services sector are performing a very difficult profession and emphasized the importance of not only having theoretical and practical competencies, but also being predisposed to this profession from an individual perspective. They also stated that personal competencies such as problem-solving skills, patience, empathy, and the ability to fulfill multiple tasks at the same time should be possessed.

Participants have different views on communication and language competence, which are discussed lastly in the expectations category. Some participants emphasized that effective communication is very important in the sector. They drew attention to the correct use of voice and proper use of Turkish. In addition, the participants who stated that there is a need for foreign language, especially with the opening of the sector to the foreign market, stated that there is a need for personnel who know English and German at B1 level. They said that the necessity of foreign language is also very important for the programs used in the sector because the language of all programs is English.

CONCLUSION

When the findings obtained from quantitative data in the study were examined, it was seen that the program objectives were determined in accordance with the needs of the learners, teaching materials were designed in accordance with the objectives of the program, teaching activities overlapped with the expectations of the learners and the determined learning outcomes were achieved. The findings obtained from qualitative data suggest that the program needs to be updated, enriched and diversified, especially in terms of content and implementation. These results align with the results of Yucesan Kaya (2019)'s research, which was carried out using the same evaluation model before in Open Education System. In that study, which evaluated the Turkish Language and Literature Undergraduate Program conducted through distance education, it was determined that the program outcomes were achieved in four dimensions (Context, Input, Process and Product) in Stufflebeam's (2003) model.

When the results of the research are evaluated in terms of the sector, it is seen that the call center services sector has a very important place in terms of both employment and sectoral value. However, as previously stated in the research conducted by Celik (2016), the sector has many problems such as education, recognition, trust, turnover rate, institutional supports, competition with foreign sectors, etc. Especially in the public sector, the perception that call center services are not a profession but just call answering causes the sector to be seen as a seasonal or transitional job. This increases the turnover rate in the sector. The problems experienced during the education process and the expectations of graduates exist not only for institutions providing distance education services but also in formal education. The general problem of the people who graduated and started to work in the sector is that the education given remains more theoretical despite the dynamic and practical structure of the sector. The fact that the sector does not seek call center services department graduates as a prerequisite for the personnel it hires, especially in the role of customer representative, negatively affects the interest in the program and public perception. When the reasons for this are investigated, the fact that the candidates graduating from the program do not have a good command of the application dimension of the program and that there is in-house training for this does not distinguish the graduates of the department from the others. In this respect, educational institutions have some duties.

It is especially important for educational institutions to organize the learning activities in the program by considering the above-mentioned issues. With internship and practice courses, the deficiencies in the graduates regarding the sector, in the application dimension, can be eliminated. As Oliva (2009) points out, education programs are expected to meet the needs of learners in both academic and professional life. In this study, when the reasons why the learners prefer the program are examined, the rate of marking the option "for promotion in the sector" reveals a different situation regarding the internship and the duration of the program. Internship would be unnecessary for those who work in the sector and prefer the program for promotion. Learners who enroll in the program for this purpose expect a more advanced education. In the interviews, it was seen that such a target group needs courses such as management organization, business law, advanced excel and programming knowledge. However, it is not possible to provide all these courses in the current duration of the program. For this reason, it may be useful to restructure the program at the undergraduate level, especially for learners with career plans in the sector.

However, it is important that the competence of the personnel trained for the sector is known by the sector as well as the restructuring of the program in the light of the findings obtained in the processes in which both learning activities and evaluation methods are determined. The most effective way to ensure this is to realize university-industry cooperation in all these processes (Bektas&Tayauova, 2014). Considering that one of the main tasks of educational institutions is to train individuals with adequate equipment in the fields that society needs, there is a need for university-industry cooperation in order to employ educated individuals in the relevant sectors and to benefit efficiently from this workforce. The call center services sector has favorable conditions for the employment of women and disabled people, especially in terms of working conditions and the remote working option, which has started to be applied more and more recently with the COVID-19 pandemic. It will be beneficial for both the learners and the sector to complete the deficiencies of the program, which serves such an important purpose, in order to provide the graduates with the necessary competencies.

As a result, it was seen that the program has sufficient theoretical content in many courses, while some courses need to be updated in line with the developments in the sector. In particular, there is a need to offer the program at the undergraduate level for managerial positions and to add new courses in line with the needs, to improve the technical dimension of the program, to include application courses, to enrich the content in line with the needs of the sector in terms of foreign language, to include scenario-based questions in exams for the evaluation of learners and to introduce internship practice. In addition to these, the sector's prioritizing the graduates of these programs both in the recruitment process and in the promotion process will significantly eliminate the problems experienced.

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EXAMINATION OF THE PREDICTION OF FLEXIBILITY FOR LEARNER SATISFACTION IN ONLINE COURSES

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ABSTRACT

Universities consider student satisfaction in order to improve the online education they give to students and to question the fulfillment of their responsibilities. Student satisfaction may depend not only on the educational institution but also on individual characteristics. One of these individual characteristics is flexibility, which requires multidimensional pedagogical responsibility in online learning environments. The aim of this study is to examine whether the flexibility of time management, the flexibility of teacher contact, and the flexibility of content predict online course satisfaction. In this research, the predictive relational research method was used. 1794 students participated in the research. During an academic term, students took an online Turkish II course at a university's Distance Education Research and Application Center. According to the results of the analysis, the students' three flexibility predicts their satisfaction and the model that explains their satisfaction is significant (R^2=.60; p<.01). In the model, the variable that most explains student satisfaction is the flexibility of content. In addition, other variables explaining student satisfaction are students' flexibility in teacher contact and their flexibility in time management. Based on the results of the research, implications, and suggestions are presented.

Keywords: Online course satisfaction, the flexibility of time management, the flexibility of teacher contact, the flexibility of content.

INTRODUCTION

Online learning environments are important in education, thanks to the flexibility in place, time and learning pace, and access to learning resources. Almost all of the higher education institutions in today's Turkiye have distance education centers and provide online education to their students (Council of Higher Education, 2020a). While general culture courses (e.g., Foreign Language, Turkish Language, Information Technologies, etc.) were given in these centers in previous years (Kocaturk Kapucu & Usun, 2020), most of the courses started to be given online during the pandemic period (Council of Higher Education, 2020b). With a decision taken in this period, up to 40% of the courses given in university curricula can be given with distance education methods "independent of the pandemic period" (Council of Higher Education, 2020a). Based on this decision, online courses will be an important part of higher education in the coming years.

There are some requirements to ensure the effectiveness and continuity of online learning. Readiness (Yurdugul & Alsancak Sarikaya, 2013), motivation (Shih et al., 2013), and self-directed learning skills (Wandler & Imbriale, 2017) of students in online learning environments are some of these requirements. In addition to these requirements for students, universities have an obligation to provide easy-to-use, accessible (Cheng ve Yuen, 2018), and interactive (Thoms ve Eryilmaz, 2014) online learning environments. Also, they have to provide technical support services to students and instructors and training on system usage (Islam, 2014). In order for universities to provide and develop these services effectively, they need to inspect and question the deficient and faulty practices, systemic improvements, and the education policy they have adopted in online courses. These inquiries and subsequent improvements will increase the quality of the education offered and thus provide satisfaction.

Identifying and ensuring student satisfaction is essential for online courses offered by higher education institutions. Because satisfaction is accepted as an indicator of the quality of education offered by higher education institutions in online courses (Ilgaz & Gulbahar, 2015; Parahoo et al., 2016). In addition, there are studies in which student satisfaction predicts the students' success, completing the course, its continuity, and the intention to take online courses in the future (Abuhassna et al., 2020; Chow & Shi, 2014; Daghan & Akkoyunlu, 2016; Hostetter, 2013; Levy, 2007; Liaw, 2008; Machado-Da-Silva et al., 2014; Oliver, 1980). Considering all these studies, student satisfaction in online courses is not a choice but a necessity for universities (Cramarenco, Burcă-Voicu, & Dabija, 2023). For this reason, it is seen that students' online course satisfaction and the factors affecting it are worth investigating.

There are several studies examining student satisfaction in online courses and the variables that affect it. These studies can be grouped under three headings: systemic factors, educational factors, and individual factors (Table 1). When these studies are examined, the system characteristics of the teaching environment are examined more than the educational and individual differences variables. When considering a learning process, students have many individual differences and these differences can affect their satisfaction with the online learning experience. One of them is the level of flexibility students perceive in the online learning process.

Table 1. Satisfaction Studies

Factors	Variables	Study
Systemic Factors	System type	(Almoeather, 2020)
	Ease of use of the system	(Cheng & Yuen, 2018; Islam, 2014; Islam & Azad, 2015; Kantoglu, Torkul, & Altunisik, 2013; Ohliati & Abbas, 2019)
	System functionality	(Islam, 2014; Islam & Azad, 2015)
	User support of the system	(Islam, 2014; Kantoglu, Torkul, & Altunisik, 2013)
	System quality / service quality	(Harsasi & Sutawijaya, 2018; Koh & Kan, 2020; Liaw, 2008; Machado-Da-Silva et al., 2014; Ohliati & Abbas, 2019; Turhangil Erenler, 2020)
	Interaction support of the system	(Cheng, 2020; Koh & Kan, 2020)
	Compatibility and accessibility of the system	(Islam & Azad, 2015)
Educational Factors	Presented information	(Koh & Kan, 2020; Machado-Da-Silva et al., 2014; Ohliati & Abbas, 2019)
	Course content	(Koh & Kan, 2020)
	Course design quality	(Cheng, 2020; Turhangil Erenler, 2020)
	Course structure	(Harsasi & Sutawijaya, 2018)
	Course duration	(Akyol, Vaughan, & Garrison, 2011)
	Instructor behaviors	(Turhangil Erenler, 2020)
	Usefulness of materials	(Kantoglu, Torkul, & Altunisik, 2013)
	Instructor-student interaction	(Kantoglu, Torkul, & Altunisik, 2013; Kuo et al., 2013; Turhangil Erenler, 2020)
Individual Factors	Social presence level	(Richardson & Swan, 2003)
	Online learning experience	(Abuhassna et al., 2020; Landrum, 2020)
	Online learning self-efficacy	(Landrum, 2020; Lim et al., 2021)
	Internet self-efficacy	(Abdel-Jaber, 2017)
	Self-directed learning level	(Abdel-Jaber, 2017)
	Using computer	(Kantoglu, Torkul, & Altunisik, 2013)
	Stress/anxiety	(Lux et al., 2022)
	Engagement	(Rajabalee & Santally, 2020; Lux et al., 2022)

Flexibility is a concept that has a history of nearly 50 years (Bell, Bowden, & Trott, 1997) and has been the subject of more research over the years with the opportunities brought by technology in education (Li & Wong, 2018; Veletsianos & Houlden, 2019). It has been stated in the studies that it is difficult to explain the definition and framework of this concept, which is used with various meanings in this time period (Jakupec & Garrick, 2000; Veletsianos & Houlden, 2019). Flexibility in learning is defined as students' learning at any time, frequency, and duration, in the learning styles they want, and determining their own learning situations (Van den Brande, 1993). This definition shows that in addition to what the system offers in teaching, students have an effortful role in the learning process to become flexible learners (Houlden & Veletsianos, 2019). Veletsianos and Houlden (2019), in their study which examined the articles published in the 40-year history of "Distance Education", one of the important journals in the field of distance education, stated in another definition that flexibility is not only related to the scope of "learning in a flexible place and at a flexible time" and but also requires pedagogical responsibilities. Accordingly, the student should be able to choose learning resources, learning activities, and assessment tasks (Naidu, 2017). In the study conducted by Cornelius, Gordon, and Ackland (2011) it was stated that the flexibility defined within the framework of the activity-focused model should draw the students' study routes towards their individual interests, the autonomy of decision making and planning would encourage independent learning, and it could provide different learning methods and resources. This definition indicates that students have the responsibility to decide what to and how to learn (Richardson, 2000; Zhang, Lou, Zhang, & Zhang, 2019). Considering all these definitions, online courses offered with different educational approaches (such as e-learning, virtual learning environments, and blended learning) support flexible learning and students can be flexible learners (Flannery & McGarr, 2014).

Online learning environments offer students the opportunity for flexibility in terms of learning place, time, duration, and access to learning content (Soffer, Kahan, & Nachmias, 2019). This opportunity is an important reason why students are willing to learn online (Jaggars, 2014). Because the flexibility offered in online learning environments is perceived positively by learners and is thought to improve learning (Soffer, Kahan, & Livne, 2017; Turan, Kucuk, and Cilligol Karabey, 2022). In fact, studies have shown that flexibility in online learning improves learning performance (Bergamin, Ziska, & Groner, 2010). The increase in learning performance will bring success. Success, on the other hand, can change the student's perception of other negative situations in the learning process. Therefore, the online learning process will provide satisfaction. On the contrary, failure in online courses can upset the student, cause a negative attitude of the student and reduce their satisfaction. This relationship between success and satisfaction has been proven by a meta-analysis study by Richardson et al. (2017). From this point of view, it can be thought that students' flexibility behaviors in online learning predict their satisfaction levels. The aim of this study is to "examine the prediction of satisfaction of flexibility in the online course".

In the research, the concept of flexibility was examined with students' perceived flexibility of time management, flexibility of teacher contact, and flexibility of content. The flexibility of time management allows them to determine the time they want to learn and their own learning pace; the flexibility of teacher contact refers to the ability to communicate with the instructor and to find different ways of communication. The flexibility of content, on the other hand, states that students can access the content they choose during their learning process and learn wherever they want (Kokoc, 2020). Within the framework of these definitions, this research answers the question "Do the flexibility of time management (FTimeM), the flexibility of teacher contact (FTeacherC), and the flexibility of content (FContent) perceived by students in the online learning process predict online course satisfaction (OCSatisfaction)?".

METHOD

In the research, the predictive relational research method, one of the relational research methods, was used in order to determine the flexibility of students in online courses to predict their satisfaction. The predictive relational research method is defined as determining the characteristics of those that have one of the two features that we know to be related and estimating and predicting the other feature (Fraenkel, Wallen, & Hyun, 2012).

Participants

Students who took the Turkish Language II courses in 14 faculties and 13 vocational schools of a state university during the spring semester of the 2020-2021 academic year participated in the research. 1794 students volunteered. 712 (39.7%) male and 1082 (60.3%) female students participated in the study. Of the participants, 1042 (58.1%) are studying at a faculty, and 752 (41.9%) are studying at a vocational school. While 636 (35.5%) of the students had the experience of taking online courses in previous years, 1158 (64.5%) did not take online courses.

Data Collection Tools

Flexibility to Learn in Online Course

The learning flexibility of the students in the online course was determined with the "Flexibility Scale in Open and Distance Learning". The scale was developed by Bergamin, Ziska, and Groner (2010), revised by Bergamin, Werlen, Siegenthaler, and Ziska (2012), and adapted into Turkish by Kokoc (2020). The scale measures the perceived flexibility levels of university students in distance learning processes. It consists of nine items and three sub-dimensions. The sub-dimensions of the scale are the flexibility of time management (α=.85), the flexibility of teacher contact (α=.72), and the flexibility of content (α=.73). The internal consistency coefficient for the entire scale was calculated as .83.

Students' Online Course Satisfaction

The "Online Course Satisfaction Scale" was used to determine the satisfaction of students in their online learning processes. The scale was developed by Bayrak, Tibi, and Altun (2020) in Turkish and aims to measure student satisfaction in online courses. The scale consists of eight items. The internal consistency coefficients for the scale are .93 (EFA), .95 (CFA-I), and .95 (CFA-II).

Implementation and Data Collection Process

In the 2020-2021 academic year, I worked in coordination with the Turkish Language Department and the Distance Education Research and Application Center in the presentation of the Turkish Language II course. The Turkish Language Department of the university prepared the contents of the Turkish Language II course. Three faculty members working in the department used the same topics, the same teaching materials, and the same teaching methods while presenting the course. The 14-week course was conducted with synchronous and asynchronous practices. We used a learning management system in the course and shared the online form of the scale on this platform at the end of the semester. Volunteer students participated by filling out this form.

Data Analysis

I used a Multiple Linear Regression Model (with Stepwise Technique) to analyze students' time management flexibility, teacher communication flexibility, and content flexibility predicting their online course satisfaction. Before analysis, I tested the assumptions of providing a sufficient number of participants, normal distribution of residuals, a linear relationship between dependent and independent variables, homogeneous distribution of variances, no multicollinearity between independent variables, and independence of residuals from each other. In addition to all these assumptions, I used Cohen's f2 statistics for the effect size of the Multiple Linear Regression Model (Cohen, 1988).

FINDINGS

In this research, I examined the flexibility of time management, the flexibility of teacher contact, and the flexibility of content to predict online course satisfaction. Before analysis, I tested assumptions. The number of participants is sufficient. The variances showed normality, linearity, and homogeneity. When the tolerance and VIF values are examined, there is no multicollinearity situation. Also, there is no autocorrelation. After examining the assumptions, the correlation between student flexibility levels and online course satisfaction to predict the model is below (Table 2).

Table 2. The Correlations between Students' Flexibility Levels and Online Course Satisfaction and Descriptive Statistics

	OCSatisfaction	n	$\bar{X}$	sd
OCSatisfaction	1.000	1794	3.46	1.00
FTimeM	.66*	1794	3.71	1.04
FTeacherC	.70*	1794	3.43	1.08
FContent	.71*	1794	3.72	.99

**p<.01*

There are moderate correlations between online course satisfaction and the flexibility of time management (r=.66; p<.01), the flexibility of teacher contact (r=.70; p<.01), the flexibility of content (r=.71; p <.01) (Table 2). The result of the Multiple Linear Regression Model, in which students' perceived flexibility predicts their satisfaction, is below (Table 3).

Table 3. Multiple Linear Regression Analysis Findings on Predicting Online Student Satisfaction

Model		bj	S(bj)	95% CI	Correlations			t	p
					r	Partial	Part		
1	(Constant)	.78	.06	[.65, .90]				11.99	.00
	FContent	.72	.02	[.69, .75]	.71	.71	.71	43.02	.00
2	(Constant)	.53	.06	[.41, .65]				8.70	.00
	FContent	.46	.02	[.42, .50]	.71	.46	.34	22.09	.00
	FTeacherC	.36	.02	[.32, .39]	.68	.38	.27	17.55	.00
3	(Constant)	.46	.06	[.34, .58]				7.61	.00
	FContent	.35	.03	[.30, .40]	.71	.29	.20	12.94	.00
	FTeacherC	.34	.02	[.30, .37]	.68	.36	.25	16.61	.00
	FTimeM	.15	.03	[.10, .19]	.65	.13	.09	5.61	.00

Model 1: R=.713, R2=.51, F=1853.84, p<.01; Model 2: R=.77, R2=.59, F=1276.23, p<.01; Model 3: R=.77, R2=.60, F=876.74, p<.01

According to the result, the flexibility of content predicts online course satisfaction in Model 1, which is significant ($F_{(1,1792)}$=1853.84, p<.01). The model explains 51% of students' online course satisfaction (R^2=.51). This means that 49% of students' satisfaction cannot be explained by the flexibility of content alone. According to the model result, it can be said that for each increase in students' flexibility of content, student satisfaction will increase by .72. Different findings were obtained in Model 2, which was analyzed.

In Model 2 analyzed, it is significant that students' flexibility of content and flexibility of teacher contact predicts online course satisfaction ($F_{(2,1791)}$=1276.23, p<.01). The model explains 59% of the students' course satisfaction (R^2=.59). 41% of student online course satisfaction cannot be explained solely by students' flexibility of content and flexibility of teacher contact. In this regard, it can be said that with each increase in students' flexibility of content, their satisfaction will increase by .46, and with each increase in students' flexibility of teacher contact, their satisfaction will increase by .36. With the addition of students' flexibility of time management to Model 2, the findings have changed.

Model 3, in which students' flexibility of content, flexibility of teacher contact, and flexibility of time management predict online course satisfaction is significant ($F_{(3,1790)}$=876.74, p<.01). The model explains 60% of students' online course satisfaction (R^2=.60). 40% of students' satisfaction is due to factors other than these variables. According to the model, it can be said that students' satisfaction will increase by .35 with each increase in students' flexibility of content, by .34 with each increase in students' flexibility of teacher contact, and by .15 with each increase in students' flexibility of time management.

In this research, I used Cohen's (1988) f^2 statistics to determine the effect size values of the regression analysis. They are 1.04 for Model 1, 1.44 for Model 2, and 1.50 for Model 3. When compared with the limit values specified by Cohen (1988) to interpret the effect size, it can be said that the effect size values of all three models are large.

DISCUSSIONS AND CONCLUSION

The aim of this research is to examine the flexibility of students who take online courses to predict their satisfaction. The flexibility of students includes the flexibility of time management, the flexibility of teacher contact, and the flexibility of content in the study. According to the research findings, there are three types of flexibility in the model that most explain students' satisfaction. There are studies in the literature that emphasize that flexibility is important in having a positive attitude toward the online learning environment, regardless of its type (Asoodar, Vaezi, & Izanloo, 2016; Divjak, Rupel, & Lesnik, 2018; Harsasi & Sutawijaya, 2018; Ilgaz & Gulbahar, 2020; Turhangil Erenler, 2020). In addition, a systematic review study by Abdull Muttalib, Akim, and Jaafar (2022), concluded that flexibility is the most important factor that ensures student satisfaction in online learning during the pandemic. Accordingly, the findings support the results of similar studies.

According to the research findings, content flexibility is the one among the types of flexibility examined that most explain the variance in students' online course satisfaction. Online learning environments are suitable for students to access more resources. In this way, students can access the learning resources they want as an alternative to the existing content (Zhang, Burgos, & Dawson, 2019). When students access alternative learning content, they do not limit themselves and can learn more deeply. This situation brings student success in the courses and there is a relationship between success and content flexibility (Soffer, Kahan, and Nachmias, 2019). In addition, considering the relationship between success and satisfaction (Richardson et al., 2017), the flexibility of content in online courses can provide satisfaction. As a supporting result for this conclusion, the flexibility of the content developed by the instructors is a satisfying factor for the students (Khojasteh et al., 2023). Moreover, Turan, Kucuk, and Cilligol Karabey (2022) concluded that there is a relationship between general satisfaction with the emergency distance learning process and the flexibility of the content during the pandemic. At the same time, there are studies stating that open-access resources increase satisfaction levels (Machado-Da-Silva et al., 2014; Weller et al., 2015).

In the research, after the flexibility of content, the variable that most explains students' online course satisfaction is the flexibility of teacher contact. Keeping students in touch with their teachers in the online course is essential to ensure the continuity of learning, to prevent the student from dropping out of school, and not feel lonely and isolated. In addition, it is important for students' satisfaction to receive feedback and not feel anxious or uncomfortable during learning (Richardson et al., 2017). For all these reasons, it is expected result that students will be satisfied with the learning environments where they feel flexible in communicating with the instructors. Similar studies support this conclusion (e.g., Turan, Kucuk, and Cilligol Karabey, 2022). In addition, although there are studies that argue that students cannot communicate as much as in face-to-face education in the online learning environment (e.g., Machado-Da-Silva et al., 2014), it is shown that students' communication with their teachers provides more satisfaction (Faize & Nawaz, 2020; Nasir, 2020).

As a result of this research, the flexibility of time management predicts student satisfaction in online courses. Online learning environments provide the opportunity to be flexible in time management to students (Soffer, Kahan, & Nachmias, 2019) and is even seen as its most important feature (Harsasi & Sutawijaya, 2018). Students generally prefer online courses because of time flexibility (Machado-Da-Silva et al., 2014). In addition, the flexibility of students to access the content at any time is important in preventing school dropout behaviors (Weller et al., 2015). Considering all these studies, it is expected result that students who are more flexible about time management in the online course will be more satisfied. In addition, the flexibility of time management is the variable that explains the model the least when compared to other types of flexibility. Turan, Kucuk, and Cilligol Karabey (2022), who examined the variables that predicted general satisfaction with emergency remote teaching during the pandemic period, reached the opposite of this result. The reasons for this result may be the examination of students' satisfaction with the whole emergency remote teaching process during the pandemic period and the low level of satisfaction with emergency remote teaching (Turan, Kucuk, and Cilligol Karabey, 2022).

Student satisfaction is important in terms of predicting the success of the teaching process, ensuring the continuity of the student, and gaining the behavior of taking online courses again in the future. In order to ensure and increase students' satisfaction, some implication suggestions can be presented based on the results obtained from the research. Higher education institutions and other related institutions can increase student satisfaction by offering students content in different presentation types (e.g., video, animation, text, graphics, etc.) in online courses. Therefore, students should not learn from one type of presentation in the content, and the contents should be prepared in different presentation types. Content differences should not be limited to the material only, different methods and techniques should also be used. Approaches such as gamification, product-oriented, and problem-solving can be used in online courses as well as in the classroom. In addition, it is important that the online course has a responsive design for different devices (especially mobile devices) so that students can access it anywhere and from any device. This design should automatically analyze students' interaction with learning content, identify possible learning deficiencies in students, and alert teachers and students about these deficiencies. This design should also have a chat panel, the usability of this panel should be high, and students should be able to live chat with teachers on this panel. In order to support this communication, in addition to the system features, the instructors should encourage their students to communicate comfortably and pedagogical in-service training should be provided on this situation. In this training, tips can be given so that the students do not feel nervous or uncomfortable while in contact with the instructors and that the instructors can give quality feedback. Moreover, the flexibility of time management, which is one of the most prominent features of online courses, should be provided. For this, it is necessary to have more asynchronous learning contents and activities. In this way, students will be able to plan their own learning and learn at any time, duration, and pace they want. Also, an officer of the institution can guide students in making these plans in online courses. In addition to all these implication suggestions, there are studies that offer vision and policies that emphasize flexible learning (e.g., Andrade & Alden-Rivers, 2019).

Limitations

This study has some limitations. While determining the satisfaction of the students, I evaluated the Turkish Language II course in general but did not evaluate the content, presentation type, method, or technique offered in the online course. As a limitation of this study, it is important to re-investigate more customized activities in the online course. In addition, it is valuable to investigate with qualitative methods to obtain in-depth information about satisfaction. Another limitation of the study is the measurement tool. The Online Course Satisfaction Scale is limited in determining satisfaction with the assessment and evaluation practices in the course. Therefore, the relationship between students' flexibility and their satisfaction with assessment and evaluation practices should be examined. Also, this research is limited to three types of flexibility. In future research, the relationship between different types of flexibility and satisfaction from this study can be examined (e.g., students' flexibility in communicating with other students).

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THE ROLE OF E-LEARNING READINESS ON SELF-REGULATION IN OPEN AND DISTANCE LEARNING

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ABSTRACT

In recent years, the proliferation of online and distance education has dramatically changed the landscape of education. With the growing demand for flexible and accessible learning opportunities, learners are increasingly turning to online and distance education programs to pursue their academic, personal, and professional goals. However, this modality of learning also presents unique challenges for learners, particularly when it comes to e-learning readiness and self-regulated learning. To explore these factors within the context of the online distance learning environment, this study used a cross-sectional quantitative research method to examine the differences in self-regulated learning skills of open and distance learners in terms of e-learning readiness in the Open Education System of Anadolu University. For the purpose of the study, an online survey was used to collect data. The participants of the study comprised 466 online distance learners. Results indicated that learners with high e-learning readiness levels had higher self-regulated learning skills compared to those with low levels. It was also determined that self-regulated learning skills did not differ in terms of the gender of the learners while they differed in terms of the time the learners spent on the learning management system.

Keywords: Online education, distance education, open and distance learning, self-regulation, e-learning readiness, online learning readiness.

INTRODUCTION

The idea behind open access to education is to liberate learners from location and time restrictions and provide equal and flexible learning opportunities. Playing an important role in meeting this need, online distance learning environments enable learners to gain certain knowledge and skills through internet-based synchronous or asynchronous applications by using information and communication technologies (ICT). Within this context, learners in online distance learning environments gain flexibility in where and when they learn and have more control over when and how they complete course-related activities (Moore & Kearsley, 2012). However, this flexibility requires learners to have different qualifications such as technology usage, time management, and effective interaction with other learners, content, and instructors (Joosten & Cusatis, 2020). Besides, learners are expected to have certain competencies in the learning process. These competencies basically include self-learning, having intrinsic motivation, being able to set one's own learning goals, and acting persistently to put these goals to work (Berigel & Cetin, 2019; Schunk & Greene, 2018). In the context of online and distance learning, self-regulation skills include all these competencies and are crucial for learners to effectively manage their time, stay focused, and engage in meaningful learning. Taking this into account, it becomes increasingly important for learners to be prepared for online learning, and it is also critical that online distance learners possess self-regulated learning skills. The effectiveness of online and distance learning depends largely on the readiness of learners. E-learning readiness, also known as online learning readiness, is a topic that is regularly discussed in various educational fields, particularly in online distance education (Firat & Bozkurt, 2020; Hung et al., 2010; Torun, 2020). Thus, learners' readiness for online learning is accepted as a determining factor that plays a vital role in taking online courses and being successful in these courses (Wei & Chou, 2020). In addition, readiness is considered as a significant skill for the learning process, as it creates significant changes in the behavior of learners, especially in the learning process (Wei & Chou, 2020). Besides, among the definitions given for the concept, the learners' self-confidence in using the internet, and related computer technologies while fulfilling their individual tasks, and the learners' ability to take responsibility for learning in online learning environments are especially emphasized (Ilgaz & Gulbahar, 2015). Similarly, there is a definition that highlights learners' ability to use technological tools and equipment as well as their access to technological tools in terms of their digital literacy (Hung et al., 2010; Ucar, 2022).

E-learning readiness encompasses a range of factors, including technical skills, digital literacy, motivation, and attitudes toward online distance learning. This readiness can significantly impact the success of online learning, and it is, therefore, crucial to assess and enhance e-learning readiness to ensure optimal learning outcomes (Bovermann et al., 2018; Hung et al., 2010; Torun, 2020). For this reason, it is necessary for distance education researchers to understand learners' e-learning readiness, in order for online learning to increase the academic success of learners. Besides, in the literature, it is underlined that educational institutions, especially within the higher education context, should analyze and understand the needs and concerns of learners and take their readiness for online learning into account before switching to online learning processes (Ilgaz & Gulbahar, 2015; Wei & Chou, 2020).

Becoming successful in open and distance learning depends on the learner's ability to take control of the learning process. This ability is broadly conceptualized as self-regulated learning (Zimmerman, 2002). In the literature, self-regulated learning skills have been comprehensively scrutinized to determine the factors affecting learner success (Alqurashi, 2019; Cakir et al., 2019). During the learning path, the learning objectives determined by the learners themselves serve as a standard in regulating and monitoring the learning process. In other words, learners try to benefit from the learning environment and materials offered to them according to their learning objectives in line with their own needs. Learners are supposed to employ certain strategies to be successful in online distance learning environments which include setting goals for reaching information, making self-assessments for putting goals into practice, planning the progress steps as a result of the evaluations, and following a road map. These strategies become more possible with self-regulated learning skills (Alqurashi, 2019).

In self-regulated learning, attention is drawn to the interaction between the individual characteristics of the learners and the qualities of a learning environment. Moreover, self-regulated learning involves using various cognitive, metacognitive, and motivational strategies to set goals, monitor progress, and adjust learning strategies as needed. Furthermore, it is underlined that learners with high academic achievement have higher self-regulated learning skills compared to learners with low academic achievement (Sitzmann & Ely, 2011). In addition, studies on self-regulated learning have yielded many supportive findings showing the relationship between self-regulated learning skills and academic achievement (Richardson et al., 2012; Sitzmann & Ely, 2011; Puzziferro, 2008). For example, Puzziferro (2008) determined that learners who had effective time management, which was a part of self-regulated learning skills, had higher academic performance. In the meta-analysis study conducted by Sitzmann and Ely (2011) in which the variables affecting academic achievement were determined, the variables of the learning goal, continuity, effort, and self-efficacy were emphasized. Finally, a study conducted by Richardson et al. (2012) showed that setting goals and directing personal effort toward these goals greatly determined average academic achievement. Briefly, self-regulated learning skills facilitate individuals' inability to adapt to different environments with various conditions. In fact, learners with these skills can regulate their learning when they are involved in a different learning environment while acting according to their own learning styles and pace. Consequently, learners can make the best use of the learning opportunity offered to them (Zimmerman, 2002).

The related studies conducted in online and distance education have focused on self-regulation learning to find out its impact on the success of learners. However, less attention has been focused on how self-regulation learning skills are affected by the e-learning readiness of online and distance learners. Therefore, this research targets to bridge this gap. Overall, this paper aims to contribute to the growing body of literature on e-learning readiness and self-regulated learning and provide insights into the strategies that can be employed to enhance the effectiveness of online and distance learning.

PURPOSE OF THE STUDY

In light of the review of the literature, the current research aims to examine self-regulated learning skills of learners in terms of e-learning readiness using Anadolum eKampus platform in the context of the 2021-2022 academic year summer term at Anadolu University Open Education System. The study is important in that it provides a general assessment of learners' e-learning readiness and examines self-regulated learning skills in terms of demographic characteristics of learners. Taking the purpose of the study into account, the study sought answers to the following research questions:

- How are learners clustered in terms of e-learning readiness?
- Do self-regulated learning skills differ significantly in terms of learners' e-learning readiness?
- Do self-regulated learning skills differ significantly in terms of learners' demographic characteristics?

METHOD

For the purposes of the study, a cross-sectional survey design based on the quantitative research method was used. The cross-sectional survey design directly reveals the current attitudes, beliefs, opinions, and practices related to a population or sub-samples taken from the population through various methods (Creswell & Guetterman, 2021, p. 430). Using this research design, the e-learning readiness and self-regulated learning skills in terms of demographic characteristics of learners using the Anadolum eKampus platform were examined. The following subheadings delineate each factor of the research design in more detail: the participants, data collection tools, and data analysis.

Participants

The participants of the study were 466 learners who use the Anadolum eKampus platform in the 2021-2022 academic year summer school term at Anadolu University Open Education System. A total of 300.966 learners enrolled in the summer school. These learners were provided with an online questionnaire via the Anadolum eKampus platform and the learners who entered the platform were asked to fill in the questionnaire voluntarily. Summer school lasted seven weeks and the data were collected throughout the summer school period.

Data Collection Tools

In the study, the online learning readiness scale (OLRS), online self-regulation questionnaire (OSRQ), and a questionnaire to collect the demographics of the participants were used to gather the data. The data collection tools are presented in three parts. In the first part, the ORLS developed by Hung et al. (2010) and adapted into Turkish by Ilhan and Cetin (2013) was used. The scale was measured in a 5-point Likert-type format consisting of five sub-factors and a total of 18 items. In the second part, OSRQ developed by Cho and Cho (2017) and adapted into Turkish by Cakir et al. (2019) was used (Tugtekin, 2022). While the scale was measured in a 5-point Likert-type format, it consisted of three sub-factors and a total of 30 items. Both scales were adapted in accordance with the purpose of the research and were used in the study after content validation was checked by two experts in the field of distance education. In the third part of the questionnaire, demographic questions were included. The survey was created online through Google Surveys and was available on the Anadolum eKampus platform. The participants were informed about the data collection tools through the learning management system.

Data Analysis

Microsoft Excel program was used to combine and clean the data, and SPSS 25 program was utilized to analyze the data. Validity and reliability analysis for the scales used were performed with exploratory factor analysis and Cronbach's α alpha coefficient. In addition, frequency analysis, k-means cluster analysis, independent samples t-test, and one-way analysis of variance (ANOVA) statistics were used to answer the research questions.

FINDINGS

As a result of the pre-check on the collected data, it was seen that repetitive response marking was not done. Subsequently, the univariate normality assumption was checked using the approach suggested by Kim (2013), and on account of the necessary examinations, it was observed that the absolute skewness and kurtosis values of the items of the scales used did not exceed the recommended threshold value ranges (2.0, and 7.0, respectively). Therefore, it was determined that the data did not pose a problem in terms of univariate normality. Then, the approach suggested by Arifin was used to control the multivariate normality assumption and the Mahalanobis distance for the items of the scales used in the study was calculated. Due to the distances obtained, a total of 78 responses exceeding the threshold value ($p<0.001$) were removed from the dataset (Arifin, 2015). With the remaining 388 data, it was seen that the data set provided both univariate and multivariate normality.

When it comes to the demographics of the participants, 54.1% of the participants were female and 45.9% were male. The participants mainly consisted of individuals aged 29 and under (40.6%). On Anadolum eKampus, the participants spent mostly 3-4 hours a day (36.1%). These findings are presented in Table 1.

Table 1. The Demographic Distribution of the Participants

Variable	Group		*n*	%
Gender*	Female		173	54.1
	Male		147	45.9
		Total	320	100.0
Age*	29 and below		130	40.6
	30-39		72	22.5
	40-49		67	20.9
	50 and over		51	15.9
		Total	320	100.0
Daily Time Spent on Anadolum eKampus	Below 1 hour		42	10.8
	1-2 hours		132	34.0
	3-4 hours		140	36.1
	5 hours and over		74	19.1
Total			388	100.0

**There are missing data of 68 participants in these variables.*

The Validity, Reliability, and Descriptive Results of the Scales

Exploratory factor analysis (EFA) was performed to determine how e-learning readiness and OLRS and OSRQ used in the study were distributed according to the factors in the study sample (principal components analysis/varimax). The results obtained are shared in Table 2 and Table 3, respectively.

Table 2. The Validity, Reliability, and Descriptive Results of the OLRS

Item	Mean	SD	FL	VE	EV	CA
OLRS Computer/Internet Self-Efficacy (KMO = 0.713; x^2 = 717,42; p<0.001)						
CSE1	4.04	0.99	0.939			
CSE2	4.30	0.92	0.905	82.22	2.47	0.889
CSE3	3.91	1.05	0.875			
Arithmetic Mean	4.08	0.89	-			
OLRS Self-Directed Learning (KMO = 0.896; x^2 = 1530.60; p<0.001)						
SDL1	4.14	0.90	0.928			
SDL2	4.23	0.94	0.909			
SDL3	3.88	1.01	0.875	77.79	3.89	0.927
SDL4	4.03	0.96	0.855			
SDL5	4.12	0.94	0.839			
Arithmetic Mean	4.08	0.84	-			
OLRS Learner Control (KMO = 0.629; x^2 = 345.06; p<0.001); In an online context,						
LC1	4.11	0.93	0.881			
LC2	4.21	0.88	0.875	67.44	2.02	0.717
LC3	3.19	1.31	0.694			
Arithmetic Mean	3.83	0.85	-			
OLRS Motivation for Learning (KMO = 0.859; x^2 = 1268.9; p<0.001); In an online context,						
MFL1	4.32	0.87	0.926			
MFL2	4.24	0.89	0.923	82.92	3.32	0.931
MFL3	4.19	0.91	0.904			
MFL4	4.22	0.92	0.889			
Arithmetic Mean	4.24	0.81	-			
OLRS Online Communication Self-Efficacy (KMO = 0.742; x^2 = 707.8; p<0.001)						
OCS1	4.18	0.99	0.928			
OCS2	4.05	0.99	0.901	82.87	2.49	0.896
OCS3	4.08	1.02	0.901			
Arithmetic Mean	4.10	0.91	-			

Based on EFA results shared in Table 2, it is seen that the KMO values for the sub-factors of the OLRS range from good to very good, while the results of Barlett's Test of Sphericity are significant in all sub-factors. In addition, while the variances explained for the scales are well above the 40% threshold, the eigenvalues meet the threshold criterion of being at least 1.0. These results provide sufficient evidence for the interpretation of EFA (Hair et al., 2014). Factor loadings range between 0.694 and 0.939 and are above the 0.50 threshold. Finally, since the Cronbach's Alpha coefficients for the sub-factors exceed the 0.70 threshold value, it was concluded that these factors were reliable (Hair et al., 2014).

Table 3. The Validity, Reliability, and Descriptive Results of the OSRQ

Item	Mean	SD	FL	VE	EV	CA
OSRQ Self-Regulation in Interaction between Learner and Content (KMO = 0.945; x^2 = 3117.05; p<0.001)				63.84	7.02	0.938
ILCS1	4.24	0.84	0.850			
ILCS2	3.96	0.95	0.838			
ILCS3	4.01	0.93	0.837			
ILCS4	4.07	0.93	0.835			
ILCS5	3.99	0.96	0.832			
ILCS6	3.95	0.96	0.825			
ILCS7	3.88	0.98	0.809			
ILCS8	3.90	1.00	0.806			
ILCS9	3.93	0.99	0.784			
ILCS10	4.11	0.92	0.745			
Arithmetic Mean	3.96	0.77	-			
OSRQ Self-Regulation in Interaction between Learner and Instructor (KMO = 0.951; x^2 = 5178.26; p<0.001)				84.22	7.58	0.976
ILI1	3.57	1.33	0.956			
ILI2	3.54	1.34	0.948			
ILI3	3.52	1.33	0.948			
ILI4	3.58	1.33	0.944			
ILI5	3.56	1.33	0.939			
ILI6	3.44	1.34	0.927			
ILI7	3.46	1.35	0.924			
ILI8	3.87	1.28	0.849			
ILI9	3.22	1.35	0.814			
Arithmetic Mean	3.53	1.22	-			
OSRQ Self-Regulation in Interaction between Learner and Learner (KMO = 0.912; x^2 = 2489.22; p<0.001)				78.99	5.25	0.944
ILL1	3.39	1.33	0.903			
ILL2	3.39	1.34	0.892			
ILL3	3.45	1.32	0.890			
ILL4	3.06	1.40	0.884			
ILL5	3.06	1.40	0.875			
ILL6	3.39	1.37	0.854			
ILL7	3.79	1.16	0.756			
Arithmetic Mean	3.36	1.15	-			

As a consequence of the EFA results presented in Table 3, it is seen that the KMO values for the sub-factors of the self-regulated learning skills scale range from good to very good, while the results of Barlett's Test of Sphericity are significant in all sub-factors. In addition, while the variances explained for the scales are well above the 40% threshold, the eigenvalues meet the threshold criterion. On the other hand, factor loadings vary between 0.745 and 0.956 and are over the 0.50 threshold (Hair et al., 2014). Due to Cronbach's Alpha coefficients (α > 0.70), all factors related to the scale were reliable (Hair et al., 2014).

The Clustering Process

A cluster analysis was performed in order to group the study participants in terms of e-learning readiness levels. The analysis was carried out in two stages. In the first stage, Ward's technique, one of the hierarchical clustering methods was used and the pattern of the participants within the framework of e-learning readiness was closely scrutinized. The results of the Ward technique indicated that a cluster consisting of two groups would be appropriate.

In the second stage of the analysis, the k-means technique, one of the non-hierarchical clustering methods, was used to test the reliability of the two-group cluster obtained thanks to the Ward technique (Hair, Black, Babin, & Anderson, 2014). It was understood that the item means gathered from both the Ward technique and the k-means technique were fairly similar to each other. Thus, the results of the analysis showed that it would be appropriate to use a cluster consisting of two groups with low and high e-learning readiness levels in the study. Descriptive information about the obtained cluster is shown in Table 4.

Table 4. The Distribution of the Participants' E-learning Readiness Levels

Factor/Item	OLRS Level			
	Low (*n* = 208; 53.6%)		High (*n* = 180; 46.4%)	
	Mean	SD	Mean	SD
Computer/Internet Self-Efficacy	3.64	0.90	4.59	0.55
CSE3	3.48	1.03	4.40	0.84
CSE1	3.58	0.98	4.57	0.69
CSE2	3.86	1.00	4.82	0.43
Self-Directed Learning	3.59	0.81	4.65	0.38
SDL2	3.74	0.96	4.80	0.48
SDL5	3.66	0.96	4.65	0.58
SDL3	3.39	0.97	4.44	0.73
SDL1	3.63	0.88	4.73	0.47
SDL4	3.51	0.91	4.63	0.59
Learner Control	3.38	0.77	4.36	0.59
LC1	3.59	0.91	4.72	0.47
LC3	2.81	1.12	3.62	1.39
LC2	3.74	0.90	4.75	0.46
Motivation for Learning	3.77	0.82	4.79	0.30
MFL1	3.86	0.91	4.87	0.36
MFL3	3.70	0.90	4.76	0.50
MFL2	3.77	0.91	4.78	0.44
MFL4	3.75	0.94	4.77	0.49
Online Communication Self-Efficacy	3.56	0.87	4.74	0.41
OCS3	3.56	0.99	4.68	0.68
OCS1	3.61	0.98	4.83	0.45
OCS2	3.50	0.95	4.69	0.55

In Table 4, it is seen that 53.6% of the study participants had low e-learning readiness levels and 46.4% had high e-learning readiness levels, and, besides, it is observed that the arithmetic means of all sub-factors are high in the participants with high e-learning readiness levels, while these means remain low in those with low level. In this respect, it can be evaluated that the participants with high e-learning readiness levels are higher than those with low e-learning readiness levels with regard to computer and internet usage self-efficacy, self-learning, learner control, learning motivation, and online communication self-efficacy abilities.

The Examination of Self-Regulation in Terms of E-learning Readiness Levels

Independent samples t-test was conducted to determine whether the sub-factors of the self-regulated learning skills of the study participants differed significantly in connection with their e-learning readiness levels. As a result of the analysis, the significance of the unequal variances option was used as the Levene test showed that the variances were not homogeneously distributed regarding the factor of "self-regulation in the interaction between learner and content". On the other hand, the significance of the equal variances option was used, as it indicated that the factors of "self-regulation in the interaction between learner and instructor", and "self-regulation in the interaction between learner and learner" were homogeneously distributed (Pallant, 2011). The results obtained are presented in Table 5.

Table 5. The Examination of Self-Regulation in terms of E-learning Readiness Levels

Variable	Level	N	Mean	SD	t	df	p
Self-Regulation in Interaction between Learner and Content	Low	208	3.59	0.73	-11.794	384.26	***
	High	180	4.38	0.59			
Self-Regulation in Interaction between Learner and Instructor	Low	208	3.09	1.15	-8.341	386	***
	High	180	4.04	1.09			
Self-Regulation in Interaction between Learner and Learner	Low	208	3.04	1.10	-6.270	386	***
	High	180	3.74	1.10			

***p<0.001.

In Table 5, in terms of e-learning readiness levels, the factors of "self-regulation in the interaction between learner and content" ($t(384.26) = -11.794$; $p<0.001$), "self-regulation in the interaction between learner and instructor" ($t(386) = -8.341$; $p<0.001$), and "self-regulation in the interaction between learner and learner" ($t(386) = -6.270$; $p<0.001$) differed statistically significant. Therefore, the findings showed that participants with high e-learning readiness levels had higher self-regulated learning skills in interaction between learner and content, learner and instructor, and learner and learner, compared to those with low e-learning readiness levels. In summary, the participants with high e-learning readiness levels had high self-regulated learning skills while those with low e-learning readiness levels also had low self-regulated learning skills. These findings are presented in Figure 1.

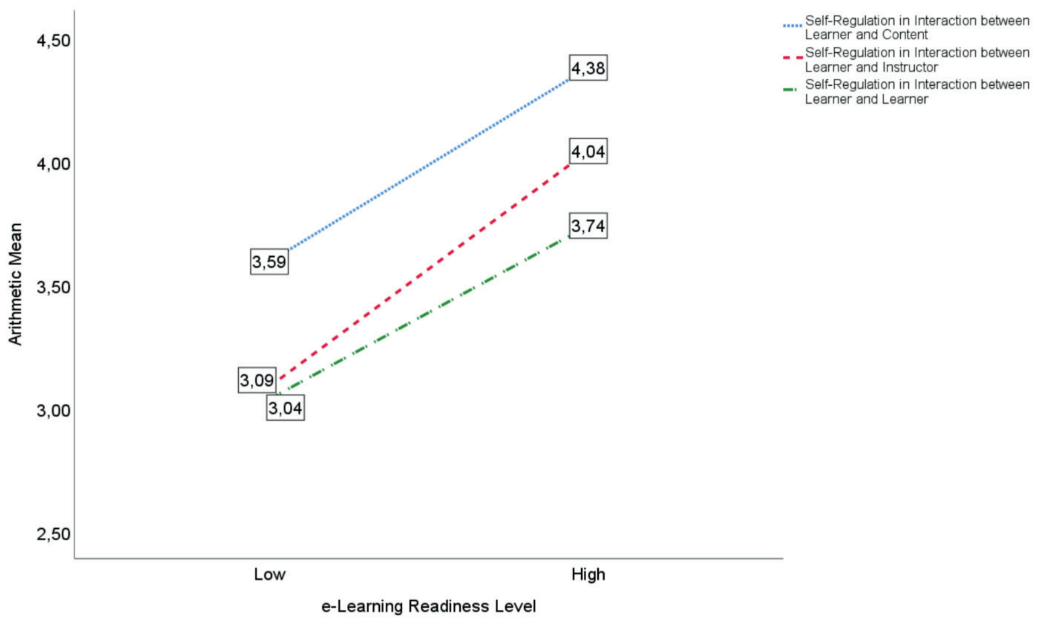

Figure 1. The Examination of Self-Regulation in terms of E-learning Readiness Levels

The Examination of Self-Regulation in Terms of Demographics

Difference tests were carried out to determine whether the sub-factors of the online self-regulation questionnaire differed significantly in terms of the demographic characteristics of the participants. In this context, one-way analysis of variance (ANOVA) was performed for age and time spent on Anadolum eKampus variables as well as independent samples t-test was used for gender variable. Moreover, when the Levene test showed that the variances were homogeneous, the significance of the equal variances option and the significance of the ANOVA statistic were used. On the other hand, the significance of the unequal variances and the Brown-Forsythe options were examined when it indicated that the variances were not homogeneous. The findings are presented in the following headings.

The Examination of Self-Regulation in Terms of Gender

It was examined whether the sub-factors of the self-regulated learning skills scale differed regarding gender, and the results of the analysis were presented in Table 6.

Table 6. The Examination of OSRQ in terms of Gender

Variable	Group	*n*	Mean	SD	*t*	df	*p*
Self-Regulation in Interaction between Learner and Content	Female	173	3.92	0.82	0.013	318	0.990
	Male	147	3.92	0.76			
Self-Regulation in Interaction between Learner and Instructor	Female	173	3.38	1.33	-0.795	318	0.427
	Male	147	3.49	1.14			
Self-Regulation in Interaction between Learner and Learner	Female	173	3.17	1.20	-1.121	318	0.263
	Male	147	3.32	1.11			

In Table 6, it is noteworthy that the sub-factors of the self-regulated learning skills did not differ regarding gender ($p>0.05$) and showed similar levels of distribution in both male and female learners.

The Examination of Self-Regulation in terms of Age

In order to examine whether the factors in OSRQ differ significantly regarding age, a one-way ANOVA was carried out. The results obtained are shared in Table 7.

Table 7. The Examination of Self-Regulation in terms of Age

Variable	Group	*n*	Mean	SD	*F*	*p*	PH Tukey
Self-Regulation in Interaction between Learner and Content	1. 29 and below	130	3.87	0.89	0.983 BF	0.401	-
	2. 30-39	72	3.92	0.75			
	3. 40-49	67	3.89	0.75			
	4. 50 and over	51	4.08	0.62			
Self-Regulation in Interaction between Learner and Instructor	1. 29 and below	130	3.66	1.17	4.022	**	1-3 1-4
	2. 30-39	72	3.49	1.21			
	3. 40-49	67	3.10	1.31			
	4. 50 and over	51	3.17	1.28			
Self-Regulation in Interaction between Learner and Learner	1. 29 and below	130	3.50	1.12	5.821	**	1-3 1-4
	2. 30-39	72	3.32	1.15			
	3. 40-49	67	2.87	1.12			
	4. 50 and over	51	2.94	1.18			

PH = Post-Hoc; $^{**}p<0.01$.

As shown in Table 7, there is a significant difference related to "self-regulation in interaction between learner and instructor" (F = 4.022; p<0.01) and "self-regulation in the interaction between learner and learner" (F = 5.821; p<0.01). However, the factor of "self-regulation in the interaction between learner and content" did not differ significantly (p>0.05). In order to investigate which age groups differed significantly regarding the factors of "self-regulation in the interaction between learner and instructor" and "self-regulation in the interaction between learner and learner", a Tukey post-hoc test was carried out. The results indicated that there was a significant difference between younger learners and older learners, and younger learners had higher self-regulated learning skills compared to older learners.

The Examination of Self-Regulation in terms of Time Spent on Anadolum eKampus

It was investigated whether the factors in the OSRQ differ significantly in terms of time spent on Anadolum eKampus, and the result of the analysis is given in Table 8.

Table 8. The Examination of Self-Regulation in terms of Time Spent on Anadolum eKampus

Variable	Group	*n*	Mean	SD	*F*	*p*	PH Tukey
Self-Regulation in Interaction between Learner and Content	1. Less than 1 hour	42	3.65	1.03	4.155 BF	**	1-4 2-4
	2. 1-2 hours	132	3.89	0.79			
	3. 3-4 hours	140	4.00	0.68			
	4. 5 hours and over	74	4.17	0.67			
Self-Regulation in Interaction between Learner and Instructor	1. Less than 1 hour	42	3.38	1.22	0.290	0.833	-
	2. 1-2 hours	132	3.55	1.20			
	3. 3-4 hours	140	3.52	1.22			
	4. 5 hours and over	74	3.60	1.27			
Self-Regulation in Interaction between Learner and Learner	1. Less than 1 hour	42	3.30	1.20	0.219	0.832	-
	2. 1-2 hours	132	3.40	1.18			
	3. 3-4 hours	140	3.38	1.11			
	4. 5 hours and over	74	3.29	1.18			

PH = Post-Hoc; $^{**}p<0.01$.

The results presented in Table 8 reveal a significant difference in the factor of "self-regulation in interaction between learner and content" regarding time spent on Anadolum eKampus (F = 4.155; p<0.01). Tamhane test, one of the post-hoc tests, was utilized to determine among which group was a significant difference. The test demonstrated significant differences in terms of "self-regulation in interaction between learner and content" between "learners spending less than 1 hour in a day" and "learners spending 5 hours and over", and between "learners spending 1-2 hours in a day" and "learners spending 5 hours and over" on Anadolum eKampus. In brief, learners spending more time in a day on Anadolum eKampus have more self-regulation in the "interaction between learner and content" skills than those spending less time. In other words, learners who spent more time on the platform interacted with the content more and had more self-regulation skills in the context of the content.

DISCUSSIONS

The present study examines the differences in self-regulated learning skills of open and distance learners in terms of e-learning readiness and learners' demographic characteristics. For this aim, the e-learning readiness levels of learners were determined and the participants were divided into groups by applying cluster analysis. As a result of the cluster analysis, two groups with low and high e-learning readiness were found. The findings showed that learners with high levels of e-learning readiness had better self-regulated learning abilities in three subscales, namely interactions between learner and content, learner and instructor, and learner and learner than others with low levels of e-learning readiness. These findings coincide with the results of Yavuzalp and Bahcivan's (2021) research. The researchers found that e-learning readiness was a key predictor of self-regulation learning skills and the ability of learners to self-regulate their learning is positively correlated with their level of e-learning readiness. Our findings are also consistent with the findings of Lin and Dai's (2022) study, which reported that e-learnings readiness positively influences self-regulated learning and learners that have a high level of e-learning readiness are more likely to employ self-regulated learning practices. Similarly, Tugtekin (2022) states in her study that the online learning experiences of learners might increase with grade level and implied that learners' e-learning readiness could increase in this process. In this context, it can be said that e-learning readiness might also increase, considering that the online learning experiences of the learners could increase in time with their grade levels. Therefore, learners with high e-learning readiness in the Open Education System might have a high level of self-regulated learning skills.

The results also indicated that there was no significant difference in the learners' self-regulated learning skills regarding gender. That is, both female and male learners have comparable levels of self-regulated learning skills within the context of the study. This result is consistent with the findings of Basol and Balgamis (2016) which found that both male and female learners have similar levels of self-regulated learning skills in technology-mediated environments. In Artsin et al. 's (2020) research, conducted in the context of a massive open online course platform, AKADEMA, contradictory findings were reported. Female learners had higher self-regulated learning skills compared to male learners. Researchers explained this result with female learners being more regulated and better at acting in an organized way and planning.

According to the results, self-regulated learning skills differed significantly in terms of learners' age. This difference showed that younger learners had more self-regulated learning skills compared to older ones. The finding is in parallel with some studies in the literature. It has been determined that especially young learners have more self-regulated learning skills compared to older learners (Artsin et al., 2020). However, different findings have been reported in different studies that the younger the learners are, the more they encounter time constraints or poor planning, and this causes low self-regulation ability (Rabin et al., 2020). Although it is considered that older learners can have more learning experience compared to learners in other age groups, it is known that older learners have some problems in allocating time to the learning process and their control over their learning process is reduced (Castel et al., 2013). As a matter of fact, considering that young learners have the ability to direct themselves and process information very quickly, it is considered that self-regulated learning skills may also be higher (Artsin et al., 2020). Within this context, it is recommended to investigate new strategies or practices that will improve the self-regulated learning skills of older learners in further studies.

The results also revealed that the learners' self-regulated learning skills differed in terms of the time they spent on the Anadolum eKampus platform. According to the related difference, learners who spend more time on the Anadolum eKampus platform have more self-regulated learning skills compared to learners who spend less time. Cho and Shen (2013) also found that learners who spend more time studying in an online learning environment have higher self-regulated learning skills. However, they also underlined that learners with high self-regulated learning skills spent more quality time in online learning environments by making academic efforts.

Although this study reports substantial insight on e-learning readiness and self-regulation in online distance learning milieus, there are some limitations to be considered. Even though the study has an acceptable sample size, it is relatively small. Taking this as a limitation, future research may replicate a study with larger samples in the same or different contexts. Furthermore, the study examined e-learning readiness and self-regulated learning skills of all learners throughout the Anadolum eKampus, not in a specific course. Future studies can be carried out comparatively each semester, especially for the courses in which most learners are enrolled within the Open Education System. In addition, through the findings, support can be provided to research and development activities that can be carried out specifically for Anadolum eKampus.

Overall, the research suggests that e-learning readiness and self-regulation are important factors in the success of learners in online distance education. Learners who are able to effectively regulate their own learning and who are ready to engage with online coursework are more likely to be successful in this setting. Further research is needed to identify strategies that can be used to improve self-regulation and e-learning readiness in online distance education.

CONCLUSION

The present study explored the self-regulated learning skills of learners using the Anadolum eKampus platform at Anadolu University Open Education System in terms of their e-learning readiness. The findings of this study indicated that learners' e-learning readiness is significantly associated with their ability to self-regulate their learning. The results also highlighted that learners who are highly prepared for online learning also possess a high level of self-regulated learning skills. Therefore, it is important to remember that this point may positively affect the success of the learners, which is the ultimate goal in the learning process. Therefore, online educators should aim to promote e-learning readiness among their students to enhance their self-regulation skills. Additionally, future research should focus on investigating effective interventions that can foster learners' readiness for e-learning and enhance their self-regulation learning skills. The results also stated that learners who spent more time on the online learning platform have more self-regulated learning skills compared to learners who spent less. Finally, raising learners' e-learning readiness will help to increase their self-regulation skills and ultimately to learners' success in open and distance learning environments.

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CRITERIA FOR DESIGNING AND EVALUATING THE QUALITY OF VIRTUAL CLASSROOMS DURING EMERGENCY LEARNING

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ABSTRACT

Distance education during emergencies requires planning, design, and goal setting to create an effective learning environment. Virtual distance education involves more than just uploading educational content; it is rather an educational process that provides choice for learners, as well as flexibility and responsibility for learning and academic support. In this context, the aim of this research is to determine the quality criteria for designing virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment. Also, the research aims to propose a method for evaluating and measuring the extent to which virtual classrooms during emergency learning meet its design quality criteria. The study used the descriptive method and analysis processes to determine the quality aspects of the virtual classrooms design, to draw out the design criteria and quality indicators, and to explore the opinions of the research population on the importance of these criteria and their measurement indicators. A purposive population of (17) specialists in the field of educational design and e-learning participated in the study, all of whom hold a PhD degree in the specialty in order to systematize the list of criteria for designing the virtual classroom and the indicators for measuring them in light of emergency learning. The importance of this current research lies in its aim to contribute to the improvement of training and learning environments through virtual classrooms during emergency learning, and to provide a list of design criteria that benefit teachers and instructional designers, in addition to reconsidering the use of learning management system tools and electronic content with virtual classrooms in order to achieve the maximum benefit for students in achievement outcomes of their learning, especially in the context of emergency learning.

Keywords: Emergency distance learning, emergency remote teaching, COVID-19, online learning, distance education, digital learning.

INTRODUCTION

Online education in its various styles is increasingly and steadily growing all over the world, not because of emergencies alone but also because of the impact of new digital technologies, and the increasing demand for manpower that possesses digital skills to deal with the ever-evolving digital economy.

Covid-19 pandemic has posed a big challenge to education throughout the world. Many governments have decided to suspend face-to-face education and replace it with distance education in emergencies in a response to stop the spread of coronavirus. According to a UNESCO report (UNESCO, 2020), more than 1.5 billion learners or nearly 90% of the enrolled students worldwide have been affected by the schools and educational institutions lockdown; for that, measures to face the lockdown have been taken on a global scale, and lessons have turned to be delivered via various channels such as e-learning management systems, broadcasts, television, web portals, etc. The speed of this educational transformation has been phenomenal. Within a short period of time, teachers with years of experience in face-to-face teaching had to shift to online classes, moving educational content via virtual classrooms as a step forward to help prevent the spread of coronavirus.

Instructors had to discover how to shift their practices from face-to-face to distance teaching in emergencies, and that includes creating spaces for online content, new tools to deliver the content, understanding the online pedagogy, engaging parents, and using different pedagogical strategies to address teaching and learning both synchronous and asynchronous (Hartshorne, Baumgartner, Kaplan-Rakowski, et.al., 2020). The lockdown caused by the world pandemic has necessitated that nearly all teachers should use technology to reach out and teach learners remotely, while virtual learning has been hastily applied, driven by the immediate need to adapt to rapid changes in delivery.

The process of emergency distance teaching requires careful planning, design, and goal setting to create an effective learning environment (Themelis & Sime, 2020). Distance virtual learning involves more than just uploading educational content; it is rather an educational process that provides learners with choice, flexibility, responsibility for learning, and academic support. Well-planned virtual learning experiences are different from the delivery of educational content delivered online in response to a crisis or disaster. Educational institutions that provide education during emergencies must understand these differences when providing distance education in emergencies. In this context, this research aims to achieve the following objectives:

- Determining the criteria of design quality of virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment.
- Proposing a method for evaluating and measuring the extent to which virtual classrooms, during emergency learning, meet the criteria of their design quality.

The importance of this current research lies in its aim to contribute to the improvement of training and learning environments via virtual classrooms during emergency learning, and to provide a list of design criteria that benefit teachers and instructional designers, in addition to reconsidering the use of learning management system tools and electronic content with virtual classrooms in order to achieve the maximum benefit for students in achievement outcomes of their learning, especially in the context of emergency learning.

THEORETICAL FRAMEWORK

This section describes the e-learning and distance education in emergencies, virtual learning environments, and their design criteria.

E-Learning and Distance Education in Emergency Situations

Access to education is directly disrupted by emergencies such as wars, conflicts, natural disasters, or disease outbreaks (Creed & Morpeth, 2014). UNICEF has reported that about 35 million children are missing out on education due to conflicts or disasters (UNICEF, 2018). The recent outbreak of COVID-19 worldwide has added another example to the emergency learning environment.

The current unprecedented challenge and the ongoing emergency caused by COVID-19 has led to a greater use of e-learning and virtual learning environments than ever before as an emergency response to enable the continuity of education and to make teaching and learning possible and resilient. Educational institutions around the world have chosen to use distance education through various LMSs and other web-based platforms to create virtual classrooms instead of traditional classrooms.

Distance education in emergencies is defined as a temporary shift in education delivery to an alternative delivery method during a crisis. It involves the use of entirely remote teaching solutions and processes for teaching which has been being provided primarily on a face to face-to-face basis, and that it will revert to the traditional method once the crisis has passed (Hodges, Moore, Lockee, et.al., 2020). The primary focus of distance education in emergencies is not to build a completely new education ecosystem but to provide temporary and alternative access to education under the crisis conditions (Tung Son, Ngoc Anh, Quoc Tuan, et. al., 2020).

Virtual learning environments provide tools for emergency teaching and guide teachers towards delivering learning content within the full context of a student's curriculum, organizing communication within the classroom, providing rich learning options for students, and providing tools for delivering learning resources and materials to students (Anthony Jnr, & Noel, 2021; Bruns, et.al. , 2021). Many educational institutions have adopted virtual learning platforms such as Blackboard Learn, Blackboard Collaborate, Moodle, Google Classroom, Skype, Microsoft Class Note, Microsoft Teams, etc., to replace face-to-face classes with virtual online classes (Crawford, 2020).

Online teaching and learning have been studied for decades. Many research studies, theories, models, and standards have focused on the quality of teaching, online learning, and the design of online educational content. The results of several studies (Cidral, et. al., 2018; Mtebe & Raphael, 2018; Al-Samarraie, et. al., 2017; Chen, & Yao, 2016) prove that effective online learning results from careful instructional planning and design, through the use of a systematic model for design and development. The design process and careful consideration of various design decisions affect the quality of education. On the other hand, this rigorous design process will be absent in most hasty situations of emergency learning unlike experiences that are planned beforehand and are in place from the start and designed to be online because the primary goal in emergency settings is not to create a strong learning environment, but to provide temporary access to education and educational support in a quick and reliably available setting during emergencies or crises (Arora & Srinivasan, 2020).

There are many theories and guidelines for the application of distance learning in recent years. However, implementing it in a short time is not easy, as many factors are impossible to carry out such as curricula review, materials preparation, training of lecturers and students, and preparation of relevant infrastructure (Tung Son, et. al., 2020). However, defining the criteria for designing virtual classrooms is essential to provide quality distance education as an effective means of dealing with emergencies.

Environments of Virtual Classrooms Learning

The virtual learning environment is defined as an integrated electronic learning environment, used in the creation and management of educational content, learner management, learning processes, events, activities, interactions, and evaluation processes; it enables teachers and learners to communicate, interact, and share, whether in a synchronous or asynchronous manner, and to provide assistance and guidance as well as educational and technical support online, and therefore the virtual learning environment is the backbone of e-learning (Khamis, 2018).

The virtual classrooms of all styles (synchronous, asynchronous, and blended virtual classroom) represent one of the most important applications of educational technology; these classes are classified as one of the main means in interactive e-learning systems. They include tools that increase the diversity of the teacher's role and effectiveness, and also increases the role of the learners in the learning environment, strengthens their cooperation with peers participating in the virtual classroom, and enables both teachers and learners to interact as if they were face-to-face in traditional classrooms, but with more effective procedures and processes, commensurate with the virtual learning environment (Mercimek, & Caka, 2022; Martin & Parker, 2014).

Virtual classrooms offer the best means of simulating the positive qualities of face-to-face education thanks to their synchronous and asynchronous nature (Derboven, Geerts, & De Grooff, 2017). Virtual classrooms benefit learners in acquiring diverse knowledge and skills, develop learners' motivation for higher achievement, and help them participate in teamwork and cooperation in a way that promotes joint knowledge-building, as well as developing skills related to interaction that results in more meaningful learning processes (Herrera-Pavo, 2021). The use of virtual learning platforms has provided its ability to overcome the challenges facing educational and training institutions in providing quality learning; also, virtual training has provided the same advantages as the traditional training, as it gives the trainee the opportunity to gain practical experience in a virtual environment, as well as providing opportunities to use a flexible mix of teaching and training methods (Ruggiero, & Boehm, 2016; Moazami, et. al., 2014).

The use of virtual learning environments in education is no longer in question. Its effectiveness has been proven in many educational situations at different levels of study. Previous studies have revealed the effectiveness of training through virtual classrooms with different learning outcomes. The results of the study of Zwart, Goei, Noroozi, et. al., (2021) demonstrated that virtual learning environments have provided useful educational tools for training nursing students to carry out professional duties and tasks and facilitating additional support for learning Sports Medicine. The study of Balasubramaniam, Bhargava, Agrawal, et. al., (2018) confirmed the results of the previous study about the effectiveness of a virtual training model in improving key nursing skills for a group of nursing assistants. The study of Crane, (2017) also demonstrated that synchronous and asynchronous employee training through virtual classrooms succeeded in acquiring practical practices in the hospital environment. In addition, a study by Yilmaz, (2015) showed the positive effects of synchronous virtual classes on students' achievement in distance learning of physics at Istanbul University.

During emergency learning, training and learning via virtual classrooms bring about good learning experiences and acquisition of new skills (Agrati, & Vinci, 2020), improve student learning of pharmaceutical sciences (Alqurshi, 2020), and teach remote medical sciences quickly through providing engagement and high-quality learning experiences for learners of Western Michigan University School of Medicine (Vollbrecht, et.al., 2020). The virtual classrooms have also contributed to the distance training for teachers during emergencies and have achieved positive results in acquiring the necessary skills to provide effective education during the pandemic period (Islam, Nur, & Talukder, 2021; Llerena-Izquierdo, & Ayala-Carabajo, 2021; Whalen, 2021).

A review of the previous literature (Nortvig, Petersen, & Balle, 2018; Wang, Quek, & Hu, 2017; Berry, 2017; Stohr, et.al., 2016; Jordan, 2016; Politis, & Politis, 2016) reveals styles of cross-curricular instruction through classrooms and their analysis, and this has resulted in a number of conclusions. The first of which is that the synchronous style of virtual classes facilitates social interaction, which is an important factor to motivate the learners to participate in all learning activities; the second important advantage is the provision of instant instructing, where the instructor is present throughout the webinar or training sessions, and can have a real-time dialogue with the participants, and this also increases levels of motivation and interest and helps reduce the sense of distance and isolation that occurs during the asynchronous e-learning. In contrast, asynchronous virtual classes lack the real-time aspect, but give participants more time to think before contributing, while the blended style of virtual classes combines the advantages of both synchronous and asynchronous styles. Also, there are clear differences between the methods and tools of each style and these differences must be taken into consideration when designing pedagogical strategies.

Also, a review of previous studies (Nortvig, Petersen, & Balle, 2018; Wang, Quek, & Hu, 2017; Berry, 2017; Stohr, et.al., 2016; Jordan, 2016; Politis, & Politis, 2016) demonstrated that there is a discrepancy in preferring one type of education over another in training through virtual classrooms on learning outcomes. Therefore, careful analysis of the different styles of online classes points to the fact that no single medium can deliver the perfect teaching and learning experience on its own, each focusing on one or several aspects of the process. Thus, the most important thing to consider when adopting e-learning tools is the best way to combine different synchronous and asynchronous styles in order to provide an appropriate learning structure for different learners, contexts, and content. Moreover, with consideration of the complexity of the educational process, the use of these tools is not an end in itself, but rather a means to provide a high-yielding teaching and learning experience; and that the way they are used requires a great focus on the basic educational aspects and the role of the teacher, in addition to focusing on the quality of the educational design of those virtual environments, which is what the current research seeks to study by setting the necessary criteria for designing virtual classrooms.

Criteria for Designing Virtual Learning Environments

The design of virtual learning environments requires defining the principles, criteria, precise indicators, and developing an appropriate model for designing and evaluating these environments. Previous literature revealed that there are many criteria for designing and evaluating these environments, which are difficult to list in this context, but the researcher has reviewed some of them. For instance, Cidral, et. al., (2028) have focused the criteria for system quality, the quality of its use, the quality of information, the criteria for diversity in evaluation methods, and the quality of cooperation and partnership with others (Cidral, et. al., 2018). On their part, Mtebe & Raphael, (2018) developed a model in which they focused on system quality criteria, course instructor quality, service quality, and course quality. In the model of Chen, & Yao, (2016), they set the criteria for the virtual learning environment, which were the quality of the course instructor, the quality of the course content, the quality of the technology used, and the quality of the design. Also, Al-Samarraie, et. al., (2017) identified five criteria for achieving the quality of the e-learning environment as follows: the quality of information, the quality of the system, the ease of the technology used, the utility, and the benefit.

In light of the literature review and previous studies, and in light of the theoretical foundations of learning in virtual environments, and the experience of researchers in using virtual classroom systems for a long period, this research identifies a number of criteria, and formulates a number of foundations and indicators that must be taken into consideration when designing virtual learning environments in the context of emergency learning, as provided in the section of research procedures and results.

RESEARCH QUESTIONS

The research problem was identified in the following main question: *"How can a virtual learning environment be designed during emergency learning?"*.

To answer this main question, the following sub-questions were formulated:

Q1: What are the quality criteria for designing virtual classrooms during emergency learning?

Q2: What is the method of applying the quality criteria for designing the virtual classrooms during emergency learning?

METHOD AND PROCEDURES

Methodology

Since the current research is a developmental research in educational technology, the descriptive approach was used in the study and analysis processes to determine the quality aspects of the design of virtual classrooms, and to draw out the design criteria and quality indicators, and to explore the opinions of the research population about the importance of these criteria and their performance indicator.

Population

The research population consisted of faculty members and instructional designers from experts specialized in the field of educational technology and e-learning. A purposive sample of (17) specialists working in Saudi universities and e-learning centers participated in the research, all of whom have a PhD degree in the specialization, (5 professors, 4 associate professors, 8 assistant professors); This is for the purpose of systemizing the list of criteria for designing the virtual classrooms and the indicators for measuring them in light of emergency learning.

Procedures

The design and development of learning environments in the virtual classrooms requires defining a set of criteria in light of which design processes and procedures are carried out. The researchers have identified a list of these criteria according to the following steps:

A. Determining The Sources of The Criteria: In setting the criteria, the researchers relied on the literature review and previous scientific studies (Khamis, 2018; Cidral, et. al., 2018; Mtebe & Raphael, 2018; Al-Samarraie, et. al., 2017), and on exploring the opinions of specialized experts and consultants in the field of educational technology, e-learning, and instructional design on the lists of criteria proposed by the researchers. Conditions and specifications were defined to build criteria for designing and evaluating the quality of the virtual classrooms, which resulted a preliminary list of criteria consisting of (10) basic criteria, and (103) measurement indicators.

B. Organizing The List of Criteria: The Criteria Contained in The List are Organized as Follows:

- A general criterion that expresses an aspect of the instructional design and the use of the virtual classroom.
- Sub-criteria representing the general criterion; it includes a set of performance indicators.
- Criteria or performance indicators which are used to measure the extent to which the design criterion for the virtual classroom is achieved.

C. Arbitration of Criteria and Determining Their Relative Importance:

- A preliminary list of criteria consisting of (10) basic criteria, and (103) measurement performance indicators were presented to the research group, (17) arbitrators, to express their opinions and suggestions about these criteria, their importance, and their relevance to the general area of design quality for the virtual classroom, the clarity of their performance indicators associated with them, as well as the reliability of these criteria, and their suitability for the purpose of the current research.
- The arbitrators were asked to determine the relative importance of each of the criteria for designing the learning environment in the virtual classroom on a five-step scale.
- The relative importance of each criterion for designing the virtual classroom environment was calculated according to the opinions of the arbitrators, and then the average relative weight was calculated, and the criteria that obtained 80% or more of the approval of the total number of arbitrators were maintained.

D. Final List of Criteria: After reviewing and obtaining the opinions of the research arbitrators, the researchers carried out the following in light of their remarks:

- With regard to the criteria, the arbitrators agreed on them with some remarks, based on which the researchers combined the educational technology criteria with the technology used, and combined the criteria of quick and easy navigation, with the criteria of technical foundations for the design of the virtual learning environment. The final list of criteria of quality evaluation of the virtual classroom consisting of (8) basic criteria, are: 1) technology used in the virtual classroom, 2) educational content design in the virtual classroom, 3) learning content management in the virtual classroom, 4) learning environment in the virtual classroom, 5) teaching and learning strategies in the virtual classroom, 6) technical foundations for virtual classroom design techniques, 7) evaluation/assessment and feedback in the virtual classroom, 8) the perceived cost and benefit of a virtual classroom environment.
- Regarding the indicators, the arbitrators agreed on their validity, with some remarks, based on which the researchers modified the linguistic formulation of some indicators, and included some other indicators under the criteria that pertain to them, and omitted (13) indicators to avoid repetition.

The necessary amendments were made in light of the arbitrators' remarks and comments, so that the list of criteria for designing the virtual learning environment online in its final form consists of (8) criteria and (90) indicators for measurement.

RESEARCH RESULTS

The First Question: "What are The Criteria for Designing The Virtual Classroom During Emergency Learning?"

To answer this question, the mean of the responses has been calculated for the degree of significance of each criterion of the virtual class design, and the degree of significance of each indicator to measure the criterion has been calculated; this was based on the following degrees of importance: (Very important = 5, Highly important = 4, Important = 3, Moderately important = 2, Slightly important = 1, Not important = 0), after having presented the list of the proposed criteria to the research population, the results were as shown in the following tables (1-8):

(1) Technology Used in The Virtual Classroom

Table 1. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (1)	Indicators	Mean
The instructional design of the learning environment in the virtual classroom employs technological criteria to design an appropriate application interface that facilitates learning and its occurrence.	1.1 The virtual classroom environment provides a simple, uncomplicated, and easy to use interface.	4.38
	1.2 The Virtual Classroom platform is easy to use.	4.25
	1.3 The use of the system conforms to international specifications and standards in the design of content and operation.	4.18
	1.4 The virtual separation system has the ability to operate and use via mobile devices.	4.11
	1.5 The virtual classroom system informs students of the requirements to run it on their computer.	4.17
	1.6 The virtual classroom environment supports all types of multimedia files supported by the Internet browser, such as interactive Java files, and 360 virtual reality files.	4.03

The results contained in Table 1 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.03 to 4.38 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(2) Educational Content Design in The Virtual Classroom

Table 2. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (2)	Indicators		Mean
The instructional design of a virtual classroom learning environment provides instructional content that is comprehensive enough to achieve the objectives set for the instructional content and learning outcomes, and is prepared by qualified professionals	2.1	The learning content of the virtual classroom is appropriate to help the learner achieve the learning objectives.	4.34
	2.2	The content respects accuracy, objectivity and modernity, and the content is comprehensive, appropriate, consistent, and diversified.	4.21
	2.3	The content in the virtual classroom is clear, understandable, and free of spelling or grammatical errors.	4.17
	2.4	The presentation of the content in the virtual classroom is organized in a sequential manner that facilitates students' assimilation and stimulates their motivation towards learning.	4.24
	2.5	The scientific material is divided and presented into successive parts.	4.22
	2.6	The educational content is available in the virtual classroom in the form of multimedia such as video files, audio files, and instructional images.	4.15
	2.7	The virtual classroom includes learning activities following each task, and the activities cover all aspects of the content.	4.21
	2.8	The learning activities in the virtual classroom range from easy to difficult, and from concrete to abstract.	4.14
	2.9	The virtual classroom takes into consideration linking educational activities with life situations, and provides integrated educational experiences.	4.20
	2.10	It allows content creation and configuration within the virtual classroom environment.	4.18
	2.11	It allows the learners to update learning content without the need for a new version.	4.01
	2.12	The virtual class system allows content retrieval and configuration.	4.13
	2.13	It allows content to be downloaded, exchanged, and shared with others.	4.09
	2.14	It allows downloading of multiple files in different standard formats.	4.14

The results contained in Table 2 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.01 to 4.34 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(3) Learning Content Management in The Virtual Classroom

Table 3. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (3)	Indicators		Mean
The instructional design of the learning environment in the virtual classroom makes it easier for learners to deal with the learning content and manage it in multiple ways.	3.1	It is easy for learners to access learning content easily.	4.21
	3.2	It is easy for learners in the virtual classroom to track their progress in studying the content.	4.26
	3.3	It is easy for learners in the virtual classroom to know the learning tasks, activities, and update its content.	4.18
	3.4	The virtual classroom environment enables searching within the content.	4.29
	3.5	The virtual classroom provides tools for presenting educational activities that enable students to generate ideas and achieve higher levels of understanding.	4.13
	3.6	The virtual classroom environment provides students with tools to help them design educational activities that achieve the desired learning objectives.	4.9
	3.7	The virtual classroom environment presents the content in a way that stimulates students' thinking.	4.11
	3.8	The virtual classroom environment provides a variety of opportunities for students to interact with the content, with the teacher, and with each other.	4.06
	3.9	The virtual classroom environment considers presenting the content in a way that helps students discuss multiple points of view on the topic and draw conclusions.	4.12
	3.10	The virtual classroom environment provides the presentation of appropriate, varied and comprehensive questions and exercises.	4.18
	3.11	The virtual classroom environment provides adequate opportunities to solve learning activities in synchronous and asynchronous styles.	3.95
	3.12	The virtual classroom environment provides specific dates and methods for easy delivery of learning activities and tasks.	4.09

The results contained in Table 3 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 3.95 to 4.29 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(4) The Area of Learning Environment Management in The Virtual Classroom

Table 4. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (4)	Indicators		Mean
The instructional design of the learning environment in the virtual classroom makes it easy for learners to manage the learning environment, and to track its status during the learning process.	4.1	The system facilitates the process of registering the student to attend the virtual class sessions, or to leave them whenever he wants.	4.36
	4.2	The virtual classroom environment regulates communication between students and faculty members, and between students, and students and content.	4.41
	4.3	The virtual classroom environment allows students to upload files and images in different standard formats, and suitable storage spaces.	4.23
	4.4	The virtual classroom environment provides aids such as the Whiteboard for students to present their ideas and plans for solving problems.	4.09
	4.5	The virtual classroom environment allows students to freely and easily navigate and control the content structure.	4.14
	4.6	Each student's virtual classroom involves creating their own E-profile.	4.21
	4.7	The virtual classroom environment assesses student performance in a synchronous and asynchronous manner.	4.19
	4.8	The virtual classroom environment regularly displays feedback on student performance.	4.24
	4.9	The virtual classroom environment displays students' feedback and opinions on developing learning content and learning style.	4.15
	4.10	The virtual classroom environment provides monitoring of formative and summative assessment results.	4.21
	4.11	The virtual classroom system enables keeping track of the student's status during the learning process.	4.25
	4.12	The virtual classroom system provides guiding information that shows how to learn through the different virtual classroom styles and tools.	4.17
	4.13	The virtual class system provides scheduling synchronous and asynchronous sessions, and provides reminders and notification of their appointments.	4.07
	4.14	The virtual classroom system provides learners with easy creation and management of work and group learning groups, and assigns roles for learners in each group.	4.31
	4.15	The virtual classroom environment allows all the synchronous virtual lectures to be recorded in the system so that students can retrieve them at any time.	4.28
	4.16	The virtual classroom environment enables students to conduct text, audio, video, and gesture conversation.	4.17
	4.17	The virtual classroom environment enables students to watch educational videos, and hear audio files related to the content.	4.22
	4.18	The virtual classroom environment enables students to view their projects and learning tasks within the learning management system.	4.24
	4.19	The classroom system facilitates the generation of reports on the performance of both the teacher and the learner, and allows saving and printing them.	4.20
	4.20	The virtual classroom environment provides a clear guide on how to use it and use its tools.	4.18

The results contained in Table 4 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.07 to 4.41 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(5) Teaching and Learning Strategies in the Virtual Classroom

Table 5. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (5)	Indicators		Mean
virtual classroom uses teaching and learning strategies and educational activities appropriate to the objectives of the content, its requirements, and the characteristics of learners that allow for a real and meaningful interaction (between the learner and the course instructor, between learners, and between the learner and the content), to motivate learners, enhance academic commitment, and keep the learner actively engaged in the learning process.	5.1	The instructional design of the virtual classroom uses learning activities appropriate to the objectives and requirements of the content.	4.38
	5.2	The instructional design of the virtual classroom uses learning activities that are appropriate to the characteristics of the learners and motivate and keep them engaged in the learning process.	4.28
	5.3	The learning activities, discussions, and collaborative assignments in the virtual classroom are well designed to facilitate collaborative and individual learning among students.	4.19
	5.4	The design of the virtual classroom learning environment uses clear and appropriate methods, mechanisms, and instructions to achieve diverse interactions and learning activities.	4.22
	5.5	The design of the virtual classroom learning environment allows for ongoing support and assistance for the learner as they go through the learning process.	4.30
	5.6	The virtual classroom system makes it easier for learners to use discussion forums, educational blogs, and other asynchronous communication tools.	4.08
	5.7	The virtual classroom system makes it easier for learners to take notes while interacting with the learning content in a way that ensures the learner's self-organization.	3.92
	5.8	The virtual classroom system makes it easy for learners to communicate with each other in a synchronous manner.	4.21
	5.9	The virtual classroom environment enables the use of different styles of interaction between the learner and the content.	4.13
	5.10	The virtual classroom environment allows the student to control the choice of type, level, and quantity of examples, applications, and exercises.	4.17
	5.11	The virtual classroom environment stimulates the student's active engagement in the learning events.	4.23
	5.12	The virtual classroom environment considers supporting the learner-centered learning.	3.95
	5.13	It is considered that the duration of the virtual classroom session should not exceed (60-90) minutes per session, to ensure participation and interaction, as well as group cohesion.	4.31

The results contained in Table 5 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 3.92 to 4.38 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(6) Technical Foundations of Virtual Classroom Design Techniques

Table 6. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (6)	Indicators		Mean
The instructional design of a virtual classroom learning environment uses technical principles to design multimedia elements to capture the learner's attention.	6.1	The instructional design of the virtual classroom includes the use of quality and clear written instructional texts.	4.45
	6.2	Texts are written in easy, simple, and understandable words.	4.37
	6.3	The words have a specific meaning and not interpreted in any other sense.	4.31
	6.4	It is insured when writing the content that no more than three font sizes are used on one screen.	4.26
	6.5	The texts are free of spelling and grammatical errors.	4.39
	6.6	Images, static and line drawings are used functionally as needed to achieve the learning objectives.	4.26
	6.7	Instructional phonics are of quality and clarity.	4.22
	6.8	The live tempo of the teacher's voice during his explanation is maintained via the synchronous virtual class.	4.16
	6.9	Instructional images and graphics are of good quality and clarity, and support the educational content.	4.22
	6.10	The instructional videos are of high quality and clarity, and support the educational content.	4.18
	6.11	Animations are used in educational situations for which videos cannot be used	4.09
	6.12	The animation is accompanied by an audio voice-over.	4.06
	6.13	Navigation tools in the virtual classroom facilitate quick and easy access for learners to other sources of knowledge.	4.17
	6.14	Navigation mechanisms are effective and allow the learner to move between parts of the content easily and conveniently.	4.21
	6.15	The links used in navigation are appropriate, clear, and work correctly without errors.	4.23

The results contained in Table 6 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.06 to 4.45 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(7) Evaluation/ Assessment and Feedback in The Virtual Class

Table 7. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (7)	Indicators		Mean
The design of the virtual classroom employs appropriate assessment strategies to measure learning effectiveness, assess student progress against stated learning goals, as well as measuring the effectiveness and quality of the virtual learning environment.	7.1	The virtual classroom learning environment uses assessment and measurement strategies appropriate to the learning objectives, requirements, and characteristics of learners.	4.38
	7.2	It is easy for learners to access test results, assignments, and tasks.	4.42
	7.3	The virtual classroom system automatically keeps and corrects test results.	4.38
	7.4	The design of the learning environment for the virtual classroom provides adequate two-way feedback to enhance learning.	4.19
	7.5	The design of the learning environment for the virtual classroom provides appropriate feedback in light of test results, assignments, and tasks.	4.21

The results contained in Table 7 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.19 to 4.42 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(8) The Perceived Cost and Benefit of A Virtual Classroom Environment

Table 8. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion		Indicators	Mean
The cost of designing and managing the virtual classroom is appropriate, and achieves its objective effectively and efficiently.	8.1	The costs of creating a virtual classroom are appropriate for the purpose for which it was designed.	4.39
	8.2	The costs of creating a virtual classroom take into consideration the financial and economic burden on the students.	4.26
	8.3	Digital learning repositories are used to save the cost of producing digital learning resources and multimedia learning objects to support creating learning content for the virtual classroom.	4.32
	8.4	All criteria for evaluating the cost of creating a virtual class every time period are in place.	4.13
	8.5	The cost of creating a virtual class is proportional to the perceived benefit.	4.22

The results contained in Table 8 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.13 to 4.39 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

Results of Answering The Second Question: "What Is The Method of Applying The Quality Criteria for Designing The Virtual Classroom During Emergency Learning?"

The process of implementing the instructional design quality criteria for the virtual classroom requires the use of a grade scale that is both accurate and easy to use. The scale was built as follows:

1. Determining a relative weight or relative importance for each criterion that determines its importance when evaluating the design of the virtual classroom, through three levels (weights): basic criterion is scored (3 points) as the decisive important criterion in the effectiveness of the design of the virtual classroom; very important criterion is scored (2 points) as the criterion that has a moderate importance in the effectiveness of the design of the virtual class; important criterion is scored (1 point) as the criterion that has a low importance in the effectiveness of the design of the virtual classroom.
2. Using a specific rating or value for each criterion to help the evaluator estimate the extent to which the criterion meets or achieves its performance indicators. This rating is determined through a five-point graded scale: Excellent = 5 points for the criterion that meets all its performance indicators; Very Good = 4 points for the criterion that meets all of its performance indicators but vary in quality or implementation; Good = 3 points for the criterion that meets 50%-75% of its performance indicators; Acceptable = 2 points for the criterion that meets from 25%-75% of its performance indicators; Poor = 1 point and is for the criterion that meets less than 25% of its performance indicators; Null = zero for the criterion or any of its performance indicators which are not met.
3. Calculating the total score for the criteria list: the total score = the sum of (relative weight x performance levels score, where the list of evaluation criteria for the design of the virtual class included (8) criteria, (90) performance indicators; thus, the full score for the evaluation of instructional design of the virtual class = (8 x 3 x 5) = 120 points as the highest score (full score), while the minimum score for

the assessment of the educational design of the virtual class = (8 x 1 x 1) = 8. Thus, the list of criteria for the design of the virtual class in its final form is valid for assessing the quality of virtual class during emergency learning.

DISCUSSION

This study has resulted in developing a list of instructional design quality criteria for the virtual classroom, consisting of (8) basic criteria and (90) performance indicators for these criteria. The main areas of quality evaluation of the virtual classroom, as mentioned in the research results, are: 1) the area of technology used in the virtual classroom, 2) the area of educational content design in the virtual classroom, 3) the area of learning content management in the virtual classroom, 4) the area of managing the learning environment in the virtual classroom, 5) teaching and learning strategies in the virtual classroom, 6) technical foundations for virtual classroom design techniques, 7) evaluation/ assessment and feedback in the virtual classroom, 8) the perceived cost and benefit of a virtual classroom environment. The full score for the evaluation of instructional design of the virtual class 120 points as the highest score (full score), while the minimum score for the assessment of the educational design of the virtual class 8 points. Thus, the list of criteria for the design of the virtual class in its final form is valid for assessing the quality of virtual class during emergency learning.

These criteria and their performance indicators were consistent with what was dealt with in the literature and previous studies: (Rabiman, et. Al., 2020; Panyajamorn, et. Al., 2018; Greer, & Harris, 2018) found that effective instructional design of virtual classrooms facilitates access, storage and sharing of educational materials online, and increases learners' satisfaction with the learning environment and the quality of learning. Designing effective e-learning content supports student learning and improves their abilities, and user-centered design can help improve student engagement in learning.

Al Mamun et. Al. (2020 found that the good content design standard acts as interactive scaffolding in learning modules that support learners and promote independent learning for students in an online environment. And studies (Rizeq, et. Al., 2022; Aldiab, et. Al., 2019) agreed with the results of the current study that learning content management systems in the virtual classroom should make it easier for learners to access learning content easily and conveniently, help them know learning tasks and activities, and enable them to search within content and track their progress in content study.

This finding was supported by studies (Coulianos, et. Al., 2023; Aldiab, et. Al., 2019) which found that regulating the management of the virtual classroom environment should facilitate the process of enrolling a student to attend or exit virtual classroom sessions whenever he wishes, facilitating communication between students and faculty, and between students and each other, students and content, creating and managing group learning and working groups, and defining roles for learners in each group easily. The virtual classroom environment also allows all virtual lectures to be recorded simultaneously within the system so that students retrieve them at any time, view student projects and learning tasks within the LMS, generate reports on the performance of both the teacher and learner, and allow them to be saved, and printed.

Studies (Wardani, et. Al., 2021; Ouadoud, et. Al, 2016) found that have found that a good instructional design of the virtual classroom should provide learning activities appropriate to the objectives and requirements of the content, appropriate to the characteristics of learners, motivate them and keep them busy with the learning process, provide educational methods and strategies that will provide clear and appropriate instructions to achieve diverse interactions and learning activities, provide continuous support and assistance to the learner as he walks through the learning process, and ensure participation and interaction in working groups and learning.

Skokanova, et. Al., 2022; Karan, et. Al., 2021 found the effective instructional design of the virtual classroom learning environment should functionally employ images, static and linear graphics, audios and videos as needed to achieve learning goals, be characterized by quality and clarity, and provide sailing tools that facilitate quick and easy access for learners to other sources of knowledge. Also, that effective instructional design of the learning environment for the virtual classroom should employ assessment and measurement strategies appropriate to learning objectives, requirements and characteristics of learners, facilitate learners to access the results of tests, assignments and tasks, and provide sufficient feedback to enhance learning (Skokanova, et. Al., 2022; Karan, et. Al., 2021).

This finding was supported by (Janssen, et. Al., 2020; Telukdarie, & Munsamy, 2019) who found that the costs of creating a virtual classroom must be appropriate to the purpose for which it was designed, achieve its purpose effectively and efficiently, inexpensive and take into account the financial and economic burden of students.

CONCLUSION AND RECOMMENDATIONS

This study presented a list of quality criteria for designing virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment, and also suggested a method for evaluating and measuring the extent to which these criteria are met. In formulating criteria for the quality of designing virtual classrooms, the researchers reached some conclusions, as follows:

- The effectiveness of learning in the asynchronous virtual classroom is determined by the optimal engagement of students, and this engagement can be achieved through factors that enhance learning, such as focusing learners' interest and commitment on their learning, and the presence of motivation and desire for them to accomplish the required learning tasks. These are the two factors that direct learners to engage in content and help them learn new skills.
- The instructional design of the asynchronous virtual classroom should include the facilitation of students' engagement in learning, promotes collaborative behavior patterns, and supports independence in managing their own learning; peer learning through a virtual, asynchronous classroom provides learners with an opportunity to interact and learn from each other, with a positive impact on academic achievement and satisfaction with the expected task outcomes.
- Group work or small group work is successful when learners share a common goal, organize and lead teamwork, and use technology and communication tools in the virtual classroom effectively.

Based on the foregoing results, the current research provides a set of *recommendations and educational implications*, to take advantage of them as practical actions that benefit professors and educational designers when designing virtual learning environments. The most eminent of which are:

- There is a need to pay attention to designing virtual learning environments based on educational foundations and criteria aimed at achieving various learning outcomes, and activating the teaching of practical courses, using the virtual classroom system, as this has an effective impact on providing students with better practical and applied skills.
- There should be diversity in designing learning activities and tasks in virtual environments to meet students' learning preferences, besides joint work and collaboration in implementing learning activities and tasks.

Also, the current research looks forward to *future work* in: Conducting more continuous reviews on these criteria to keep pace with educational updates in virtual learning environments; and conducting correlational studies to study the relationship between the achievement of quality aspects in the design of the virtual classroom and its impact on improving students' learning and skills in the virtual environment.

The importance of this current research lies in its aim to contribute to the improvement of training and learning environments through virtual classrooms during emergency learning, in addition to providing a list of virtual classroom design criteria that will benefit professors and instructional designers, in order to achieve the maximum benefit for students in achieving learning outcomes, especially in the context of emergency learning in response to COVID-19 crises both in the present time and in the future.

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EVALUATION OF LEARNING MANAGEMENT SYSTEMS USING INTERVAL VALUED INTUITIONISTIC FUZZY-Z NUMBERS

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ABSTRACT

The use of online education tools has increased rapidly with the transition to distance education caused by the pandemic. The obligation to carry out all activities of face-to-face education online made it very important for the tools used in distance education to meet the increasing needs. In line with these needs, radical changes have occurred in the learning management systems used in distance education. Therefore, in this study, it is aimed to determine the features that the systems used in distance education should have and to compare the existing systems according to these features. For this purpose, a novel fuzzy extension, interval valued intuitionistic fuzzy Z-numbers, is defined for modeling uncertainty, and AHP and WASPAS methods using proposed fuzzy numbers are developed to determine the importance of decision criteria and compare alternatives.

Keywords: E-Learning, Interval Valued Intuitionistic Fuzzy Z-Numbers, Fuzzy AHP, Fuzzy WASPAS.

INTRODUCTION

In today's Information Age, Information and Communication Technologies (ICTs) can be easily accessed from every corner of the world and become widespread day by day. ICTs have entered the lives of people with the decrease of costs and have significantly affected their lifestyles. In this sense, developing technologies and widespread use of the Internet have brought advantages such as adapting to rapid changes, differentiation, fast access to the information needed, problem solving and creative thinking. Developments in ICTs directly affect the field of education as well as every area of our lives and the concept of E-learning that emerged as a result of these developments has also started to gain importance today. The ability to obtain, absorb and apply proper information effectively has become one of the key skills today. With the concept of learning, which is the key to achieving one's full potential, the survival of individuals, organizations and nations in the 21st century will depend on their learning capacity and their application of learned things in daily life.

With the development of ICTs, accessing information from different sources in a shorter time has enabled the development and diversification of distance education/distance learning environments. In this way, in the 21st century, individuals can easily access the information they need anywhere, anytime, by any means. Therefore, with the development of each new communication technology, e-learning and individualized distance education opportunities are gradually increasing. As a result of this situation, distance education environments are now designed as processes that are more flexible, easily accessible and include daily life as much as possible. Also, achieving success and quality in distance education services has become the focus of both educators and researchers.

Distance education is an education system model that brings together learners, instructors and teaching activities with different communication technologies infrastructure. Distance education is the fastest developing and spreading type of education service in Turkiye and the world. This system, which has been offered to people in different infrastructures with its rapid development from the past to the present, currently serves as a web-based system in Turkiye.

E-learning / online learning stands for electronic learning or in other terms web-based education that involves learning and information management activities carried out through internet technologies. This concept allows users to efficiently gather information and content with both simultaneous and asynchronous methodologies and effectively meet the need to gain up-to-date knowledge. E-learning technologies find more usage areas as open and/or distance education applications become widespread in the world and in parallel with this, they undergo a rapid development process. It is aimed to personalize learning by using technology, that is, teaching by taking into account the average learning needs and styles of an audience in the group, to develop one's own learning skills and to enable him to learn by determining his own needs. In line with this goal, subjects such as e-learning methods, e-learning tools, and evaluation of e-learning have come to the fore in order to enable learning using technology.

In recent years, the use of web-based learning in the higher education system has been increasing. While the effect of using the Internet in education has gradually increased, the inclusion of new technologies in education has brought the inevitable result. While this situation improves the learning of students, distance education has become a crucial part of education. With the development of technology in education, the need for distance education tools has increased and therefore most universities have started to use web-based distance education systems and e-learning tools. The learning management system (LMS) is one of the e-learning tools that has become a critical tool for almost all higher education institutions and a propellent force in online learning. Some of these tools are open source while others are for commercial purposes.

The main purpose of this paper is to determine a suitable learning management system platform to meet the requirements of universities in Turkiye. For this purpose, interval valued intuitionistic fuzzy Z-numbers (IVIF-Z), a new fuzzy extension for modeling uncertainty in linguistic expressions, is developed for the first time in this study. Then, the IVIF-Z AHP method, which will be used in weighting the criteria to be used in the selection of distance education systems, and the IVIF-Z WASPAS method, which will be used to compare the existing LMS platforms, have been developed.

The organization of the paper is as follows: First literature review on learning management systems and proposed methodology are given. Then, the basics of e-learning and e-learning tools are determined. After giving the preliminaries of the proposed fuzzy extensions, interval valued intuitionistic fuzzy Z-AHP (IVIF Z-AHP) and interval valued intuitionistic fuzzy Z-WASPAS (IVIF Z-WASPAS) are proposed. Later, the proposed method is applied to the learning management systems used in Turkiye and the results are discussed. Finally, the article ends with the discussions and conclusions.

LITERATURE REVIEW ON LEARNING MANAGEMENT SYSTEMS

Distance education and e-learning / online learning, which come to the fore with the development of technology, are two distinguishable teaching/learning methods that emerged at that time (Micha, 2019). This study has been focused on e-learning tools and more specifically on LMSs. In the literature, some studies show learning management systems have positive effects on the teaching and learning process (Han and Shin, 2016; Ramirez-Correa et al., 2017). Also, some studies introduce learning management systems whose use with distance education is increasing day by day, comparing them in terms of their features and usage, and investigating their effect on the learning and teaching process. Machado and Tao (2007) created two study groups, a faculty group and a student group, and compared the user experience between the proprietary solution Blackboard and the open-source solution Moodle. In the study, the user experience of each system's basic functions as communication tools, student-student interaction tools, student-instructor interaction tools were compared using online questionnaires. Miyazoe (2008) examines whether different LMS affects students' participation in online interaction and their evaluation of the course. To answer these, it was planned to use a semi-identical course design and an LMS to compare two different LMS, Blackboard and Moodle. A questionnaire consisting of 20 five-point Likert-scale questions and five open questions that consist of basic demographics, specific purposes of computer usage, usage of mobile phones etc. was applied in four classes, and correlation analysis was performed between variables. Cheung (2007), WebCT, Blackboard and Moodle functionally examined three web-based learning management systems commonly used in higher education. The study presents a comparison of the functional framework of LMS systems in terms of curriculum design, communication and discussion, performance evaluation and course management, focusing on their use in teaching and learning of continuing education courses.

Payette and Gupta (2009) examine the transition from one type of commercial software, Blackboard to another open-source software, Moodle. 34 faculty members and 390 students were surveyed to gain insight into the transition from one LMS system to another. The aim is to identify issues that can be addressed with targeted training and insights that will improve the transition process. Al-Ajlan (2012) conducted a comparative study between Moodle and other LMS systems to meet the requirements of Qassim University. In this study, in which three comparisons were made by dividing the features into technical tools, support tools and learner tools, the features and capabilities and technical aspects of 10 LMS tools, Moodle, ATutor, Scholar360, Sakai, Blackboard etc. were examined. As a result of the study, it was determined that the best platforms were Moodle and Sakai, which have missed only two of the forty features, while extensive and in-depth analyses proved Moodle should be selected as the most suitable platform for Qassim University. Cavus and Zabadi (2014) focused on the file exchange/internal mail, whiteboard/video services, discussion forums, live chat and online journal mail features of each of the six open-source learning management systems such as ATutor, Claroline, Dokeos, Ilias, Moodle ve Sakai. This article aims to make it easier for educators who want to make the best choice when choosing a learning management system by revealing which learning management system has the best communication tools. The comparison result showed that Moodle and ATutor have the best communication tools with a user-friendly interface. Orfanou et al. (2015) stated that the perceived ease of use of learning management systems had an effect on students' learning effectiveness and learning experience. In the study which 769 students participated, they examined the perceived ease of two learning management systems, eClass and Moodle, using the System Usability Scale.

Cigdem and Ozturk (2016) aimed to examine the factors that determine the behaviours of 155 students in using learning management systems through a questionnaire in the study. As a result of their study, it was revealed that multimedia features and interaction affected students' perceived satisfaction. The study conducted by Kasim and Khalid (2016) is discussed several potential Learning Management Systems that Higher education institutions such as Moodle, Sakai, ATutor, Blackboard and SuccessFactors can be used for teaching and learning processes. In the study, a comparison is made among selected LMS providers based on various features such as flexibility, ease of use, accessibility, user-friendliness, and the ability to integrate with other systems, and results are presented which is about the preference of platform to be used. Juarez Santiago et al. (2020) conducted a study to evaluate a model in which architectural design, configuration, metadata and statistical coefficients were obtained using four LMSs as Edmodo, Schoology, Classroom, Moodle. This model enabled the determination of reliability, accuracy and correlation by using and integrating factors previously used in many studies such as Anxiety - Innovation (AI), Utility and Use (UU), Tools Learning (TL), System Factors (SF), Access Strategies (AS), Virtual Library (VL), and Mobile Use (MU).

The lack of recent studies on learning management systems in the literature and the insufficiency of studies comparing between LMSs systems led to the emergence of this study. In this study, it is aimed to examine the platforms used by universities in the distance education process, especially during the COVID-19 pandemic, in various dimensions (instructional, formal, educational program and program compatibility) and evaluate the platforms through decision makers' views. In this respect, it is considered an original study.

DISTANCE EDUCATION

Distance education offers learners and lecturers a learning environment where the lessons are taught live, visually and audibly in a virtual environment, without time and space limitations, and where the participant can watch them again whenever they want. In today's conditions, distance education is an innovative education system in which education and training are rapidly passed to the computer environment. E-learning, which is a component of distance education, and e-learning tools that enable distance education are tools that are part of this digital transformation in education and training. In this section, e-learning and e-learning tools are explained in detail.

E-Learning

The technologies that have developed over time within the scope of the needs and requirements of the age, the widespread use of the internet and the computers, which have become essential for education have changed the scope of education, and the concept of e-learning has started to come to the fore in education. Internet and online communication tools, which enable cheap, global, interactive and intensive computer communication, have created a learning environment independent of time and place, unlike traditional education (Collins and Halverson, 2018). When it comes to learning independent of time and space, the first thing that comes to mind is the concept of distance education (Bicer and Korucu, 2020). In this sense, the Internet has also transformed the concept of distance education and has become an accelerating factor in this transformation process. As a result of this, the concept of E-learning has emerged, which is a new learning environment that provides the learner with many flexibilities such as being able to learn anytime and anywhere, parallel to the purpose of distance education, and even considered by most researchers as a sub-topic of distance education. Although E-learning and distance education are sometimes confused with each other, E-learning is just a form of distance education (Rosenberg and Foshay, 2002). Although there are different definitions, E-learning is most simply defined as conducting educational activities in electronic environments or transferring knowledge and skills through electronic technologies (Gulbahar, 2017).

In the early 90s, after the use of radio and television channels in education, with the use of Flash-based multimedia contents and through CD-ROMs and DVD-ROMs, distance learning activities began, and these activities evolved into e-learning with the spread of the Internet (Ulker and Yilmaz, 2016). E-learning can be seen as the most effective and significant technological solution, together with the technological facilities provided to meet the needs of both individuals and society, to complete the development by providing life-long learning and rapid learning in the context of using technology, in the economic context and line with personal needs (Bicer and Korucu, 2020). As technological innovations continue on their way without slowing down, especially the use of e-learning technologies for education and training is becoming more widespread day by day, and the transfer of knowledge with technology has started to be the focus on the attention of universities. Because while these technologies provide a wide area for learning courses, seminars, discussion forums and other approaches, offer innovative approaches to instructor-learner interaction (Singh et al., 2011). Therefore, e-learning technologies and developments in this field have made educational design a major skill for organizations that manage with open and distance education, especially during the COVID-19 outbreak. In today's conditions, the number of universities providing education with e-learning continues to increase day by day, and practices such as universities' orientation towards distance education, and open education programs at some universities have left many learners confronted with e-learning systems (Bahadir, 2020). Therefore, technology-supported systems, in other words, e-learning environments and technologies, are used to better meet the learning needs of learners in different ways in the education performed inside or outside the classroom.

With the individualization of education by e-learning, multiple-learning environments have gained prominence. The fact that the curriculum and course contents are constantly available in the virtual environment and the course can be repeated continuously can be considered as some of the contributions of e-learning. Factors such as supporting the contents with visual materials, and thus simplifying comprehension are another positive contribution of e-learning to the teaching-learning process. Nowadays, with e-learning, it is possible to reach any information from anywhere for not only the registered student group but also every segment of society. These possibilities are becoming more and more intense in parallel with the development of information technologies. On the other hand, individuals who receive education within the scope of e-learning are also allowed to manage their own time. While e-learning has positively affected the motivation of the individual towards learning by supporting individual teaching, it has largely eliminated the psychological pressure of group learning. These opportunities have been significant in terms of revealing the individual's own originality. E-learning has become an important alternative in enabling different segments to participate more in the learning process by making learning more interesting and attractive. At this point, with e-learning, individuals and/or groups can get or share information/data by finding the opportunity to reach different individuals and groups that they cannot reach in traditional learning. Within the scope of e-learning, the individual is not only dependent on a single resource but also gets the opportunity to benefit from many different object-based and visual web environments to understand more easily the same subject. The opportunity of interaction offered by e-learning allows the learner to benefit from the internet environment in accordance with his/her level of knowledge. Therefore, many possibilities that traditional education cannot offer can be offered with e-learning.

Today, overcrowded classrooms in educational institutions in Turkiye has always been a problem, so the instructor-learner interaction has remained very limited. Therefore, e-learning has become a necessity to eliminate the limitations in the instructor-learner interaction level and to bring this interaction level to an equal level for all students.

Although e-learning provides many benefits for teachers and students, it also brings some problems. The factors that make e-learning difficult are the fact that individuals do not have self-discipline in working, the possibility of preventing the socialization process of individuals, the process of creating content is comprehensive, time-consuming and costly, the inability to give up traditional learning habits easily, and the need of having sufficient knowledge and technological infrastructure. In addition to the limitations of e-learning, also it can be costly for students to own a computer. While technical problems on the computer or the internet can hinder teachers and students, they also may not have sufficient knowledge about computers and the Internet. While teaching with e-learning can be costly at the beginning, those who take lessons with e-learning may be new in this field and there may not be knowledgeable and experienced people in their environment who can help them.

Making preparations by knowing all these disadvantages and taking into account the benefit to be gained can provide e-learning more effective and beneficial. A simple comparison between traditional education and e-learning is given in the table below (Gowda and Suma, 2017).

Table 1. Comparison of Traditional education and E-learning (Gowda and Suma, 2017)

Factor	Traditional Education	E-Learning
Time	Dependent, periodic	Independent, lifelong
Place	Dependent, restricted	Independent, theoretically unlimited
Transfer	Not dependent on technology	Technology dependent
Learning Process	Slow	Fast
Learning Environment	Under control, regular, face-to-face, limited time	Uncontrolled, no rules, learner away from the instructor, unlimited time
Material	Depends on books	Depends on LMS
Flexibility	Inflexible, not reconfigurable	Flexible, can be reconfigured depending on the individual, time and purpose
Utilization / Access	Limited, a certain number of learners	Unlimited theoretically
Setup Cost	Low	High
Operating cost	Relatively expensive	Cheap

E-learning basically includes concepts such as web-based learning, computer-based learning, virtual classrooms and digital collaboration. In this context, hardware and software tools are required for the development and implementation of E-learning. These tools, which are indispensable parts of e-learning, can be classified into two groups as creation tools and learning tools as seen in Table 2:

Table 2. Classification of e-learning tools (Kisla and Karaoglan, 2011)

Productivity Tools	Learning Tools
• Authoring Tools	• Learning Management Systems
• Content Management Systems	• Learning Content Management Systems
• Video Editing Tools	• ePortfolio
• Audio Editing Tools	• Assessment Tools
• Chart Drawing Tools	• Online Interview Tools
• Animation Tools	• Virtual Classrooms
• Simulation Tools	• Other
• Other	

While creation tools are used in the design and development of e-learning environments, learning tools are used in sub-processes such as transferring the information to the learner, repeating it, evaluating the learner and so on.

E-learning Tool: LMSs

In this period of the Information Age, rapid developments in communication technologies affect the structure and form of education and force educators to develop new educational programs and learning-teaching models (Altiparmak et al., 2011). One of these models is distance education and the application of distance education has started to become widespread in the form of e-learning. In this context, how to realize the most effective distance education and training has led experts and organizations that develop education programs to think about Learning Management Systems (LMSs). LMSs are software that manage learning activities (Bezovski and Poorani, 2016). LMSs, which have come to a very significant point among e-learning tools, are defined by Ellis et al. (2009) as web-based software that enables the management of educational material, control of documents, monitoring of learners and instructors and reporting operations, as well as online classroom activities to be held. Besides, these integrated systems provide functions such as presenting learning material, sharing and discussing the presented learning material, managing course catalogues, taking assignments, taking exams, providing feedback on these assignments and exams, organizing learning materials, and keeping system records (Sezer and Yilmaz, 2019). The main purpose of these systems is to facilitate e-learning activities and to realize them in a more systematic and planned way. Although there are many different LMSs, the common usage purposes of LMSs are to support teaching, to allow the student to structure the information herself/himself, to increase the quality of education and to increase permanence (Bahceci and Yildiz, 2016). Since learning activities can be evaluated through these systems, the learning style is continuously improved at this point.

The most important criteria for success in such applications is to be able to access extensive information quickly, easily and regularly. The high level of interaction between the user and the system, the ability to answer the user's questions, to provide a more effective learning service by taking advantage of the multimedia support and the opportunities provided by the internet constitute substantial advantages. Despite the fact that instructors and students are far from each other, it is ensured that are close them to each other with the tools in the application and at the same time, it is also possible to bring together learning materials from a wide variety of sources. The main reasons for the widespread use of LMS are that learners can access 24/7 learning materials, that the management of large user groups and learning materials at the same time saves time and cost, and the advanced reporting system allows data analytics (Poyraz and Ozkul, 2019). Also, the features such as the ability to instantly respond to students who want to ask questions through the live-chat environment, and the ability to send students' documents to the system with the "Upload" play an important role in choosing this software.

Nowadays, especially with the COVID-19 pandemic, schools and universities have switched to 100% online education mode, which has forced education to transform (Dwivedi et al., 2020) and LMSs have started to be used more actively by many universities. There are many LMSs produced for commercial purposes and open-source. Among the commercial LMSs, globally the most used are Blackboard/WebCT, Desire2Learn (D2L), eCollege, it's learning, eLeaP. In addition, the main open-source learning management systems can be listed as Moodle, Chamilo, Totara Learn, Canvas, ILIAS, Opigno, ATutor, OLAT, Sakai, Claroline, eFront, Dokeos, Bodington, Drupal, LAMS, Docebo, DotLRN, eLedge, Openelms.

METHODOLOGY

This section consists of three subheadings in which IVIF-Z numbers are proposed and the steps of IVIF-Z AHP and IVIF-Z WASPAS methods are developed.

Preliminaries on Interval Valued Intuitionistic Fuzzy Z-Numbers

In this subsection, firstly, the preliminaries of fuzzy Z numbers and the interval valued intuitionistic fuzzy numbers that form the basis for the proposed IVIF-Z numbers are given. Then the definitions of the proposed IVIF-Z numbers are determined.

Fuzzy Z-Numbers

Z -numbers, an ordered pair of fuzzy sets $Z(\tilde{A},\tilde{B})$, are introduced by Zadeh in 2011 (Zadeh, 2011). The first component $(\tilde{A})$ of a Z-number $Z(\tilde{A},\tilde{B})$ is a fuzzy restriction of the values of X variable, and the second component $(\tilde{B})$ is referred to as certainty of the fuzzy restriction.

The restriction $R(X)\colon X\ is\ A$ is referred to a possibilistic restriction shown in Eq. (1) where $\mu_{\tilde{A}}(x)$ is the membership function of $\tilde{A}$:

$$R(X)\colon X\ is\ A \rightarrow Poss(X=x)=\mu_{\tilde{A}}(x) \qquad (1)$$

Figure 1 represents a simple fuzzy Z-number; $Z=(\tilde{A},\tilde{B})$ which has a trapezoidal membership function for fuzzy restriction and a triangular membership function for fuzzy reliability.

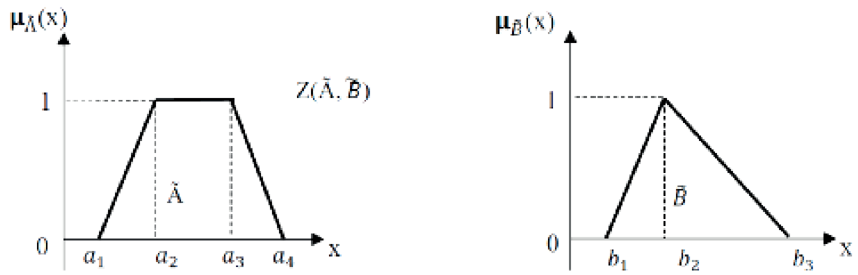

Figure. 1. A simple fuzzy Z-number

Let $\tilde{A}=\{\langle x,\mu_{\tilde{A}}(x)\rangle|\mu(x)\in[0,1]\}$ and $\tilde{B}=\{\langle x,\mu_{\tilde{B}}(x)\rangle|\mu(x)\in[0,1]\}$ where $\mu_{\tilde{A}}(x)$ is a trapezoidal membership function and $\mu_{\tilde{B}}(x)$ is a triangular membership function as shown in Figure 1. To convert a Z-number into a regular fuzzy number, Eqs. (2-4) could be used [95]. First to convert the reliability into a crisp number Eq. 2 can be used:

$$\alpha=\frac{b_1+2b_2+b_3}{4} \qquad (2)$$

Then, the weighted Z-number can be denoted as $\tilde{Z}^{\alpha}$ by adding the weight of the reliability to the restriction:

$$\tilde{Z}^{\alpha}=\{\langle x,\mu_{\tilde{A}^{\alpha}}(x)\rangle|\mu_{\tilde{A}^{\alpha}}(x)=\alpha\mu_{\tilde{A}}(x),\mu(x)\in[0,1]\} \qquad (3)$$

The weighted Z-number, in other words weighted restriction, can be converted to an ordinary trapezoidal fuzzy number $\tilde{Z}'$ which is shown in Figure 2 using Eq. (4) and Eq. (5):

$$\tilde{Z}' = \left\{ \langle x, \mu_{Z'}(x) \rangle \middle| \mu_{Z'}(x) = \mu_{\tilde{A}}\left(\frac{x}{\sqrt{\alpha}}\right), \mu(x) \in [0,1] \right\} \tag{4}$$

$$Z' = \left(\sqrt{\alpha}a_1, \sqrt{\alpha}a_2, \sqrt{\alpha}a_3, \sqrt{\alpha}a_4\right) \tag{5}$$

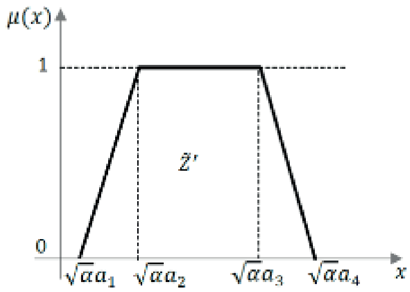

Figure 2. Ordinary fuzzy number transformed from Z-number

Interval Valued Intuitionistic Fuzzy Sets

While $D \subseteq [0,1]$ is the set of all closed sub-intervals of the interval and X is a discourse universe, the interval-valued intuitionistic fuzzy set $\tilde{A}$ is defined over X as follows (Atanassov, 1986):

$$\tilde{A} = \{\langle x, \mu_{\tilde{A}}(x), v_{\tilde{A}}(x) \rangle | x \in X\} \tag{6}$$

where $\mu_{\tilde{A}} \to D \subseteq [0,1]$, $v_{\tilde{A}}(x) \to D \subseteq [0,1]$ by satisfying the condition $0 \leq sup\, \mu_{\tilde{A}}(x) + sup\, v_{\tilde{A}}(x) \leq 1$, $\forall x \in X$.

The membership and non-membership functions of the element x to the set A are represented as intervals $\mu_{\tilde{A}}(x)$ and $v_{\tilde{A}}(x)$ respectively. Thus, $\mu_{\tilde{A}}(x)$ and $v_{\tilde{A}}(x)$ are closed intervals for each $x \in X$ and $\mu_{\tilde{A}}^{-}(x), \mu_{\tilde{A}}^{+}(x), v_{\tilde{A}}^{-}(x)$ and $v_{\tilde{A}}^{+}(x)$ are indicated as starting and ending points of closed intervals. Interval-valued intuitionistic fuzzy set (IVIF) $\tilde{A}$ is indicated by

$$\tilde{A} = \{\langle x, [\mu_{\tilde{A}}^{-}(x), \mu_{\tilde{A}}^{+}(x)], [v_{\tilde{A}}^{-}(x), v_{\tilde{A}}^{+}(x)] \rangle | x \in X\} \tag{7}$$

where $0 \leq \mu_{\tilde{A}}^{+}(x) + v_{\tilde{A}}^{+}(x) \leq 1$, $\mu_{\tilde{A}}^{-}(x) \geq 0$, $v_{\tilde{A}}^{-}(x) \geq 0$.

For each element x, we compute the hesitancy degree (unknown degree) of an IVIF of $x \in X$ in $\tilde{A}$ defined as follows:

$$\pi_{\tilde{A}}(x) = 1 - \mu_{\tilde{A}}(x) - v_{\tilde{A}}(x) = ([1 - \mu_{\tilde{A}}^{+}(x) - v_{\tilde{A}}^{+}(x)], 1 - \mu_{\tilde{A}}^{-}(x) - v_{\tilde{A}}^{-}(x)) \tag{8}$$

For convenience, let $\mu_{\tilde{A}}(x) = [\mu_{\tilde{A}}^{-}(x), \mu_{\tilde{A}}^{+}(x)] = [\mu_{\tilde{A}}^{-}, \mu_{\tilde{A}}^{+}]$, $v_{\tilde{A}}(x) = [v_{\tilde{A}}^{-}(x), v_{\tilde{A}}^{+}(x)] = [v_{\tilde{A}}^{-}, v_{\tilde{A}}^{+}]$, so $\tilde{A} = ([\mu_{\tilde{A}}^{-}, \mu_{\tilde{A}}^{+}], [v_{\tilde{A}}^{-}, v_{\tilde{A}}^{+}])$.

Some arithmetic operations are given in the following considering interval-valued intuitionistic fuzzy numbers and $\lambda \geq 0$. Let $\tilde{A} = ([\mu_{\tilde{A}}^{-}, \mu_{\tilde{A}}^{+}], [v_{\tilde{A}}^{-}, v_{\tilde{A}}^{+}])$ and $\tilde{B} = ([\mu_{\tilde{B}}^{-}, \mu_{\tilde{B}}^{+}], [v_{\tilde{B}}^{-}, v_{\tilde{B}}^{+}])$ be two interval-valued intuitionistic fuzzy numbers. Then (Zavadkas et al., 2014, Kahraman et al. 2016, Bolturk and Kahraman, 2019),

$$\tilde{A} \oplus \tilde{B} = ([\mu_{\tilde{A}}^{-} + \mu_{\tilde{B}}^{-} - \mu_{\tilde{A}}^{-}\mu_{\tilde{B}}^{-}, \mu_{\tilde{A}}^{+} + \mu_{\tilde{B}}^{+} - \mu_{\tilde{A}}^{+}\mu_{\tilde{B}}^{+}], [v_{\tilde{A}}^{-}v_{\tilde{B}}^{-}, v_{\tilde{A}}^{+}v_{\tilde{B}}^{+}]) \tag{9}$$

$$\tilde{A} \otimes \tilde{B} = ([\mu_{\tilde{A}}^- \mu_{\tilde{B}}^-,\ \mu_{\tilde{A}}^+ \mu_{\tilde{B}}^+], [\nu_{\tilde{A}}^- + \nu_{\tilde{B}}^- - \nu_{\tilde{A}}^- \nu_{\tilde{B}}^-,\ \nu_{\tilde{A}}^+ + \nu_{\tilde{B}}^+ - \nu_{\tilde{A}}^+ \nu_{\tilde{B}}^+]) \tag{10}$$

$$\tilde{A} \ominus \tilde{B} = \{(z, [max_{z=x-y} min\{\mu_{\tilde{A}}^-(x), \mu_{\tilde{B}}^-(y)\}, max_{z=x-y} min\{\mu_{\tilde{A}}^+(x), \mu_{\tilde{B}}^+(y)\}],$$
$$[min_{z=x-y} max\{\nu_{\tilde{A}}^-(x), \nu_{\tilde{B}}^-(y)\}, min_{z=x-y} max\{\nu_{\tilde{A}}^+(x), \nu_{\tilde{B}}^+(y)\}])\mid (x,y) \in X\ x\ Y\} \tag{11}$$

$$(\tilde{A})^{\tilde{B}} = ([min\ (\mu_{\tilde{A}}^-, \mu_{\tilde{B}}^-), min\ (\mu_{\tilde{A}}^+, \mu_{\tilde{B}}^+)], [max\ (\nu_{\tilde{A}}^-, \nu_{\tilde{B}}^-), max\ (\nu_{\tilde{A}}^+, \nu_{\tilde{B}}^+)]) \tag{12}$$

$$\tilde{A} \oslash \tilde{B} = ([\min(\mu_{\tilde{A}}^-, \mu_{\tilde{B}}^-), \min(\mu_{\tilde{A}}^+, \mu_{\tilde{B}}^+)],\ [\max(\nu_{\tilde{A}}^-, \nu_{\tilde{B}}^-), \max(\nu_{\tilde{A}}^+, \nu_{\tilde{B}}^+)]) \tag{13}$$

$$\lambda \tilde{A} = ([1 - (1 - \mu_{\tilde{A}}^-)^\lambda,\ 1 - (1 - \mu_{\tilde{A}}^+)^\lambda], [(\nu_{\tilde{A}}^-)^\lambda,\ (\nu_{\tilde{A}}^+)^\lambda]),\ \lambda > 0 \tag{14}$$

$$\tilde{A}^\lambda = ([(\mu_{\tilde{A}}^-)^\lambda,\ (\mu_{\tilde{A}}^+)^\lambda], [1 - (1 - \nu_{\tilde{A}}^-)^\lambda,\ 1 - (1 - \nu_{\tilde{A}}^+)^\lambda]),\ \lambda > 0 \tag{15}$$

Aggregation operators are given in the following Eqs. (16-19). Let $\tilde{\alpha_j} = ([\mu_j^-, \mu_j^+][\nu_j^-, \nu_j^+])$ $(j = 1,2,\ldots,n)$ be a collection of interval-valued intuitionistic fuzzy numbers and let IIFWA: Qn → Q, if

$$IIFWA_w(\tilde{\alpha_1}, \tilde{\alpha_2}, \ldots, \tilde{\alpha_n}) = w_1\tilde{\alpha_1} \oplus w_2\tilde{\alpha_2} \oplus \ldots \oplus w_n\tilde{\alpha_n} \tag{16}$$

then IIFWA is called an interval-valued intuitionistic fuzzy weighted averaging (IIFWA) operator, where Q is the set of all IVIFNs, $w = (w_1, w_2, \ldots, w_n)$ is the weight vector of the IVIFNs $\tilde{\alpha_j}$ $(j = 1,2,\ldots,n)$, and $w_j > 0$, $\sum_{j=1}^n w_j = 1$. The $IIFWA$ operator can be further transformed in to the following form (Xu, 2007):

$$IIFWA_w(\tilde{\alpha_1}, \tilde{\alpha_2}, \ldots, \tilde{\alpha_n}) = (1 - (\prod_{j=1}^n (1 - \mu_j^-))^{w_j}, 1 - (\prod_{j=1}^n (1 - \mu_j^+))^{w_j},$$
$$(\prod_{j=1}^n \nu_j^-)^{w_j}, (\prod_{j=1}^n \nu_j^+)^{w_j}) \tag{17}$$

Especially if $w = (1/n, 1/n, \ldots, 1/n)$, then the IIFWA operator reduces to an IIFA (interval-valued intuitionistic fuzzy averaging) operator, where

$$IIFA(\tilde{a}_1, \tilde{a}_2, \ldots, \tilde{a}_n) = \frac{1}{n}(\tilde{a}_1 \oplus \tilde{a}_2 \oplus \ldots \oplus \tilde{a}_n)$$
$$= \left(\left[1 - (\prod_{j=1}^n (1 - \mu_j^-))^{\frac{1}{n}}, 1 - (\prod_{j=1}^n (1 - \mu_j^+))^{\frac{1}{n}}\right], \left[(\prod_{j=1}^n \nu_j^-)^{\frac{1}{n}}, (\prod_{j=1}^n \nu_j^+)^{\frac{1}{n}}\right]\right) \tag{18}$$

Let $\tilde{\alpha_j} = ([\mu_j^-, \mu_j^+][\nu_j^-, \nu_j^+])$ $(j = 1,2,\ldots,n)$ be a collection of interval-valued intuitionistic fuzzy numbers and let IIFOWG: Qn → Q, if

$$IIFOWG_w(\tilde{\alpha_1}, \tilde{\alpha_2}, \ldots, \tilde{\alpha_n}) = \tilde{\alpha_1}^{w_1} \otimes \tilde{\alpha_2}^{w_2} \otimes \ldots \otimes \tilde{\alpha_2}^{w_n} \tag{19}$$

then $IIFOWG_w$ is called an interval-valued intuitionistic fuzzy ordered weighted geometric averaging operator, where Q is the set of all IVIFNs, $w = (w_1, w_2, \ldots, w_n)$ is the weight vector of the IVIFNs $\tilde{\alpha_j}$ $(j = 1,2,\ldots,n)$, and $w_j > 0$, $\sum_{j=1}^n w_j = 1$. The $IIFOWG$ operator can be further transformed in to the following form (Xu&Chen, 2007):

$$IIFOWG(\tilde{\alpha_1}, \tilde{\alpha_2}, \ldots, \tilde{\alpha_n}) = ([\prod_{j=1}^n (\mu_j^-)^{w_j}, \prod_{j=1}^n (\mu_j^+)^{w_j}],\ [1 - \prod_{j=1}^n (1 - \nu_j^-)^{w_j}, 1 -$$
$$\prod_{j=1}^n (1 - \nu_j^+)^{w_j}] \tag{20}$$

To convert an interval valued intuitionistic fuzzy number $\tilde{\alpha} = ([\mu^-, \mu^+][\nu^-, \nu^+])$ to its crisp equivalent, Eq. (21) can be used for defuzzification (Kahraman et al., 2016)

$$S(\tilde{\alpha}) = \left(\frac{\mu^- + \mu^+ + (1-\nu^-) + (1-\nu^+) + \mu^- \times \mu^+ - \sqrt{(1-\nu^-) \times (1-\nu^+)}}{4}\right) \tag{21}$$

Interval Valued Intuitionistic Fuzzy Z-Numbers (IVIF-Z)

Let $\tilde{A}_I = ([\mu_{\tilde{A}_I}{}^{-}, \ \mu_{\tilde{A}_I}{}^{+}], [\nu_{\tilde{A}_I}{}^{-}, \ \nu_{\tilde{A}_I}{}^{+}])$ and $\tilde{B}_I = ([\mu_{\tilde{B}_I}{}^{-}, \ \mu_{\tilde{B}_I}{}^{+}], [\nu_{\tilde{B}_I}{}^{-}, \ \nu_{\tilde{B}_I}{}^{+}])$ are two interval-valued intuitionistic fuzzy numbers. $z(\tilde{A}_I, \tilde{B}_I)$ is an interval valued intuitionistic fuzzy-Z (IVIF-Z) number where $\tilde{A}_I$ represents a fuzzy restriction of the values of X variable and $\tilde{B}_I$ is referred to as fuzzy reliability of the fuzzy restriction.

To convert an IVIF-Z number into an IVIF number, first, the reliability can be converted into a crisp number using Eq. (22):

$$\alpha_I = \left(\frac{\mu_{\tilde{B}_I}{}^{-} + \mu_{\tilde{B}_I}{}^{+} + (1-\nu_{\tilde{B}_I}{}^{-}) + (1-\nu_{\tilde{B}_I}{}^{+}) + \mu_{\tilde{B}_I}{}^{-} \times \mu_{\tilde{B}_I}{}^{+} - \sqrt{(1-\nu_{\tilde{B}_I}{}^{-}) \times (1-\nu_{\tilde{B}_I}{}^{+})}}{4} \right) \tag{22}$$

The weighted IVIF- Z number can be denoted as $\tilde{Z}^{\alpha_I}$ by adding the weight of the reliability to the restriction:

$$\tilde{Z}^{\alpha_I} = \left\{ \langle x, \left(\mu_{\tilde{A}_I{}^{\alpha_I}}(x), \nu_{\tilde{A}_I{}^{\alpha_I}}(x) \right) \rangle \, \middle| \mu_{\tilde{A}_I{}^{\alpha_I}}(x) = \alpha_I \mu_{\tilde{A}_I}(x), \nu_{\tilde{A}_I{}^{\alpha_I}}(x) = \alpha_I \nu_{\tilde{A}_I}(x), \mu(x), \nu(x) \in [0,1] \right\} \tag{23}$$

The weighted Z number, in other words, weighted restriction can be converted to an ordinary fuzzy number $\tilde{Z}'$ using Eq. (24) and Eq. (25):

$$\tilde{Z}' = \left\{ \langle x, \mu_{Z'}(x) \rangle \middle| \mu_{Z'}(x) = \left(\mu_{\tilde{A}_I}\left(\frac{x}{\sqrt{\alpha_I}}\right), \nu_{\tilde{A}_I}\left(\frac{x}{\sqrt{\alpha_I}}\right) \right), \mu(x), \nu(x) \in [0,1] \right\} \tag{24}$$

$$\tilde{Z}' = \left(\left[\left(1 - (1 - \mu_{\tilde{A}}{}^{-})^{\sqrt{\alpha_I}}\right), \left(1 - (1 - \mu_{\tilde{A}}{}^{+})^{\sqrt{\alpha_I}}\right) \right], \left[\left((\nu_{\tilde{A}}{}^{-})^{\sqrt{\alpha_I}}\right), \left((\nu_{\tilde{A}}{}^{+})^{\sqrt{\alpha_I}}\right) \right] \right) \tag{25}$$

IVIF-Z AHP Method

Saaty (1980) proposed Analytic Hierarchy Process to determine the criteria weights for a determined goal and since then it became one of the most used multi-criteria decision-making methods. Many fuzzy extensions of AHP have been proposed by various authors for different levels of uncertainty in the evaluation environment in scaling linguistic assessments (Figure 3).

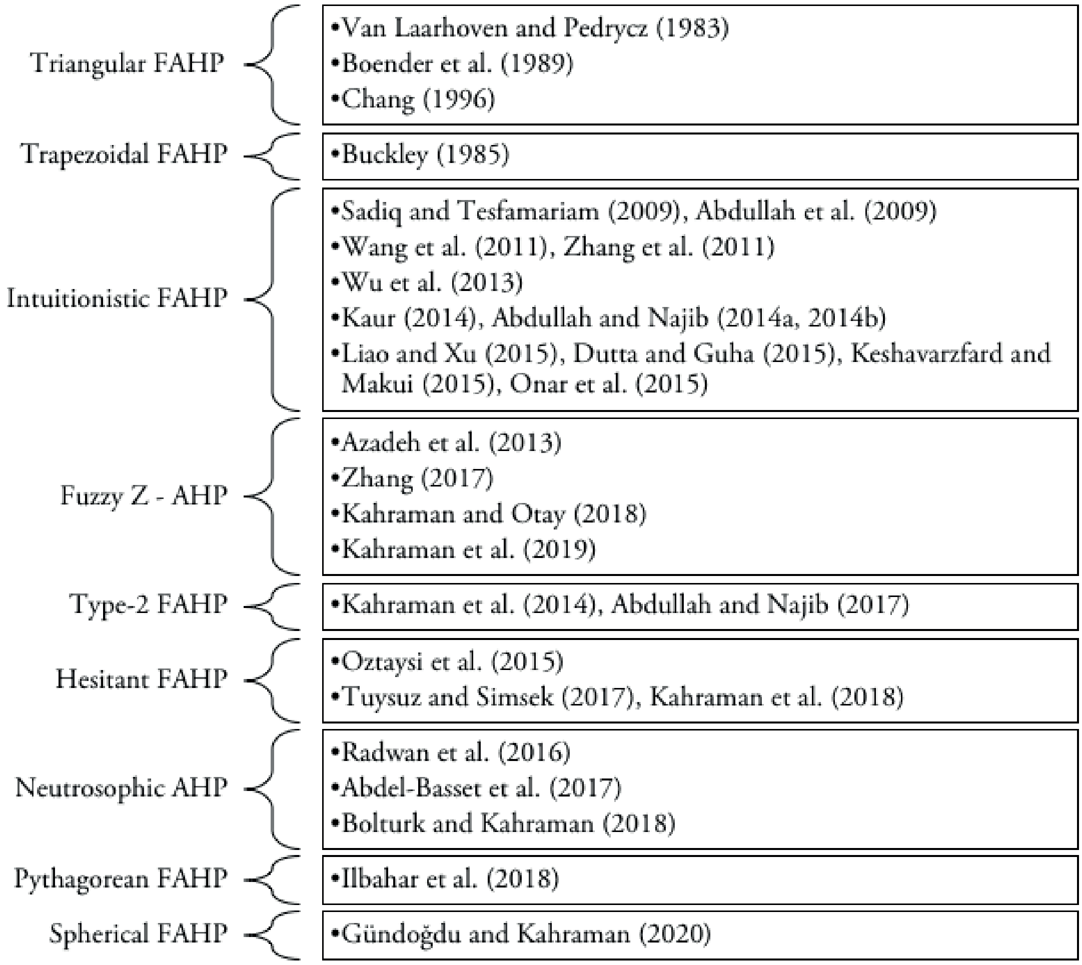

FIgure 3. The timeline of Fuzzy AHP extensions (Ucal Sari and Kahraman, 2020)

In this paper, a new extension of the AHP method that is IVIF-Z AHP is proposed and its steps are determined as follows:

Step 1. Define the problem and construct the hierarchical structure of the problem.

Step 2. Use the scale of linguistic restriction given in Table 3 and the scale of linguistic reliability function given in Table 4 for the pairwise comparisons.

Table 3. Linguistic scale for fuzzy restriction function and corresponding IVIF scales (Dogan et al., 2019)

Linguistic Restriction	IVIF scale of restriction function
Absolutely Less Important (ALI)	([0.1, 0.25], [0.65, 0.75])
Greatly Less Important (GLI)	([0.15, 0.3], [0.6, 0.7])
Moderately Less Important (MLI)	([0.2, 0.35], [0.55, 0.65])
Weakly Less Important (WLI)	([0.25, 0.4], [0.5, 0.6])
Equally Important (EI)	([0.5, 0.5], [0.5, 0.5])
Weakly More Important (WMI)	([0.5, 0.6], [0.25, 0.4])
Moderately More Important (MMI)	([0.55, 0.65], [0.2, 0.35])
Greatly More Important (GMI)	([0.6, 0.7], [0.15, 0.3])
Absolutely More Important (AMI)	([0.65, 0.75], [0.1, 0.25])

Table 4. Linguistic scale for fuzzy reliability function and corresponding IVIF scales

Linguistic Reliability	IVIF scale of reliability function
Absolutely Reliable (AR)	([1, 1], [0, 0])
Strongly Reliable (SR)	([0.7, 0.9], [0, 0.1])
Very Highly Reliable (VHR)	([0.6, 0.8], [0.05, 0.2])
Highly Reliable (HR)	([0.5, 0.7], [0.15, 0.3])
Fairly Reliable (FR)	([0.4, 0.6], [0.25, 0.4])
Weakly Reliable (WR)	([0.3, 0.5], [0.35, 0.5])
Very Weakly Reliable (VWR)	([0.2, 0.4], [0.45, 0.6])
Strongly Unreliable (SU)	([0.1, 0.3], [0.55, 0.7})
Absolutely Unreliable (AU)	([0, 0.2], [0.65, 0.8])

Step 3. Construct the pairwise comparison matrices and fill in them with IVIF-Z numbers using the linguistic terms determined in Step 2 and their corresponding linguistic scales that are determined in Table 3 and Table 4.

Step 4. Transform IVIF-Z numbers to their corresponding equivalent interval valued intuitionistic fuzzy numbers using Eqs. (22-25) and construct transformed interval-valued intuitionistic judgement matrix as given in Eq. (26):

$$\tilde{R} = \begin{bmatrix} ([\mu_{11}^{-}, \mu_{11}^{+}], [\nu_{11}^{-}, \nu_{11}^{+}]) & ([\mu_{12}^{-}, \mu_{12}^{+}], [\nu_{12}^{-}, \nu_{12}^{+}]) & \cdots & ([\mu_{1n}^{-}, \mu_{1n}^{+}], [\nu_{1n}^{-}, \nu_{1n}^{+}]) \\ ([\mu_{21}^{-}, \mu_{21}^{+}], [\nu_{21}^{-}, \nu_{21}^{+}]) & ([\mu_{22}^{-}, \mu_{22}^{+}], [\nu_{22}^{-}, \nu_{22}^{+}]) & \vdots & ([\mu_{2n}^{-}, \mu_{2n}^{+}], [\nu_{2n}^{-}, \nu_{2n}^{+}]) \\ \vdots & \vdots & \ddots & \vdots \\ ([\mu_{n1}^{-}, \mu_{n1}^{+}], [\nu_{n1}^{-}, \nu_{n1}^{+}]) & ([\mu_{n2}^{-}, \mu_{n2}^{+}], [\nu_{n2}^{-}, \nu_{n2}^{+}]) & \cdots & ([\mu_{nn}^{-}, \mu_{nn}^{+}], [\nu_{nn}^{-}, \nu_{nn}^{+}]) \end{bmatrix} \quad (26)$$

Step 5. Check the consistency of each fuzzy pairwise comparison matrix. Assume $\tilde{A} = [\tilde{a}_{ij}]$ is a fuzzy positive pairwise comparison matrix and $A = [a_{ij}]$ is its defuzzified positive pairwise comparison matrix. If the result of the comparisons of $A = [a_{ij}]$ is consistent, then it can imply that the result of the comparisons of $\tilde{A} = [\tilde{a}_{ij}]$ is also consistent.

Step 6. Construct the aggregated interval-valued intuitionistic judgement matrix using $IIFOWG_w$ operator using Eq. (20).

Step 7. Apply steps of IVIF AHP method proposed by Kahraman et al. (2020):

Step 7.1. Calculate the score judgement matrix using Eq. (27) :

$$\tilde{S} = \begin{bmatrix} [\mu_{11}^{-} - \nu_{11}^{+}, \mu_{11}^{+} - \nu_{11}^{-}] & \cdots & [\mu_{1n}^{-} - \nu_{1n}^{+}, \mu_{1n}^{+} - \nu_{1n}^{-}] \\ \vdots & \ddots & \vdots \\ [\mu_{n1}^{-} - \nu_{n1}^{+}, \mu_{n1}^{+} - \nu_{n1}^{-}] & \cdots & [\mu_{nn}^{-} - \nu_{nn}^{+}, \mu_{nn}^{+} - \nu_{nn}^{-}] \end{bmatrix} \quad (27)$$

Step 7.2. Calculate the interval multiplicative matrix using Eq. (28):

$$\tilde{A} = (\tilde{a}_{ij})_{nxn} = \begin{bmatrix} [10^{(\mu_{11}^{-} - \nu_{11}^{+})}, 10^{(\mu_{11}^{+} - \nu_{11}^{-})}] & \cdots & [10^{(\mu_{1n}^{-} - \nu_{1n}^{+})}, 10^{(\mu_{1n}^{+} - \nu_{1n}^{-})}] \\ \vdots & \ddots & \vdots \\ [10^{(\mu_{n1}^{-} - \nu_{n1}^{+})}, 10^{(\mu_{n1}^{+} - \nu_{n1}^{-})}] & \cdots & [10^{(\mu_{nn}^{-} - \nu_{nn}^{+})}, 10^{(\mu_{nn}^{+} - \nu_{nn}^{-})}] \end{bmatrix} \quad (28)$$

Step 7.3. Determine the priority vector of the interval multiplicative matrix by calculating the $\tilde{w}_i$ interval for each criteria using Eq. (29):

$$\tilde{w}_i = \left[\frac{\sum_{j=1}^{n} \tilde{a}_{ij}^-}{\sum_{i=1}^{n}\sum_{j=1}^{n} \tilde{a}_{ij}^+}, \frac{\sum_{j=1}^{n} \tilde{a}_{ij}^+}{\sum_{i=1}^{n}\sum_{j=1}^{n} \tilde{a}_{ij}^-}\right] \tag{29}$$

Step 7.4. Construct the possibility degree matrix $P = (p_{ij})_{mxn}$ using Eq. (30):

$$P(w_i \geq w_j) = \frac{\min\{L_{w_i} + L_{w_j}, \max(w_i^+ - w_j^-, 0)\}}{L_{w_i} + L_{w_j}} \tag{30}$$

where $L_{w_i} = w_i^+ - w_i^-$ and $L_{w_j} = w_j^+ - w_j^-$ and $p_{ij} \geq 0, p_{ij} + p_{ji} = 1, p_{ii} = 0.5$.

Step 7.5. Prioritize the possibility degree matrix $P = (p_{ij})_{mxn}$ by Eq. (31)

$$w_i = \frac{1}{n}\left[\sum_{j=1}^{n} p_{ij} + \frac{n}{2} - 1\right] \tag{31}$$

Step 7.6. Normalize the weights vector obtained in Step 7.5.

Interval Valued Intuionistic Fuzzy Z-WASPAS

The WASPAS method was first introduced into the literature in 2012 by Zavadskas et al. (Zavadskas et al., 2012). Combining the weighted sum model and the weighted product model to increase the order accuracy, this method is widely used as an effective decision-making tool due to its simplicity and increased accuracy in ranking alternatives (Sergi and Sari, 2021). Timeline of the fuzzy extensions of WASPAS method is shown in Figure 4.

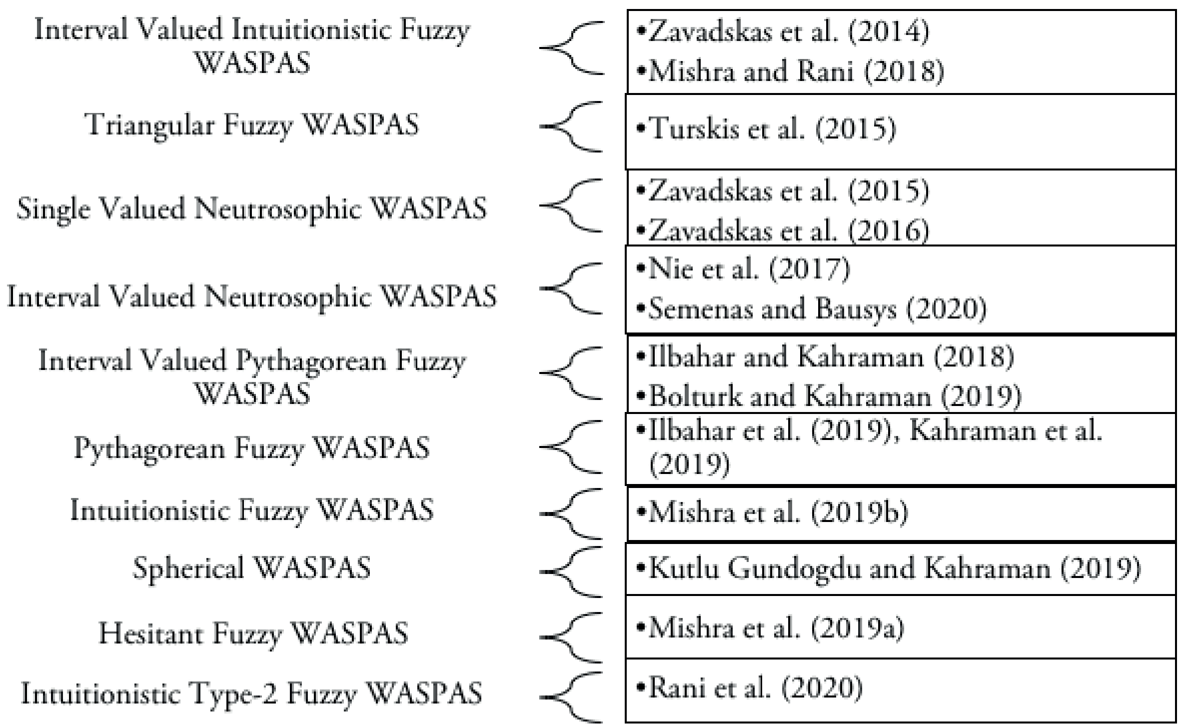

FIgure 4. The timeline of Fuzzy WASPAS extensions

In the following, the steps of proposed IVIF- Z WASPAS method are given step by step:

Step 1. Determine the decision matrix. Use the scale of linguistic restriction function and the scale of linguistic reliability function presented in Table 3 and Table 4.

Step 2. Transform IVIF-Z numbers to their corresponding equivalent interval valued intuitionistic fuzzy numbers.

Step 3. Normalize the decision matrix. For the decisions in which the highest score is preferred or in other words for positive criteria Eq. (32) is used for the normalization:

$$\tilde{\tilde{x}}_{ij} = \frac{\tilde{x}_{ij}}{\max \tilde{x}_{ij}} \tag{32}$$

For the decisions in which the lowest score is preferred or in other words for negative criteria Eq. (33) is used for the normalization:

$$\tilde{\tilde{x}}_{ij} = \frac{\min \tilde{x}_{ij}}{\tilde{x}_{ij}} \tag{33}$$

Score values of $\tilde{x}_{ij}$ can be used to determine the minimum and maximum values using Eq. (21).

Step 4. Apply the methods of weighted sum model and weighted product model.

Step 4.1. Construct weighted normalized decision matrix for weighted sum model (WSM) using Eq. (34) where $\widetilde{w}_j$ is the interval valued intuitionistic fuzzy weight of criterion j:

$$\tilde{\tilde{x}}_{ijWSM} = \tilde{\tilde{x}}_{ij}\widetilde{w}_j \tag{34}$$

Step 4.2. Construct weighted normalized decision matrix for weighted product model (WPM) using Eq. (35):

$$\tilde{\tilde{x}}_{ijWPM} = \tilde{\tilde{x}}_{ij}^{\widetilde{w}_j} \tag{35}$$

Step 5. Calculate the combined utility function values of the WASPAS method for each alternative as in Eq. (36):

$$U_i = \lambda \sum_{j=1}^{n} \tilde{\tilde{x}}_{ij}\widetilde{w}_j + (1-\lambda) \prod_{j=1}^{n} \tilde{\tilde{x}}_{ij}^{\widetilde{w}_j} \tag{36}$$

where λ is determined by the decision maker and belongs to the interval of [0,1].

Step 6. Calculate the score of each alternative by defuzzifying combined utility function values using the score function determined in Eq. (21).

Step 7. Rank the alternatives starting from the highest value of obtained defuzzified values.

APPLICATION: COMPARE AND SELECT THE BEST LMS, HIGHER EDUCATION SYSTEM IN TURKIYE

Learning Management Systems can be used in three different ways, as commercial products (e.g. Blackboard), free open source products (e.g. Moodle) and customized software systems that serve the educational purposes of specific organizations.

In this study, use LMS of higher education institutions in Turkiye are examined, some of the most popular LMS are listed along with universities that are used in Table 5:

Table 5. List of Learning Management Systems in Turkiye

LMS Platform	University	City
Moodle (A1)	Koc University	Istanbul
	Bogazici University	Istanbul
	Ozyegin University	Istanbul
	Bilkent University	Ankara
	Kocaeli University	Kocaeli
	Ege University	Izmir
	Karadeniz Technical University	Trabzon
Canvas (A2)	Eskisehir Technical University	Eskisehir
	Eskisehir Osmangazi University	Eskisehir
	Anadolu University	Eskisehir
	Alanya Alaaddin Keykubat University	Antalya
	Abdullah Gul University	Kayseri
ALMS – Advancity (A3)	Marmara University	Istanbul
	Istanbul Gelisim University	Istanbul
	Gazi University	Ankara
	Akdeniz University	Antalya
	Uludag University	Bursa
	Inonu University	Malatya
Blackboard (A4)	MEF University	Istanbul
	Istanbul Bilgi University	Istanbul
	Koc University	Istanbul
	Hacettepe University	Ankara
	Izmir University of Economics	Izmir
Microsoft Office 365 Teams (A5)	Galatasaray University	Istanbul
	Fenerbahce University	Istanbul
	Istanbul Medipol University	Istanbul
	Dogus University	Istanbul
	Canakkale Onsekiz Mart University	Canakkale
Customized Enterprise LMS (A6)	Ninova – Istanbul Technical University	Istanbul
	CATS – Istanbul Kultur University	Istanbul
	SAUPORT – Sakarya University	Sakarya
	Olives – Cukurova University	Adana

Moodle, which stands for Modular-Object-Oriented-Dynamic-Learning-Environment, is a free and open-source learning management system designed to help educators create online courses. The software can work in any environment under MySQL and PostgreSQL database systems and supporting PHP language such as Linux, Windows, etc. It is used by approximately 246,000,000 users in 235 countries and is available in 82 languages. It has a user-friendly interface and can be used comfortably from both computers and mobile devices. There are an online demo version and supporting system, and its different modules can be easily accessed online.

Canvas, whose open-source version is free, is a learning management system that also offers many paid and closed source services. Canvas LMS has a responsive design, so learners can access them from all operating systems, browsers and even mobile devices. Canvas LMS contains many tools and facilities for e-learning activities.

Academic LMS, namely ALMS, is a completely domestic academic learning management system developed by Advancity that meets all communication and sharing needs of academic staff and students for formal and distance education. 120 institutions including Turkiye's nearly 60 higher education institutions prefer the ALMS that is one of the most used academic learning management systems in Turkiye with an active user base of 800,000. Although it is asynchronous software, it has integration with synchronous virtual classroom applications. It works easily on any mobile device with an internet connection without requiring any extra software.

Blackboard Learn is a virtual learning environment and commercial learning management system that enables online lecturing, learning, community building and knowledge sharing. It has a scalable design that allows course management, customizable open architecture and integration with student information systems and authentication protocols.

Google Classroom is a flexible, secure and easy to use the platform offered by Google as an alternative to Blackboard and Moodle, which can be used by universities as well as non-governmental organizations and all users who have a personal Google Account. This platform offers educators the opportunity to create and upload free online learning resources, to send homework to learners, to collect and evaluate them.

These solutions, which enable all training processes to be easily managed at a single point, create efficiency and savings in educational processes while facilitating the work of training units and providing automation and digitalization. Institutions consider several criteria to choose the most suitable system for them. From a broader perspective, it can be said that the factors affecting the choice of learning management system are usability, integration, support services, accessibility, security, reduced cost/fee and personalization. Since these factors generally determine the characteristics of the system to be selected, these criteria were selected for the evaluation of the most appropriate LMS (Table 6).

Table 6. LMS criteria and descriptions

Criteria	Reference	Description
Usability (C1)	(Unal and Unal, 2011)	Easy to use the system
Integration (C2)	(Bilgic and Tuzun, 2020)	Easy integration and compatibility with different add-ons and platforms
Support Services (C3)	(Mtebe, 2015)	Assistance support for students and instructors through phone, email, online FAQ, user community, live chat, training videos etc.
Accessibility (C4)	(Chaubey and Bhattacharya, 2015)	Accessible for everyone from any device or browser
Security (C5)	(Muhammad and Cavus, 2017)	Ensuring user authentication and data integrity
Reduced Costs / Fee (C6)	(Kaya, 2012)	Includes common and setup fees and some other charges
Personalization (C7)	(Petrova, 2019)	Personal assigments, ability of grouping people, special assignments to groups

Generally, it was not possible to reach users who knew all the systems examined in the evaluation in detail, as the users were familiar with only some of the alternatives investigated in the study. In order to overcome this situation, which can be stated as the biggest limitation of the study, the decision makers were selected from among the professors who actively used at least three of these systems and had administrative duties.

After conducting the literature research and asking the expert's opinion, seven criteria as usability, integration, support services, accessibility, security, reduced costs / fee, personalization were selected for evaluation of LMS alternatives. Opinions on the determined criteria were received by a group of experts who use at least one of the LMS alternatives and they were asked to make a pairwise comparison through survey questions. The evaluations of the experts for pairwise comparisons are collected individually. Besides that, to see the difference between the outcomes of the aggregation of several evaluations and evaluations done in a focus group with consensus technique, the same experts agreed on a common comparison matrix as a result of a meeting. In the pairwise comparison matrices linguistic scales in Table 3 and 4 are used. The pairwise comparison results for restriction and reliability functions obtained from the individual evaluations and group evaluation are shown in Table 7.

Table 7. Pairwise comparison matrix - restriction and reliability of decision criteria

		Restriction Evaluations							Reliability Evaluations						
		C1	C2	C3	C4	C5	C6	C7	C1	C2	C3	C4	C5	C6	C7
EXPERT 1	C1	EI	MMI	AMI	GMI	WLI	MMI	EI	AR	SR	HR	SR	VHR	SR	SR
	C2	MLI	EI	EI	ALI	ALI	WLI	MLI	SR	AR	VHR	VHR	VHR	VHR	VHR
	C3	ALI	EI	EI	MLI	ALI	EI	MLI	HR	VHR	AR	AR	FR	FR	FR
	C4	GLI	AMI	MMI	EI	MLI	WMI	WLI	SR	VHR	AR	AR	SR	SR	FR
	C5	WMI	AMI	AMI	MMI	EI	AMI	WMI	VHR	VHR	FR	SR	AR	SR	AR
	C6	MLI	EMI	EI	WLI	ALI	EI	GLI	SR	VHR	FR	SR	SR	AR	HR
	C7	EI	MMI	MMI	WMI	WLI	GMI	EI	SR	VHR	FR	FR	AR	HR	AR
EXPERT 2	C1	EI	GMI	EI	EI	GMI	EI	GMI	AR	VHR	SR	AR	HR	HR	FR
	C2	GLI	EI	WLI	WLI	EI	WLI	EI	VHR	AR	SR	FR	SR	FR	FR
	C3	EI	WMI	EI	EI	WMI	EI	WMI	SR	SR	AR	AR	HR	FR	VHR
	C4	EI	WMI	EI	EI	WMI	EI	GMI	AR	FR	AR	AR	SR	AR	SR
	C5	GLI	EI	WLI	WLI	EI	WLI	EI	HR	SR	HR	SR	AR	FR	AR
	C6	EI	WMI	EI	EI	WMI	EI	WMI	HR	FR	FR	AR	FR	AR	AR
	C7	GLI	EI	WLI	GLI	EI	WLI	EI	FR	FR	VHR	SR	AR	AR	AR
EXPERT 3	C1	EI	GLI	GMI	WMI	WLI	WMI	WMI	AR	AR	VHR	SR	FR	HR	SR
	C2	GMI	EI	AMI	GMI	WMI	MMI	MMI	AR	AR	VHR	SR	HR	FR	AR
	C3	GLI	ALI	EI	WLI	ALI	WLI	WLI	VHR	VHR	AR	FR	HR	AR	VHR
	C4	WLI	GLI	WMI	EI	MLI	WMI	WLI	SR	SR	FR	AR	VHR	FR	FR
	C5	WMI	WLI	AMI	MMI	EI	AMI	MMI	FR	HR	HR	VHR	AR	SR	FR
	C6	WLI	MLI	WMI	WLI	ALI	EI	WLI	HR	FR	AR	FR	SR	AR	FR
	C7	WLI	MLI	WMI	WMI	MLI	WMI	EI	SR	AR	VHR	FR	FR	FR	AR
EXPERT 4	C1	EI	WLI	GLI	WLI	GLI	GLI	MLI	AR	AR	SR	VHR	VHR	FR	FR
	C2	WMI	EI	WLI	WLI	MLI	MLI	MLI	AR	AR	AR	SR	VHR	SR	FR
	C3	GMI	WMI	EI	MMI	MLI	EI	WLI	SR	AR	AR	HR	VHR	HR	FR
	C4	WMI	WMI	MLI	EI	GLI	WLI	WLI	VHR	SR	HR	AR	VHR	SR	AR
	C5	GMI	MMI	MMI	GMI	EI	WMI	MMI	VHR	VHR	VHR	VHR	AR	FR	HR
	C6	GMI	MMI	EI	WMI	WLI	EI	EI	FR	SR	HR	SR	FR	AR	SR
	C7	MMI	MMI	WMI	WMI	WML	EI	EI	FR	FR	FR	AR	HR	SR	AR
EXPERT 5	C1	EI	WLI	EI	MLI	GLI	MLI	MLI	AR	VHR	FR	VHR	AR	HR	AR
	C2	WMI	EI	MMI	WLI	MLI	WLI	WLI	VHR	AR	HR	FR	SR	FR	AR
	C3	EI	MLI	EI	MLI	GLI	MLI	MLI	FR	HR	AR	AR	FR	AR	VHR
	C4	MMI	WMI	MMI	EI	GLI	WLI	WLI	VHR	FR	AR	AR	SR	AR	AR
	C5	GMI	MMI	GMI	GMI	EI	WMI	MMI	AR	SR	FR	SR	AR	AR	VHR
	C6	MMI	WMI	MMI	WMI	WLI	EI	WMI	HR	FR	AR	AR	AR	AR	HR
	C7	MMI	WMI	MMI	WMI	MLI	WLI	EI	AR	AR	VHR	AR	VHR	HR	AR
GROUP OF EXPERTS	C1	EI	WLI	EI	MLI	GLI	MLI	MLI	AR	FR	WR	HR	SR	HR	VHR
	C2	WMI	EI	MMI	WLI	MLI	WLI	WLI	FR	AR	VHR	FR	VHR	FR	HR
	C3	EI	MLI	EI	MLI	GLI	MLI	MLI	WR	VHR	AR	HR	SR	HR	HR
	C4	MMI	WMI	MMI	EI	GLI	WLI	WLI	HR	FR	HR	AR	SR	FR	HR
	C5	GMI	MMI	GMI	GMI	EI	WMI	MMI	SR	VHR	SR	SR	AR	VHR	VHR
	C6	MMI	WMI	MMI	WMI	WLI	EI	WMI	HR	FR	HR	FR	VHR	AR	VHR
	C7	MMI	WMI	MMI	WMI	MLI	WLI	EI	VHR	HR	HR	HR	VHR	VHR	AR

All consistency ratios for the pairwise matrices are calculated less than 0.1, so comparisons are consistent. The linguistic statements in pairwise comparison matrices are converted to interval valued intuitionistic fuzzy reliability and restriction matrices using the scales in Table 2 and Table 3. Then, IVIF-Z evaluations for each comparison are transformed to IVIF numbers using Eqs. (22-25) and transformed interval-valued intuitionistic judgement matrices are obtained. For the aggregated analysis, individual evaluations of 5 experts are aggregated using Eq. (20) and the aggregated interval-valued intuitionistic judgement matrice is obtained and given in Table 8.

Table 8. Aggregated interval-valued intuitionistic judgement matrice

	C1	C2	C3	C4	C5	C6	C7
C1	([0.5,0.5], [0.5,0.5])	([0.281,0.415], [0.367,0.472])	([0.328,0.4], [0.299,0.355])	([0.335,0.44], [0.363,0.449])	([0.202,0.331], [0.404,0.494])	([0.297,0.41], [0.391,0.478])	([0.321,0.429], [0.373,0.46])
C2	([0.303,0.431], [0.341,0.455])	([0.5,0.5], [0.5,0.5])	([0.338,0.434], [0.313,0.392])	([0.206,0.338], [0.396,0.486])	([0.209,0.325], [0.425,0.5])	([0.232,0.356], [0.381,0.471])	([0.255,0.363], [0.39,0.464])
C3	([0.225,0.321], [0.379,0.433])	([0.251,0.362], [0.38,0.462])	([0.5,0.5], [0.5,0.5])	([0.308,0.437], [0.473,0.563])	([0.119,0.229], [0.382,0.457])	([0.251,0.308], [0.353,0.383])	([0.182,0.285], [0.33,0.405])
C4	([0.311,0.421], [0.381,0.467])	([0.344,0.454], [0.255,0.371])	([0.432,0.536], [0.359,0.464])	([0.5,0.5], [0.5,0.5])	([0.191,0.327], [0.466,0.562])	([0.338,0.439], [0.366,0.452])	([0.206,0.31], [0.304,0.379])
C5	([0.351,0.461], [0.247,0.362])	([0.396,0.478], [0.263,0.349])	([0.354,0.439], [0.153,0.248])	([0.434,0.542], [0.224,0.348])	([0.5,0.5], [0.5,0.5])	([0.431,0.539], [0.226,0.35])	([0.529,0.607], [0.281,0.393])
C6	([0.342,0.448], [0.355,0.441])	([0.352,0.455], [0.258,0.373])	([0.353,0.379], [0.276,0.313])	([0.338,0.439], [0.366,0.452])	([0.178,0.321], [0.469,0.567])	([0.5,0.5], [0.5,0.5])	([0.261,0.354], [0.329,0.404])
C7	([0.317,0.428], [0.374,0.46])	([0.359,0.445], [0.294,0.382])	([0.313,0.396], [0.198,0.294])	([0.272,0.362], [0.229,0.324])	([0.251,0.386], [0.531,0.614])	([0.3,0.387], [0.299,0.372])	([0.5,0.5], [0.5,0.5])

Normalized weights of the criteria are calculated by using Eqs. (27-31), and these weights are shown in Table 9.

Table 9. Normalized weights of decision criteria based on aggregated evaluations

	$\widetilde{w}_i$	w_i	Normalized weights	Rank
Usability	([0.091,0.191])	0.814	0.136	5
Integration	([0.083,0.178])	0.764	0.127	7
Support Services	([0.079,0.157])	0.689	0.115	6
Accessibility	([0.094,0.203])	0.852	0.142	4
Security	([0.141,0.313])	1.131	0.188	1
Reduced Costs / Fee	([0.099,0.201])	0.861	0.143	3
Personalization	([0.101,0.211])	0.889	0.148	2

The same procedure is followed for the pairwise comparison matrix that is constructed using consensus method and the normalized weights of the criteria are calculated as shown in Table 10.

Table 10. Normalized weights of decision criteria for the group evaluations

	$\widetilde{w}_i$	w_i	Normalized weights	Rank
Usability	([0.062,0.118])	0.566	0.094	5
Integration	([0.085,0.18])	0.811	0.135	7
Support Services	([0.06,0.115])	0.551	0.092	6
Accessibility	([0.095,0.203])	0.889	0.148	4
Security	([0.157,0.366])	1.183	0.197	1
Reduced Costs / Fee	([0.116,0.252])	1.028	0.171	2
Personalization	([0.106,0.233])	0.972	0.162	3

When the results obtained with the combined individual evaluations and the results of the analysis using group evaluation are compared, it is seen that the order of criterion weights is close to each other. Only the order of importance of reduced cost and personalization criteria has shifted.

Since the results obtained by the aggregation of individual assessments use more information in expressing uncertainty, the weights obtained in Table 9 will be used in the continuation of the study. According to fuzzy IVIF-Z-AHP results, security is determined as the most important criterion where integration is determined as the least important criterion. After obtaining the criterion weights with fuzzy IVIF-Z-AHP, the next step is to evaluate the alternatives by using the fuzzy IVIF-Z-WASPAS method.

The biggest limitation experienced during the alternative evaluation was the inability to find instructors who are familiar with all the alternatives. For this reason, it was decided that it would be more appropriate to take joint decisions in the focus group meeting, which was formed by the experts involved in the evaluation of the alternatives. The decision matrix which is shown in Table 11, is determined using the scale of linguistic restriction function and reliability function, according to Step 1 of the proposed fuzzy IVIF-Z WASPAS.

Table 11. Decision matrix with linguistic terms for restriction and reliability function

	Restriction Evaluations						Reliability Evaluations					
	A1	A2	A3	A4	A5	A6	A1	A2	A3	A4	A5	A6
C1	WMI	MMI	MMI	WMI	GMI	GMI	FR	HR	VHR	HR	SR	HR
C2	GMI	AMI	WMI	MMI	MMI	MLI	VHR	SR	FR	HR	HR	HR
C3	WMI	WLI	MLI	WLI	WMI	WMI	WR	FR	FR	WR	FR	FR
C4	GMI	MMI	MMI	GMI	MMI	MMI	HR	HR	HR	HR	VHR	VHR
C5	MMI	GMI	WMI	MMI	GMI	WMI	FR	HR	FR	VHR	WR	FR
C6	GMI	MMI	GMI	GMI	WMI	GMI	HR	HR	FR	FR	HR	HR
C7	AMI	MMI	WMI	GMI	GMI	WLI	SR	VHR	HR	HR	FR	VHR

Linguistic terms are converted to their corresponding IVIF-Z numbers by using IVIF scales in Table 3 and 4. Then, IVIF-Z numbers are transformed to their corresponding equivalent interval valued intuitionistic fuzzy numbers by using Eqs. (22-25) and the initial decision matrix is constructed as shown in Table 12.

Table 12. Initial decision matrix with IVIF numbers

	A1	A2	A3	A4	A5	A6
C1	([0.346, 0.416], [0.173, 0.277])	([0.420, 0.496], [0.153, 0.267])	([0.457, 0.540], [0.166, 0.291])	([0.381, 0.458], [0.191, 0.305])	([0.535, 0.624], [0.134, 0.268])	([0.458, 0.534], [0.114, 0.229])
C2	([0.498, 0.581], [0.125, 0.249])	([0.580, 0.669], [0.089, 0.223])	([0.346, 0.416], [0.173, 0.277])	([0.420, 0.496], [0.153, 0.267])	([0.420, 0.496], [0.153, 0.267])	([0.153, 0.267], [0.420, 0.496])
C3	([0.309, 0.371], [0.155, 0.247])	([0.173, 0.277], [0.346, 0.416])	([0.139, 0.242], [0.381, 0.450])	([0.155, 0.247], [0.309, 0.371])	([0.346, 0.416], [0.173, 0.277])	([0.346, 0.416], [0.173, 0.277])
C4	([0.458, 0.534], [0.114, 0.229])	([0.420, 0.496], [0.153, 0.267])	([0.420, 0.496], [0.153, 0.267])	([0.458, 0.534], [0.114, 0.229])	([0.457, 0.540], [0.166, 0.291])	([0.457, 0.540], [0.166, 0.291])
C5	([0.381, 0.450], [0.139, 0.242])	([0.458, 0.534], [0.114, 0.229])	([0.346, 0.416], [0.173, 0.277])	([0.457, 0.540], [0.166, 0.291])	([0.371, 0.433], [0.093, 0.186])	([0.346, 0.416], [0.173, 0.277])
C6	([0.458, 0.534], [0.114, 0.229])	([0.420, 0.496], [0.153, 0.267])	([0.416, 0.485], [0.104, 0.208])	([0.416, 0.485], [0.104, 0.208])	([0.381, 0.458], [0.191, 0.305])	([0.458, 0.534], [0.114, 0.229])
C7	([0.580, 0.669], [0.089, 0.223])	([0.457, 0.540], [0.166, 0.291])	([0.381, 0.458], [0.191, 0.305])	([0.458, 0.534], [0.114, 0.229])	([0.416, 0.485], [0.104, 0.208])	([0.208, 0.332], [0.415, 0.498])

Since all criteria in the initial decision matrix are benefit criteria, the maximum of the alternative scores for each criterion to be maximum is taken as the reference value. Then, the normalized decision matrix is obtained by using Eqs. (32-33) for normalization. The weighted normalized decision matrices for the weighted sum model and weighted product model are constructed using Eqs. (34-35). Then, the combined utility function values for each alternative are calculated using Eq. (36) as shown in Table 13 depending on WSM and WPM values, where λ is determined by the decision-maker to be 0.5.

Table 13. WSM, WPM and combined utility function values

	WSM	WPM	
A1	([0.441, 0.519] , [0.128, 0.244])	([0.426, 0.501] , [0.132, 0.245])	([0.434, 0.51] , [0.13, 0.245])
A2	([0.433, 0.516] , [0.15, 0.27])	([0.407, 0.495] , [0.165, 0.277])	([0.42, 0.506] , [0.157, 0.274])
A3	([0.369, 0.446] , [0.177, 0.29])	([0.346, 0.431] , [0.191, 0.297])	([0.358, 0.438] , [0.184, 0.293])
A4	([0.408, 0.485] , [0.153, 0.268])	([0.385, 0.468] , [0.164, 0.274])	([0.396, 0.476] , [0.158, 0.271])
A5	([0.42, 0.495] , [0.142, 0.262])	([0.413, 0.487] , [0.146, 0.264])	([0.417, 0.491] , [0.144, 0.263])
A6	([0.357, 0.442] , [0.199, 0.317])	([0.325, 0.422] , [0.236, 0.34])	([0.342, 0.432] , [0.217, 0.329])

Finally, the score of each alternative is determined by defuzzifying the values of the combined utility function with Eq (21) and the alternatives are ranked starting from the highest value to the lowest one. The score values and ranks of the alternatives are listed in Table 14.

Table 14. Ranking of the LMS alternatives

	Score values	Ranking
Moodle	0.4948	1
Canvas	0.4811	2
ALMS	0.4290	5
Blackboard	0.4622	4
Microsoft Office	0.4777	3
Customized LMS	0.4128	6

The results obtained in Table 14 indicate that Moodle is the most appropriate platform among the LMS platforms compared in this study for the universities in Turkiye. Also, it is observed that the second and third ranked alternatives, Canvas and MS Office, have very close score values.

To validate the proposed method, ordinary fuzzy AHP and WASPAS methods are performed using same evaluations.The results of the ordinary fuzzy AHP and IVIF-Z AHP are compared in Table 15.

Table 15. Comparison of the IVIF-Z AHP and Fuzzy AHP results

	IVIF-Z AHP		Fuzzy AHP	
	$\tilde{w}_i$	Normalized weights	Fuzzy Weights	Defuzzified Normalized Weights
Usability	([0.091,0.191])	0.136	([0.057, 0.116, 0.251])	0.116
Integration	([0.083,0.178])	0.127	([0.043, 0.091, 0.222])	0.096
Support Services	([0.079,0.157])	0.115	([0.036, 0.071, 0.152])	0.071
Accessibility	([0.094,0.203])	0.142	([0.05, 0.118, 0.281])	0.121
Security	([0.141,0.313])	0.189	([0.144, 0.324, 0.673])	0.314
Reduced Costs / Fee	([0.099,0.201])	0.143	([0.056, 0.125, 0.279])	0.125
Personalization	([0.101,0.211])	0.148	([0.065, 0.157, 0.358])	0.158

Although the ranking of the criteria according to their importance remained the same with the proposed method and ordinary fuzzy AHP, the difference between the importance weights of the criteria has decreased with the effect of the reliability of the evaluators in the proposed method.

The results of the ordinary fuzzy WASPAS and IVIF-Z WASPAS are compared in Table 16.

Table 16. Comparison of the IVIF-Z WASPAS and Fuzzy WASPAS results

	IVIF-Z WASPAS		Fuzzy WASPAS	
	Normalized Score values	Ranking	Normalized Score Values	Ranking
Moodle	0.1794381	1	0.204513	2
Canvas	0.1744789	2	0.183033	3
ALMS	0.1555592	5	0.122557	5
Blackboard	0.1676134	4	0.170527	4
Microsoft Office	0.173225	3	0.204745	1
Customized LMS	0.1496854	6	0.114625	6

According to the results given in Table 16, the relative ranking of the alternatives remains same except "Microsoft Office" alternative. Again IVIF-Z WASPAS results in closer score values between alternatives than the ordinary fuzzy WASPAS method because of the reliabilities of the linguistic evaluations. The results of the comparison showed that, as expected, rankings are formed that are close to each other but differ under the effect of the additional uncertainty taken into account.

SENSITIVITY ANALYSIS

One-at-a time sensitivity analysis has been performed for investigating the robustness and validation of the proposed IVIF-Z CODAS methodology. When the weight of the "usability" criterion is taken into account and the weights of the other criteria are updated according to their relative importance, the first change in the rankings of alternatives occurs after a 24% increase or 89% decrease, where the first alternative remains the same. The first alternative changes only after the weight of the "usability" criterion is increased by 65%. The results of the sensitivity analysis for each criterion are given in Table 17.

Table 17. Sensitiviy Analysis Results

	Q1	Rank	Q2	Rank	Q3	Rank	Q4	Rank	Q5	Rank	Q6	Rank	Q7	Rank
Decrease in the weight of the criterion that first affects the alternative ranking	89%	1 2 5 4 3 6	18%	1 3 5 4 2 6	73%	1 2 5 3 4 6	never		23%	1 3 5 4 2 6	61%	1 3 5 4 2 6	67%	1 2 6 4 3 5
Decrease in the weight of the criterion that first affects the first-ranked alternative	never		never		85%	2 1 5 3 4 6	never		never		never		80%	2 1 6 4 3 5
The increase in the weight of the criterion that first affects the alternative ranking	24%	1 3 5 4 2 6	11%	2 1 5 4 3 6	16%	1 3 5 4 2 6	78%	1 3 5 4 2 6	77%	2 1 5 4 3 6	165%	1 2 5 3 4 6	197%	1 2 5 3 4 6
The increase in the weight of the criterion that first affects the alternative in the first place	65%	2 3 5 4 1 6	110%	2 1 5 4 3 6	279%	2 4 6 5 1 3	605%	2 6 5 1 4 3	77%	2 1 5 4 3 6	600%	2 5 3 4 6 1		never

According to these results, due to the fact that the weights of the alternatives are close to each other, the decrease or increase in the weights of the alternatives affects the selected alternative only with very large percentage changes. It has also been observed that the reduction of the alternative weights hardly changes the first-order alternative. This shows that the results of the study are robust.

CONCLUSION AND FURTHER RESEARCH

With the changing dynamics, online education has become more common. The effect of the tools used, especially the LMS platforms, on the quality of education cannot be denied. Therefore, in this study, it is aimed to examine the features expected from LMS platforms and to compare existing LMS platforms in line with these features. For this purpose, IVIF-Z numbers are defined for the first time in this study, and AHP and WASPAS methods are adapted as the proposed new fuzzy extension. The results of the proposed methods are compared with the ordinary fuzzy methods for validation. Additionally, one-at-a time sensitivity analysis has been performed for investigating the robustness and validation of the proposed methodology.

The most important limitation of this study is the inability to reach an expert who uses all alternatives in his/her lectures. In order to minimize the effect of this limitation, the group decision making process was preferred for the evaluation of alternatives.

For further researches, it is suggested to apply IVIF-Z number scales to the other multicriteria decision-making methods. It is also suggested to compare several fuzzy extensions of the same methods to determine the effects of the amount of uncertain information considered in the analysis.

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FACTORS AFFECTING TEACHERS' ONLINE LEARNING EXPERIENCES IN PROFESSIONAL DEVELOPMENT PROGRAM: STRUCTURAL EQUATION MODELLING

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ABSTRACT

There is a sudden transition in education during this pandemic era of COVID-19. Students' learning which is previously conducted in an offline face-to-face meeting should shift to online learning. This sudden change surely affects students' learning experience. In the attempt to create a better online learning, this study investigates the interplay of the factors affecting participants' online learning experience namely self-directed learning and TPACK (Technological, Pedagogical, and Content Knowledge). A quantitative study using Partial Least Square- Structural Equation Modeling (PLS-SEM) model analysis was employed to explore this issue. A total of 434 in-service teachers joining an online Teacher Professional Development program participated in this study. The results show that Self-directed learning and TPACK are positively and significantly associated with online learning experience. It indicates that students with high self-directed learning skills and TPACK are predicted to have a positive and satisfying online learning experience. Further implication for pedagogy and future research recommendation is discussed.

Keywords: COVID-19, online learning, self-directed learning, TPACK.

INTRODUCTION

Pandemic era of COVID-19 has started in 2020 and has not ended yet. During this era, many sectors, including education, has been forced to adapt to this "new normal" era where offline meetings are limited and shortened. As teacher education is essential, government attempts to conduct it even in this "crisis". In Indonesia, in which this study was conducted, teacher education, or known as teacher professional development (TPD), was conducted virtually using Learning Management Systems (LMS) for avoiding the spread of the virus. While prior years give opportunities to teachers to upgrade their skills in offline programs, in this new era, they are accustomed to join it virtually. This forced condition surely has various impacts depending on many factors. Furthermore, teachers, specifically in Indonesia, struggled in facing online TPD due to lack of ICT literacy and skills (Sari, 2012; Widodo & Riandi, 2013). This phenomenon was seen from the lower participation on the online sessions compared to the face-to-face sessions. Voogt & Mckenney (2016) augmented that teachers faced difficulties in using technology in their courses. However, it surely depends on many factors. Every individual should have different impact of the sudden online learning implication.

While researchers proved the effectiveness of online learning (Harasim, 2017), others reported differently. The studies of Hart et al. (2019) and Panigrahi et al. (2018) reported that students struggled in online learning. This issue also probably happens to in-service teachers who are joining an online TPD. Furthermore, many skills are required to support teachers' success in online TPD. Maksum et al. (2021) showed that self-directed learning support online learning in a way where the participants have positive and satisfying learning experiences. However, since the context and subjects are different, the effect of self-directed learning skills for in-service teachers' joining an online TPD remains least explored.

Looking at the importance of TPD, it is no wonder that teacher professional development (TPD) has been a research interest for years. Reeves & Li (2012) reported that teachers viewed online TPD to be as effective as a face-to-face one. Meanwhile, Sato & Haegele (2017) examined PE teachers' experience in joining an online TPD and found that the teachers, despite its limited time of face-to-face meetings, experienced positive learning experiences. In the same year, [Rodesiler] reported an online teacher-developed professional program gave positive impact for teachers' development. Marin et al. (2018) explored how to support teachers in online collaboration in the case of teacher professional development. They found that prior learning experience is essential in online collaborative learning and that their proposed platform, ILDE, was somehow able to solve this problem. In 2019, Li et al. informed that teachers in rural area had positive perception of easy-of-use, usefulness, and satisfaction from an online TPD. Quinn et al. (2020) examined the challenges of an online professional learning and development (PLD) faced by teachers in rural area. They proposed that online PLD needs more technological supports and suitable approach for teachers in rural area. Last, Deiaco et al. (2021) found that videos, interactive activities, discussion forums were the activities fostering teachers' critical reflection which benefits for their future classes.

Viewed from those prior studies, students' online learning experience in TPD was frequently explored. However, while online learning experience may determine the success of an online TPD, the factors affecting this learning experience was rarely examined. To respond to this issue, this current study aims to find out the interplay of self-directed learning and TPACK to the students' online learning experience in a LMS-based online TPD using exploratory factor analysis with Partial Least Square- Structural Equation Modeling (PLS-SEM) model analysis. This study will shed light on the factors affecting online learning experience to create an effective and successful online TPD.

LITERATURE REVIEW

Online TPD

In joining an online TPD, one of required skills needed by students is self-directed learning. Those with this skill are eventually able to manage, maintain, monitor, and evaluate their learning which leads them into a successful and satisfying learning experience. Wong (2020) reported that students with high skill of self-directed learning, as well as in-service teachers joining an online TPD, have more benefits in online learning than those with the lower one. This skill probably leads them into a more positive view of online learning. Furthermore, Maksum et al. (2021) proved that self-directed learning skills contributed positively to the learning outcomes and experiences. It indicates that self-directed learning skills are required in achieving a successful online learning.

Researchers studied on how to improve and facilitate self-directed learning for years. Ladell-thomas (2012) designed a web-based module to facilitate the students in learning independently. This module somehow facilitated the students in their independent learning and improved their self-directed learning skills. Lai et al. (2016) reported that online platform training gave opportunities for the students to enhance their self-directed learning skills, specifically in using technology to support their learning. Furthermore, students' motivation also affected their willingness to join an online course (Song & Bonk, 2016). Also, Kara (2021) showed that self-directed learning skills, students' motivation, and students' characters were predictors to achieve a successful online learning. It indicates that students need to pay attention to these factors to achieve a successful online learning.

TPACK and Online Learning for Teacher Professional Development

TPACK (Technological Pedagogical and Content Knowledge) is a framework designed to achieve effective teaching and enhance students' learning using technology (Dimitrios & Athanassios, 2019). It means that this framework has aims to use technology effectively to support teaching and learning process. The study conducted by Chai et al. (2013) proved that TPACK is able to examine teachers' knowledge and skills in conducting class using ICT. Furthermore, this framework was also used to design and examine TPD which aims to integrate technology into classroom practices (Chai et al., 2017; Foulger et al., 2017). There are three main components of TPACK namely (1) Technological Knowledge (TK), (2) Content Knowledge (CK), and (3) Pedagogical Knowledge (PK) (Koehler et al., 2013).

Technological Knowledge (TK) is related to the teachers' knowledge of technologies which can support their teaching (Spector et al., 2014). This kind of knowledge is surely important when teachers join an online TPD and teach the students in their class. Specifically during this pandemic era of COVID-19, technological knowledge (TK) is essential to support teaching and learning process (Crawford et al., 2020). Furthermore, lack of this knowledge impedes teachers in learning and teaching since the whole activities are done using technologies. Sancar-tokmak & Yanpar-yelken (2015) reported that teachers' confidence in using technologies improved as they have prior experiences in using the technology (i.e. creating digital stories). Another study conducted by Rets et al. (2020) showed that teachers' TPACK developed through experiencing a virtual exchange (VE). It indicates that prior learning experience is closely related to teachers' TPACK development and confidence. Furthermore, Nazari et al. (2019) emphasized that experienced and novice teachers have differences in technological knowledge (TK). As predicted, novice teachers, who are commonly younger than experienced teachers, have higher technological knowledge (TK) than experienced teachers.

Content Knowledge (CK) is the teachers' knowledge on the subject they teach (Spector et al., 2014). When teachers have limited content knowledge (CK), they surely will not be able to teach well. Makumane (2021) showed that students in an online TPD supported online learning as it can be accessed anywhere and anytime. They enjoy online learning as they can somehow apply the same teaching method in their own classroom. Furthermore, their factual perception or content knowledge is influenced by their habitual perceptions (pedagogical knowledge) which means that their preference of the teaching method affects their online learning' acceptance.

Pedagogical Knowledge (PK) is the teachers' knowledge of pedagogical practices such as teaching strategies and methods to help students' learning (Spector et al., 2014). Nazari et al. (2019) reported that experienced teachers have higher Pedagogical Knowledge (PK) than novice teachers. The reason is probably because experienced teachers have many teaching experiences and have taught students from different backgrounds that their teaching strategies are milled and improved simultaneously. Having high pedagogical knowledge will somehow ease them in learning the materials in online TPD, so they are predicted to have enjoyable learning experience.

Research Model and Hypothesis

The research purpose is to examine the the interplay of self-directed learning and TPACK to the students' online learning experience. Reviewing the theories and previous studies, the three variables, namely TPACK, Self-directed learning, and online learning experience, are expectedly associated to one another. Students with high self-directed learning skills and TPACK can be assumed to have positive and satisfying online learning experience. Figure 1 represents the conceptual framework with eight potential hypotheses.

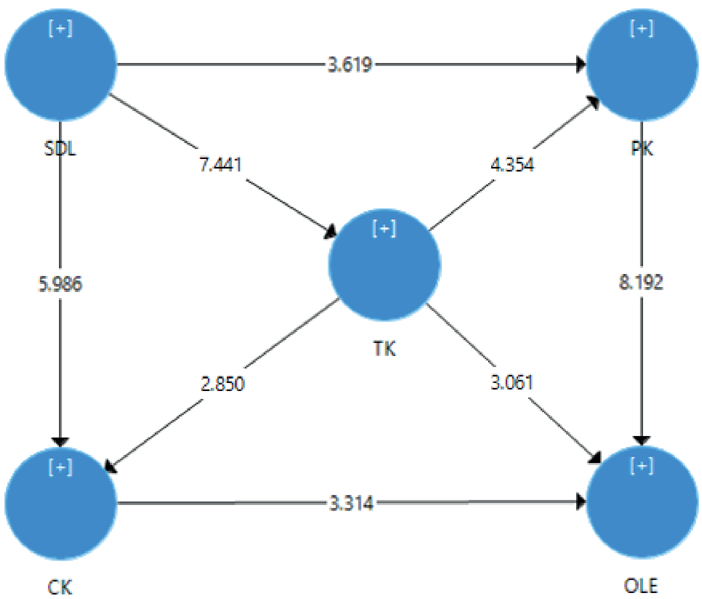

Figure 1. The conceptual framework

Looking at the conceptual framework, explicitly stated, this study tested these eight hypotheses as follows:

H1: Content Knowledge (CK) is associated with online learning experience.

H2: Pedagogical Knowledge (PK) is associated with online learning experience.

H3: Self-directed learning is associated with Content Knowledge (CK).

H4: Self-directed learning is associated with Pedagogical Knowledge (PK).

H5: Self-directed learning is associated with Technological Knowledge (TK).

H6: Technological Knowledge (TK) is associated with Content Knowledge (CK).

H7: Technological Knowledge (TK) is associated with online learning experience.

H8: Technological Knowledge (TK) is associated with Pedagogical Knowledge (PK).

Also, since this study examines the interplay of self-directed learning (SDL), technological pedagogical and content knowledge (TPACK), and online learning experience, this research questions are stated as follows:

RQ1: Is self-directed learning (SDL) associated with technological pedagogical and content knowledge (TPACK)?

RQ2: Is technological pedagogical and content knowledge (TPACK) associated with online learning experience?

METHOD

Research Design and Data Collection

This exploratory research examined the factors (i.e., self-directed learning, technological knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK)) affecting students' online learning experience regarding LMS implementation for teacher professional development program in Indonesia, specifically in this pandemic era of COVID-19. This study employed quantitative approach using Partial Least Square-Structural Equation Modeling (PLS-SEM) (Ringle et al., 2015) model analysis. It was conducted from November to December 2021. The participants were students, who are in-service teachers, joining a Teacher Professional Development (TPD) program named Pendidikan Profesi Guru (PPG) in two universities in Papua, Indonesia. The participants were 434 in total (female = 76% and male = 24%). Furthermore, the participants were in various major namely early childhood education (42%), mathematics (12%), Chemistry (25%), and physics (21%). The number of the online classes in last year were 1-5 classes (54,9%), 6-10 classes (21,1%), and >10 classes (14,1%).

Research Instrument

Google form-based online questionnaires were employed to gather the data. The variables of this study were technological-pedagogical-content knowledge (TPACK), self-directed learning (SDL), and online learning experience (OLE). The researcher adapted the instrument from the previous study conducted by Schmid et al. (2020)which beside their inherent methodological limitations present constraints related either to the validity, reliability, or practical applicability of existing instruments. Furthermore, the internal structure of the TPACK framework is a topic of debate. The two goals of this study were (1 for the TPACK variable, Chung et al. (2020) for the self-directing learning variable, and Okwumabua et al. (2011) for the online learning experience variable. This study formulated 12 questionnaire items to do the measurement. The researcher conducted a back translation in the instrument by translating the language from English to Indonesia which was done by a doctoral student majoring in translation study. This study used 5-point Likert scale with 1 = very disagree to 5 = very agree. Besides, the researcher also gathered demographic information of the participants in the instrument such as their gender, discipline, time using laptop, and time spending to access internet. Furthermore, to adapt to the context and conditions of the participants who came from Papua, the researcher ensured the reliability and validity of the instrument by carrying out several stages. First, this study used face validity by involving three experts from the fields of education, linguistics, and technology. Based on the face validity, the experts revised two items on Content Knowledge (CK) and one item on Self-directed learning (SDL). Then, the researcher also involved five potential participants in conducting content validity. Then, this study evaluated the reliability and validity of the items by conducting pilot testing on 50 PPG program students at other universities in Papua. The data obtained from the pilot testing was then analyzed using the SPSS 23 program with the results of Cronbach's alpha = .813 and r value = .62 - .82. Thus, the instrument is categorized as having a good degree of reliability and validity.

Data Analysis Procedures

This study employed PLS-SEM analysis rather than CB-SEM since an exploratory research is unsuitable to be conducted using CB-SEM which is commonly used to confirm established theory (Joe F. Hair Jr. et al., 2017) knowing the appropriate technique can be a challenge. For example, when considering structural equation modelling (SEM. The researcher used the SmartPLS 3.2 (Ringle et al., 2015) software in conducting PLS-SEM analysis. This study designed a reflective model based on the focus of the variables. In evaluating the reflective model, the researcher carried out two stages of analysis, namely measurement model and structural model assessment (Joseph F Hair Jr et al., 2021). In conducting the measurement model assessment, this study formulated the model (inner and outer). Then, the researcher analyzed the outer model to obtain the value of indicator loading, internal consistency reliability, convergent validity, and discriminant validity. Last, the study conducted a structural model assessment to obtain the value of Variance Inflation Factor (VIF), path coefficients, coefficient determination, and effect size.

FINDINGS

Measurement Models

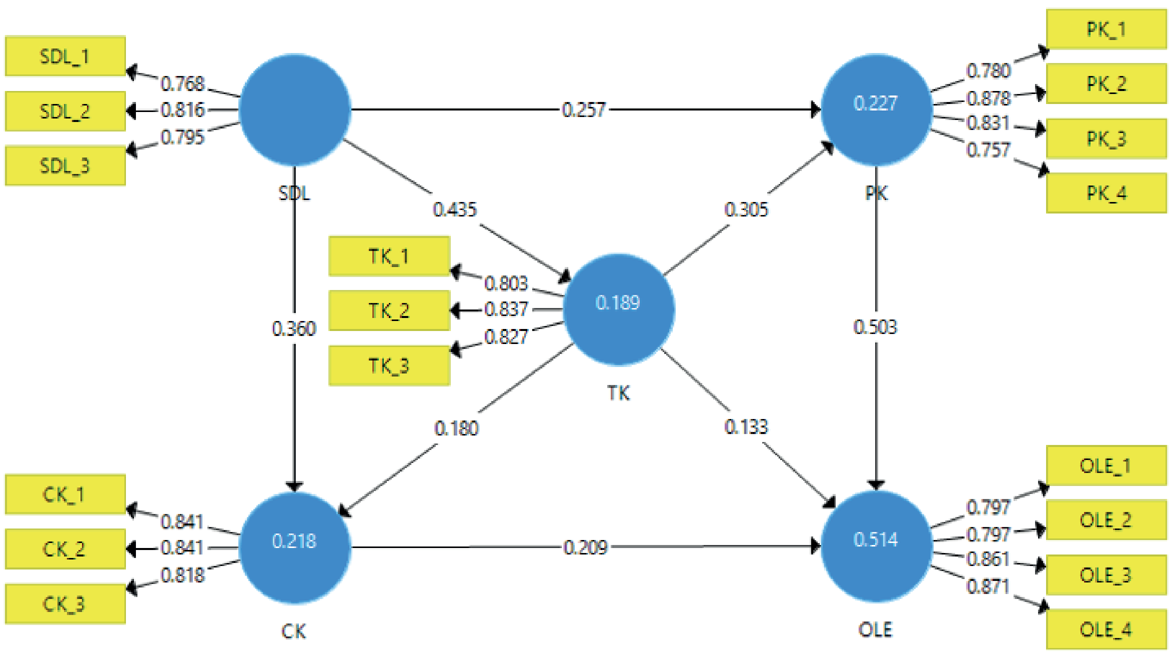

Figure 2. The proposed model

In carrying out the measurements model assessment, the researcher took the first step by proposing a specification model. The specification model (see Figure 2) is categorized as a reflective model where the construct is manifested in Hair indicators. In detail, the exogenous construct contained in the model is self-directed learning (SDL) which has three indicators. Then, the exogenous and endogenous model includes pedagogical knowledge (PK) with four indicators, technological knowledge (TK) and content knowledge (CK) with three indicators for each. Last, the endogenous construct is online learning experience (OLE) with four indicators.

Outer Model Evaluation

Table 1. Measurement model of reflective construct

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE
CK	0.781	0.783	0.872	0.695
OLE	0.851	0.853	0.900	0.693
PK	0.828	0.835	0.886	0.661
SDL	0.706	0.712	0.836	0.629
TK	0.764	0.775	0.863	0.677

Then, this study conducted an outer model evaluation to ensure the validity and reliability of the instrument by assessing the indicators. This stage was used to obtain the value indicator loading, Cronbach's Alpha, composite reliability, Average Variance Extracted (AVE), Fornell-Larcker criterion, Heterotrait-monotrait Ratio (HTMT). Indicator loading (see Figure 2.) in the construct SDL = 0.768-0.816, TK = 0.803-0.837, PK = 0.757-0.878, CK = 0.818-0.841, OLE = 0.797-0.871. Based on the loading indicator obtained in the range of 0.757-0.871, the range of numbers met the recommended threshold of > 0.708 (Joseph F. Hair et al., 2019), so convergent validity was achieved. Furthermore, in ensuring internal consistency reliability, this study referred to Cronbach's alpha (α) and composite reliability (CR) scores (see Table 2). The score is above the recommended threshold > 0.600 (Tavakol & Dennick, 2011) and the composite reliability obtained is above the recommended threshold, which is between 0.70-0.90 (Joe F. Hair et al., 2014). Furthermore, the AVE obtained is in the range of 0.629-0.695 which is in accordance with the recommended minimum threshold of 0.500 (Joe F. Hair et al., 2014).

Table 2. Fornell-Larcker criterion

Construct	CK	OLE	PK	SDL	TK
CK	**0.834**				
OLE	0.554	**0.832**			
PK	0.597	0.683	**0.813**		
SDL	0.438	0.372	0.390	**0.793**	
TK	0.336	0.412	0.417	0.435	**0.823**

In evaluating discriminant validity to ensure that each construct is different from other constructs, so this study expanded the analysis by comparing the scores on the Fornell–Larcker criterion with the AVE. The obtained value on the AVE must be lower than the value on the shared variance of all constructs in the Fornell–Larcker criterion. Based on the score for the Fornell-Larcker criterion (see bold value in Table 3), the obtained score is higher than the score in the AVE (see Table 2). Finally, the researcher evaluated the acquisition value on the Heterotrait-Monotrait-Ratio (HTMT) with a threshold not exceeding 0.850 (Joseph F Hair Jr et al., 2021). The obtained values in HTMT (see Table 4) are in the range of 0.426-0.808. Based on the obtained value in the AVE analysis, Fornell–Larcker criterion, and HTMT, it can be concluded that discriminant validity was achieved.

Table 3. HTMT

Construct	CK	OLE	PK	SDL	TK
CK					
OLE	0.675				
PK	0.744	0.808			
SDL	0.582	0.485	0.506		
TK	0.426	0.501	0.505	0.585	

Structural Model Assessment

Then, the researcher conducted a structural model assessment. The first step was to conduct a collinearity test to obtain the Variance Inflation Factors (VIF) value. This stage was carried out to ensure that there was no multicollinearity issue that can impact the patch significance test which can be affected by reliability and validity (Kock & Lynn, 2012). The threshold required in the VIF is not more than 3,300 (Joseph F Hair Jr et al., 2021) . The obtained value of VIF (see Table 5) is in the range of 1,000-1,693 on the five constructs. Based on these figures, it can be concluded that there is no issue of multicollinearity.

Table 4. VIF Values

Construct	CK	OLE	PK	SDL	TK
CK		1.578			
OLE					
PK		1.693			
SDL	1.233		1.233		1.000
TK	1.233	1.228	1.233		

Then, this study conducted a boostrap using the significance level of 0.05. Based on the results of the path analysis (see Figure 3), each value in each construct shows (+1) which is categorized as having a strong positive relationship (Joe F. Hair et al., 2014). The next stage was the hypothesis examination using the t-value criteria > 1.96 which is used as a reference in accepting the hypothesis based on the significance level of 0.05 (Joseph F. Hair et al., 2019). Based on the t-value (see T statistics in Table 6), it shows that all the hypotheses formulated are accepted. SDL is a significant predictor for PK ($\beta = 0.257$; $t = 3.619$; $p < 0.000$); TK ($\beta = 0.435$; $t = 7.441$; $p < 0.000$); and CK ($\beta = 0.360$; $t = 5.986$; $p < 0.000$). Meanwhile, TK is a significant predictor for PK ($\beta = 0.305$; $t = 4.354$; $p < 0.000$) and CK ($\beta = 0.180$; $t = 2.850$; $p < 0.005$). Furthermore, PK, TK, and CK are the significant predictor for OLE ($\beta = 0.503$; $t = 8.192$; $p < 0.000$); ($\beta = 0.133$; $t = 3.061$; $p < 0.002$); ($\beta = 0.209$; $t = 3.314$; $p < 0.001$).

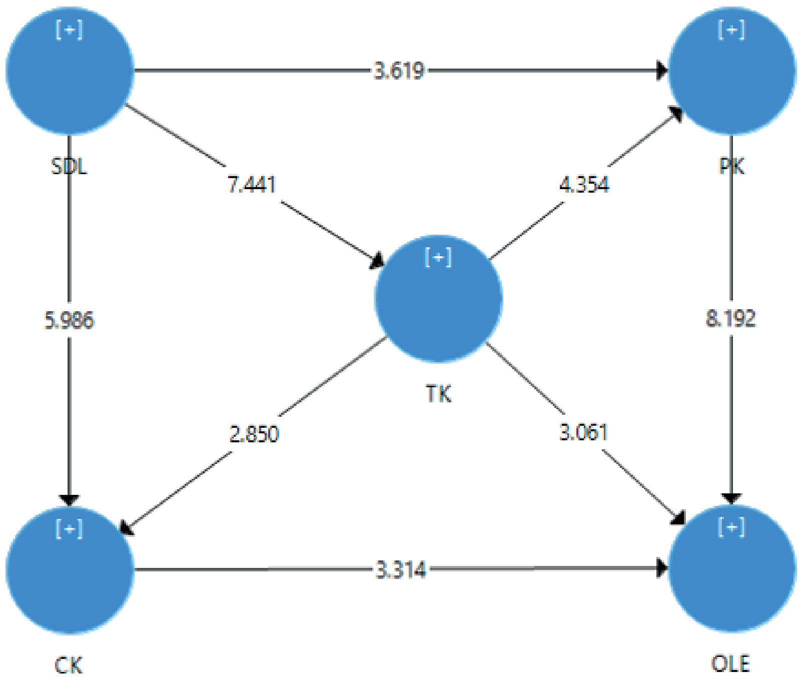

Figure 3. Bootstrap results for path analysis

Table 5. Summary of the final result

Path	β	Mean	SD	T Statistics	P Values	Sig
SDL -> PK	0.257	0.262	0.071	3.619	0.000	Yes
SDL -> TK	0.435	0.436	0.058	7.441	0.000	Yes
SDL -> CK	0.360	0.366	0.060	5.986	0.000	Yes
TK -> PK	0.305	0.300	0.070	4.354	0.000	Yes
TK -> CK	0.180	0.176	0.063	2.850	0.005	Yes
PK -> OLE	0.503	0.505	0.061	8.192	0.000	Yes
TK -> OLE	0.133	0.134	0.043	3.061	0.002	Yes
CK -> OLE	0.209	0.211	0.063	3.314	0.001	Yes

Table 6. Coefficient determination (R^2)

	R Square	R Square Adjusted	Consideration
CK	0.218	0.212	Substantial
OLE	0.514	0.508	Moderate
PK	0.227	0.221	Substantial
TK	0.189	0.186	Substantial

Furthermore, the researcher performed an analysis to obtain the coefficient of determination (R^2) which is the variance proportion parameter to determine how exogenous variables can predict endogenous variables. There are three levels namely 0.75, 0.50, 0.25 (substantial, moderate, weak) (Joe F. Hair et al., 2014). The R^2 value (see Table 7) shows that only OLE has moderate level coefficient of determination. Meanwhile, other variables (CK, PK, and TK) have a substantial level. Then, the last analysis step is to determine the effect size (f^2). f^2 has a range of levels in the form of .02, .15, and .35 (small, medium, large) (Joseph F Hair Jr et al., 2021). Based on the results of the analysis (see Table 8) CK and TK have a small effect, while PK and SDL have a medium effect.

Table 7. Effect size (f^2)

Construct	f^2	Effect size
CK	0.057	small
PK	0.307	medium
SDL	0.146	medium
TK	0.054	small

DISCUSSIONS

This study aimed to explore the factors affecting students' online learning experience as they joined an online TPD using Learning Management System (LMS) in universities in Indonesia. The students here are in-services teachers from childhood education, mathematics, Chemistry, and physics. The analysis of this study reveals that there is a positive and significant relationship between Content Knowledge (CK) and online learning experience, Pedagogical Knowledge (PK) and online learning experience, Self-directed learning and Content Knowledge (CK), Self-directed learning and Pedagogical Knowledge (PK), Self-directed learning and Technological Knowledge (TK), Technological Knowledge (TK) and Content Knowledge (CK), Technological Knowledge (TK) is associated with online learning experience, and also Technological Knowledge (TK) and Pedagogical Knowledge (PK). Thus, all eight hypotheses of this study were accepted.

The first, second, and third results show that Self-directed learning is positively and significantly associated with Pedagogical Knowledge, Technological Knowledge, and Content Knowledge. It indicates that students' good self-directed learning skills coincide with the higher Technological, Pedagogical, and Content Knowledge (TPACK). As students with self-directed learning manage to maintain, monitor, and evaluate their learning (Wong, 2020), they will surely manage to learn more easily than those with low self-directed learning skills in comprehending the knowledge including TPACK, specifically in an online TPD in which this study was taken in. Having good self-directed learning makes students motivated and interested in the learning (Cho et al., 2021). This high motivation leads the students to learn more about the materials in their class, including TPACK, and it results in their TPACK development. The finding of this present study informs another predictor affecting students' TPACK, specifically in online learning.

The fourth and fifth results show that Technological Knowledge (TK) is positively and significantly associated with Pedagogical Knowledge (PK) and Content Knowledge (CK). These findings indicate that having high Technological Knowledge will make the students, who are in-service teachers, have Pedagogical Knowledge and Content Knowledge, specifically in online learning. These findings inform how those students, who are in-service teachers, manage their class after finishing their online TPD and starting teaching in their own classes. As teaching online requires different technological skills and pedagogical approaches that offline face-to-face learning (Gurley, 2018), when teachers have good technological knowledge, they will somehow manage their teaching strategies and improve their knowledge of the subject' content they teach, supported by their technological knowledge. Furthermore, Howard et al. (2020) reported that due to sudden transition from face-to-face learning to online learning, teachers have only limited time to upgrade their skills and prepare the courses which may results in the decreasing of the teaching and learning quality. This problem may be solved easier when the teachers have good technological knowledge. They will be more ready to upgrade their skills and subject materials which are easily found online.

The sixth, seventh, and eighth results show that Pedagogical Knowledge (PK), Technological Knowledge (TK), and Content Knowledge (CK) are positively and significantly associated with Online Learning Experience. It indicates that students' TPACK affects their online learning experience. Students with high TPACK should have more positive and satisfying online learning experience. As reported by Rets et al.'s (2020) that teachers' TPACK were developed through joining an online courses, this finding somehow gives new additional insight that students' TPACK supports online learning experience positively. Nasri et al. (2020) revealed that the forced shift from face-to-face learning to online learning may be stressful for both the teachers and students, so they will need something to support them adapt to this new learning technique. This TPACK may be the solution to solve problems regarding technology in online learning. Furthermore, Badiozaman (2021) showed that technological competence affects students' readiness in online learning. It means that when the students are more ready to join online learning for having good technological competence, they will surely have more positive online learning experience. In sum, this finding that TPACK may give support and ease online learning can be a consideration to improve this TPACK to achieve a more effective, positive, and satisfying online learning experience.

As this study' model represents, self-directed learning skill also indirectly affects the students' online learning experience. This finding somehow supports Maksum et al.'s (2021) that self-directed learning skills affect online learning outcomes and experiences. It probably happens because students with good self-directed learning skills will be able to manage their learning better than those with low self-directed learning skills. It implies that those with good skills in managing their learning may have positive and satisfying online learning experience. However, this finding cannot be generalized to students with different learning styles. Students who expect structured learning will be somehow anxious when they are asked to manage their learning independently (Randi & Corno, 2021). Students with this learning style may prefer guidance and close supervision from their teachers. Still, this topic is beyond this study's scope. Thus, it needs further investigation to confirm the findings.

CONCLUSION

This study investigated the interplay of factors affecting online learning experience namely self-directed learning and TPACK. The results show that there is a positive and significant relationship between self-directed learning, TPACK, and online learning experience. In sum, this study indicates that students' self-directed learning skills and TPACK (Technological, Pedagogical, and Content knowledge) affect their online learning experiences. Students with high self-directed learning skills and TPACK are predicted to have positive, effective, and satisfying online learning experiences.

This study contributes on how to create an effective and satisfying online learning experience by informing the factors affecting their online learning experience namely self-directed learning skills and TPACK. Thus, educational practitioners should consider these factors in conducting online learning. They may provide trainings on how to do self-directed learning and how to use technology to support the students' learning. Otherwise, students are not able to "enjoy" online learning with these skills. Also, as online learning requires more technological supports, government and educational practitioners may support online learning by providing adequate technological supports.

Despite its findings and contribution, this present study has limitations. First, the participants of this study are in-service teachers, so the results may be applied for pre-service teachers who may have different characteristics and condition. Similar research with different participants, for instance pre-service teachers, may be worthwhile to conduct. Second, this study was conducted in Papua, Indonesia, in which technological supports were limited. Further studies may address students with better technological supports, for instance in a big cities with enormous technological supports, to obtain different views regarding this issue. Last, this study only employed quantitative data, so future studies may use various data, for instance interview and document analysis, to enrich the results.

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UZEP: A CLOUD-BASED DISTANCE EDUCATION PLATFORM FOR HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

Covid-19 coronavirus pandemic has affected higher education institutions all over the world, causing face-to-face education to cease. Schools have tried to carry out educational activities through online teaching either by using on premise infrastructure or by leasing cloud based online platforms. Although these platforms are convenient, most of them do not meet all the requirements for higher education institutions. Not knowing where the personal data is stored in a public cloud creates another problem for some countries according to laws. In this study, a new online learning platform has been developed for higher education institutions to solve these problems using state-of-the-art cloud technologies. The new system enables implementation of individual curricula of many higher education institutions in one software system, and it can be taken into service quickly in emergencies. It expands dynamically by activating a large number of streaming servers to meet the demand. The new system provides easy to use-learn interfaces, offers an economical solution for e-learning by sharing the resources, and compliant with the law on protection of personal data. The new platform was in service at 12 universities in Turkiye during the fall 2020, and its performance was measured with surveys at various levels.

Keywords: Distance education, internet based online learning, online assessment, educational technology, Covid-19.

INTRODUCTION

Covid-19 coronavirus pandemic has affected higher education institutions all over the world, causing face-to-face training to cease. In the beginning, some institutions postponed their education programs considering pandemic lasts soon, while others with ready infrastructure switched to online learning immediately. For more than a year, online learning platforms have been the main tool of education at almost all levels. Some online platforms are required to work on university servers due to their architectural structure, some of them are used by leasing on the public cloud. Very few universities have sufficient infrastructure on their premise, most of them had to lease from the market such as Zoom, Google-Classroom or Microsoft Teams. However, most of these online learning platforms are not very well match for higher education institutions since they are designed broader considerations. Although cloud based approaches are more economical solution, protection of personal data becomes an issue at some countries since they store the personal data (student and teacher records) in a public cloud.

After online learning became the only training method, some other problems have come to scene as well that need to be worked out for higher education to be still effective as much as face-to-face training. Some of these can be listed as rapid adaptation of instructors and students to the new teaching environment, how to perform education at courses with practical contents and exam safety etc. It was observed that before the pandemic, most of the teachers had low performance in focusing on innovation, research and dissemination in online learning, and experienced problems such as negative perception, material development and getting used to the system during the pandemic period (Akbulut et al., 2007). At the student level, the increase in negative perceptions of online learning, learning motivation problems, digital competence deficiencies and cheating behaviors have been an important problem (Bozkurt and Sharma, 2020; Lee et al., 2021).

The disadvantage of online learning is not the physical distance, but the communicative and psychological gap that can lead to misunderstanding between student and teacher. In order to eliminate this gap, the student must effectively communicate and interact with the content, instructor, other students and the platform (Moore, 1989). Hence, online platforms should be supported with interactive and collaborative student-centered learning by providing other components such as the learning management system and assessment and evaluation tools (Bonk, 2020). The way to provide communication and interaction here is the use of technology, and the educational institution must be effective in providing the infrastructure and use of this technology.

Computers, mobile systems, data communication networks and software technologies, which are the cornerstones of online learning infrastructure, are developing at a dizzying speed. In particular, developments in video distribution techniques have resulted in Internet television, and the rate of watching live and on-demand video channels such as You Tube and Netflix has increased. There are many commercial and scientific studies in which developing video distribution techniques that are adapted for online learning systems. Examples of open source and commercial applications can be given as BigBlueButton, Adobe-Connect, Zoom, Kalkuta, Skype, Microsoft-Teams and Google-Meet etc. Higher education institutions should not stay away from these technological studies and achievements; however, it may be both difficult and wasteful for every university to specialize in these areas.

Purpose of the Study

This study aims to develop and evaluate a learning management system that can meet the distance education needs of educational institutions in emergency situations, which can be easily integrated with the software currently in use and horizontally extended as needed to meet immediate high demands. The prominent features of the new system can be counted as being easy to learn and use, scalable and in compliant with the law on protection of personal data. Within the scope of the study, first a technological model was created and then a prototype system has been implemented. The new system includes a specially designed modules for higher education institutions such as learning management system that supports document sharing and communication, online assessment and evaluation tools. The new system was implemented using *Education as a Service (EaaS)* cloud model, and called as UZEP.

RELATED WORK

Distance education has been in use for years in different ways by using various technologies. It is a form of education in which the teaching takes place in a different environment from the place where it is offered, and in which learning requires special methods of communication through special course design techniques, special teaching methods, electronics and other technologies as well as special organizational and managerial arrangements (Moore and Kearsley, 2011). In order for an education to be distance education, the teacher and the student should be in different places during the learning process. In this case, it is necessary to use technological media such as printed material, sound, video, Internet and computer to provide two-way interaction in order to bring the teacher and the student together. The educational institutions play important roles in the planning of distance education, the preparation of learning materials and the provision of student support services (Keegan, 1996).

Models used in distance education can be synchronous or asynchronous, passive or interactive depending on the purpose and the tools used. For example, in a simultaneous interactive model, the lectures given by the lecturer can be followed by the students in different environments at the same time, and the students can ask questions and get answers to the lecturer within the given time. Here, students can be completely dispersed or in groups. However, in the asynchronous interactive model, students can access the audio and visual course material prepared by the instructor via the Internet at any time and send their questions to the instructor via e-mail. If the model used is synchronous-interactive, the required infrastructure is more expensive than the asynchronous-passive model, for example. Additional consultancy and written documentation are required in order not to compromise the quality of the training in all models. Both synchronous and asynchronous models can only operate with a sufficient Internet infrastructure, but the synchronous model requires uninterrupted and wider bandwidth. Although these components such as LMS and teaching modules exists in both models, they differ in their functions that they perform. For example, on platforms where courses are operated synchronously, virtual classrooms should be organized priori and the training activities should be conducted on time according to weekly programs.

Depending on the needs, a synchronous or asynchronous training model is preferred for teaching. For example, asynchronous learning may be a more suitable model for reaching learning resources at any time or continue learning at individual learning pace. However, when face-to-face training stopped due to the Covid-19 pandemic, synchronous education has become the widely preferred model at educational institutions such as K-12 and universities. In fact, Internet based platforms that implement synchronous model usually provide asynchronous access to recorded course video later. However, the opposite is not true.

The modules in which training activities are carried out on the platform structure also shows significant differences depending on synchronous or asynchronous. Synchronous platforms deliver the training activity to participants in digital form instantly. Asynchronous platforms, on the other hand, provide uploading, downloading or watching tools for training videos on the system. Such platforms have been put forward to bring together those who teach on a particular subject and those who want to take a course. These type of systems are sometime used for training large masses which is called in this case, massive open online course (MOOC).

Moodle is the most widely used, user-friendly, easy-to-use and open LMS in the world (Escobar-Rodriguez and Monge-Lozano, 2012). Moodle also comes with a distance education platform that has over 80 million users from 222 countries (De Medio et al., 2020). Moodle has a flexible architecture that can be expanded with plug-in modules. Instructors can perform all educational activities using Moodle that are supposed to be done with distance education (S´anchez and Hueros, 2010). In addition to online virtual lessons, Moodle platform offers learning material distribution and links, chat and discussion environments. Apart from that, feedback, tasks, workshops, quizzes, online tests and self-peer assessment questionnaires can be used in the system to evaluate the learning processes of students (Piotrowski, 2010). In expert evaluations, it is found that students preferred Moodle compared to Moocs (Pireva et al., 2015). However, it has seen that its establishment, operation and use may be a problem in terms of speed and practicality in the context of the pandemic period.

Apart from Moodle, there are some other platforms that support online learning: Canvas, ATutor, Claroline, Dokeos, Ilias, Sakai, ABC, Webct, Blackboard, dotLRN etc. It is seen that Moodle comes to the fore in the literature reviews (Acosta and Luj´an-Mora, 2016; Cavus and Zabadi, 2014; Martin et al., 2008; Subramanian et al., 2014; Totschnig et al., 2013).

MOOC platforms are generally used to provide free, global and online access to lectures prepared by faculty members of distinguished universities (Lambert, 2020; Zawacki-Richter and Naidu, 2016). These platforms provide support for students of all ages, income levels, languages, colors and from everywhere (Stich and Reeves, 2017). Examples of existing MOOC environments include Udemy, Udacity, Coursera, and edX. Universities become members of such platforms and operate predominantly on a non-profit basis (Littenberg-Tobias and Reich, 2020). Access to the course content offered on these platforms is generally free, but if you want to get a certificate or a diploma at the end of the training, it becomes paid. In this section, several MOOC systems developed for different purposes are examined.

Coursera

Coursera is an Internet-based distance education platform created by Stanford University faculty members in 2012. It is the largest and most used MOOC platform worldwide with over 37 million users (Espada et al., 2014). Coursera has a learning management platform that is based on asynchronous content delivery and includes interactions. The content on the platform is video and text-based, and learning is supported by discussion platforms.

In partnership with universities and companies, Coursera offers a wide range of online courses from computer science to personal development. More than 150 partner institutions, including select universities such as Yale, Stanford and Princeton, offer high quality courses through the platform. There are free and paid courses on the platform (Espada et al., 2014). The platform also supports assessment and evaluation activities. There are process evaluation activities for assessment activities such as homework or projects as well as questions that can be evaluated by the system such as multiple choice, right-wrong, and short answer questions.

edX

edX was established in 2012 by MIT and Harvard as a major non-profit and asynchronous content delivery platform. More than 100 renowned universities offer free and paid courses to approximately 14 million students on the platform (Espada et al., 2014). edX is a learning management system that will increase and facilitate content delivery and interactions with distance education.

Universities become members of the edX system and faculty members of those universities can open courses here. If an institution that is not a member of the edX system wants to use this learning management system, it can offer its own courses by installing the open source software called open edX on their own servers. Discussion environments are supported with video and text-based content on the platform. In the edX learning management system, there is a studio component that can be used by trainers to develop course content. This component facilitates the work of instructors in educational activities. The platform also supports assessment and evaluation activities. For example, process evaluation activities such as homework or projects can be performed in addition to multiple choice, true, false or short answer questions that can be evaluated by the system (Garcia-Loro et al., 2020). In addition to expert evaluation, peer and self-evaluation activities can also be performed on the platform.

MOOC platforms such as edX and Coursera are learning management systems that will increase and facilitate content delivery and interactions with distance education (Zhu et al., 2018). These platforms, which aim to offer massive open online courses, are hierarchically independent, there is no semantic relationship between courses and are based on asynchronous content delivery. When these platforms are logged into the system, access is provided on a search basis. Searching is based on accessing the lecture with lecture search, such as searching for a book in a traditional digital library. There are generally learning resources in the form of videos, articles, homework and/or presentations in the lessons (Zhuhadar et al., 2015). While the contents in the system are video and text-based, learning is supported by discussion platforms. Measurement and evaluation can also be done on these platforms. For measurement activities, process evaluation activities such as homework and projects can be performed in addition to questions that can be evaluated by the system such as multiple selection, right, wrong, and short answer questions. In addition to expert evaluation, peer and self-evaluation activities can also be performed during evaluation (Formanek et al., 2017).

METHOD

The main goal of this research is to develop a new distance education platform using state of the art hardware and software to meet emergency demand for distance education in higher education during the pandemic period. This proposed new model should include innovations that will be preferred after the pandemic as well. In line with these goals, firstly, a distance education model was determined, and in the second stage, a technological infrastructure was designed and created to support this model.

Developmental research model has been preferred as a method in this study. Developmental research model is one type of the designed based research model described as producing new materials, new products or devices by using existing knowledge from research and/or practical experience (Kuzu et al., 2011; Richey et al., 2003). In this model, systematic efforts are directed towards establishing new processes, systems and services to improve the existing ones. In this context, throughout the study development research method has been used for developing and evaluating educational software.

The proposed platform is built using the Internet-based synchronous distance education model. In this approach, it is aimed to eliminate both financial and managerial problems on universities by sharing the necessary resources such as servers, Internet bandwidth etc. The new platform is designed considering that it should start servicing in a short time regardless of the infrastructure at the universities.

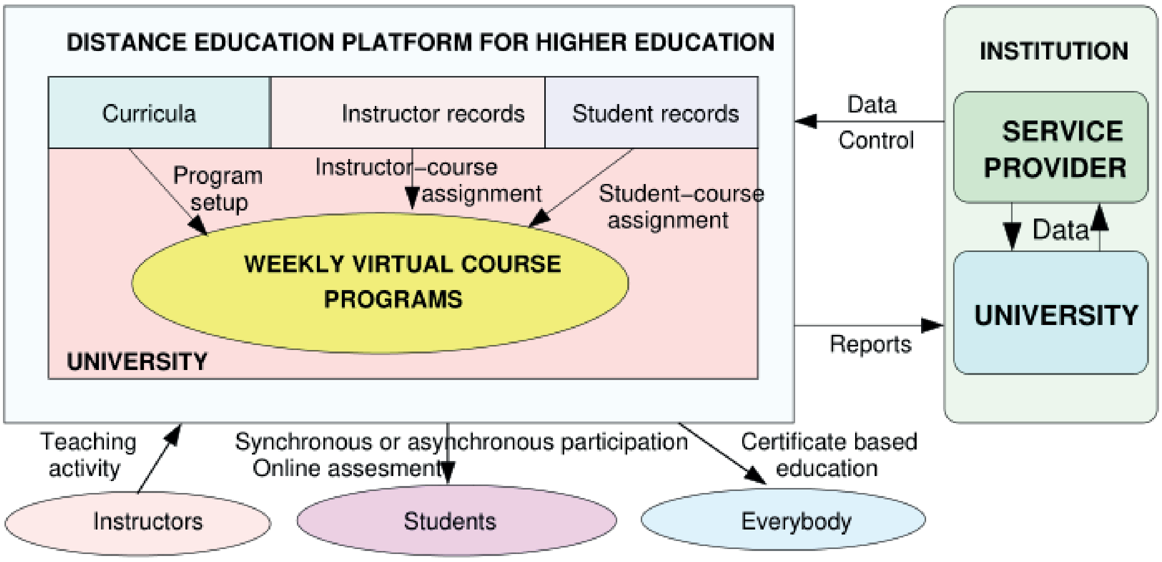

Figure 1. Conceptual block diagram of the distance education platform for higher education

With the goals mentioned above in mind, a new cloud-based distance learning platform has been developed for higher education institutions. The new platform is called UZEP, and the block diagram is shown in Figure 1. With the use of cloud architecture, the server and Internet bandwidth needs of universities for online learning have disappeared. Within the scope of the study, a special cloud structure is created at high performance computing branch of TUBITAK (The Scientific and Technological Research Council of Turkiye).

In this way, a university with many departments, thousands of students and requiring to switch online learning due to emergency, is able to transfer all of its courses and users in a very short time and continue teaching on UZEP.

UZEP designed and implemented in a model of *Education as a Service (EaaS)* in cloud terminology. In this approach, universities do not necessarily own the software or the underlying infrastructure, but use the platform as a service. They have the authority to organize and supervise the parts allocated to them in the system. For example, authorized persons are able to organize online courses, designate lecturers for the courses, and give access to students who have registered for the courses. After the virtual classes are over, they can see the statistical data such as how many people have participated online classes or re-played later. The platform can be accessed via e-government gateway or the login page provided by the universities. Figure 2 shows the components of the developed system.

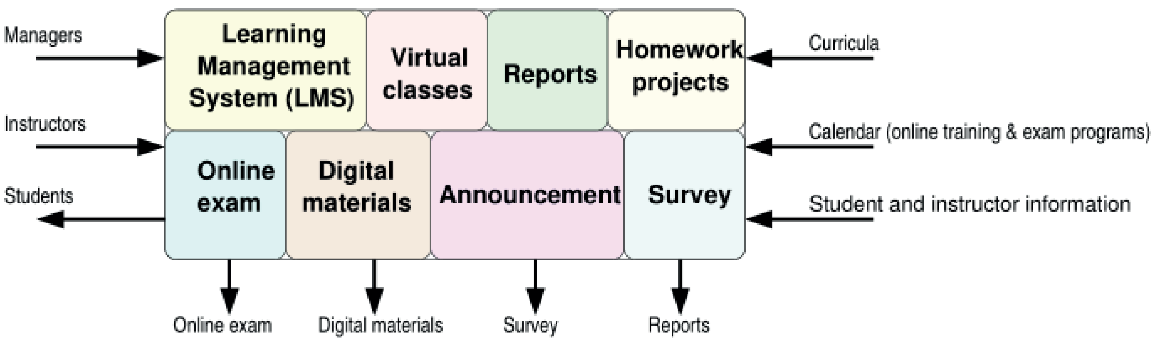

Figure 2. Block diagram showing UZEP input-output relationships and internal modules

Learning Management System (LMS): This module is the core of the system that helps organizing and monitoring training activities conducted on UZEP such as virtual classes, online assessments etc. throughout a semester or pre-defined period of time. Roles at various levels are defined in the system to control the access rights.

In order to organize weekly online classes on the system, the following data are needed: 1) Curricula, 2) instructors who teaches, and 3) student records who take the courses. Most of these data are fetched from the university management systems which are confidential. They must be handled carefully. UZEP is equipped with various interfaces to communicate with existing university management systems. Data exchange between these systems can be done quickly in a sterile way using these interfaces.

Virtual classroom module: An open source software (BigBlueButton) is integrated into the UZEP as virtual classroom module. A perfect harmony has been created between the LMS module and the video streaming server, so the user feels these components as whole. A load balancing software has been developed in front of this module to meet the demands optimally. The video streaming servers are the most CPU, memory and Internet bandwidth consuming component of the system.

Online exam module: Multiple-choice, correct/incorrect or open ended questions can be used in mixed forms through the exam using the online exam module. The module can manage up to 10,000 students for an exam at the same time. Questions can be classified into groups and equivalent question sets can be created. The questions and/or answers can be randomized. The online exam module includes many measures for copying the exam questions, such as blockage of screen copying, showing questions one by one, and it also offers a wide variety of session monitoring and logging options. Exam results can be downloaded collectively by the instructor and analyzed with various tools.

Homework-project module: Homework module has been developed for assessment of research studies or conducting online exams. In the homework module, the start and end dates of the homework to be seen by the student, and the answer upload time can be entered separately. When the exam is over, the documents uploaded to the system are evaluated by the course instructor. As in the exam module, exam results can be examined and evaluated collectively in this homework module, while the students can only see their own individual results.

Digital material sharing module: Instructors can share all kinds of digital materials (such as documents, presentations, video) with their students over UZEP. No quota or limit has been set for the documents to be shared on the system. Only students of the relevant course can view and download shared documents for one semester.

Announcement module: Instructors or administrators can send announcements to students enrolled in the course or to the users in the system. Students can send a message to the instructor of the course in case of emergency. Similarly, instructors can report a problem they encounter to distance education representatives as a message.

Survey module: Course satisfaction surveys can be made in the UZEP. The results of these surveys can be examined by both academic staff and authorized managers. Surveys can contain multiple choice options or can be organized as collecting opinions.

Reporting module: Every module produces desired reports online using available data. For example, completed virtual classes of the lecturers and the student participation reports can be viewed or downloaded through the system at any time. In addition, some managerial reports such as virtual classroom density map and statistics can also be obtained from the system.

Participants

During the study, a presentation was made to get a test-bed from the Higher Education Council of Turkiye. The council advised 12 universities to use UZEP starting from Fall-2020 semester (see Table 1). Testing the system in the real environment and the feedbacks were very important for improvements.

Table 1. Table shows user, online course, instructor, exam and session count for each university in the system between 1 October 2020 and 1 February 2021

No	University	User	Virtual Classrooms		Online Exams	
			Course	Instructor	Exam	Session
1	Agri I.C. University	13163	1840	627	3539	118613
2	Artvin University	11728	2551	386	3098	102593
3	Bayburt University	5845	1225	146	1273	43309
4	Gumushane University	20282	1226	113	852	17472
5	Hakkari University	155	1225	146	135	513
6	Kilis University	10687	2969	316	1811	57129
7	Munzur University	5977	1175	312	4	0
8	Mus Alparslan University	4744	20	44	55	17697
9	Bitlis Eren University	351	211	99	289	640
10	Sakarya University	3086	26	54	16	108
11	Igdir University	1360	446	200	227	551
12	Sirnak University	1354	266	79	15	32
	Total	78732	13180	2522	11314	358657

UZEP project team have held online meetings with these university representatives every week throughout the semester, and urgent feedbacks have been collected regularly from other channels. Requested adjustments such as synchronizing the user transfer of universities via web service, differentiating the question types to be used in the exam according to needs / demands, creating user-based, activity-based, exam session-based reports specific to universities have been added to the system after extensive evaluations with project team. At the end of the semester, a general evaluation survey was conducted with selected experts from the peer university representatives. Table 1 shows the universities that use UZEP, and some statistical data about the usage.

Data Collection and Analysis

Widely used teaching software evaluation method is considered as process evaluation, which is the evaluations performed during the development and pre-use of the software (Heinich et al., 2002). UZEP has been systematically evaluated by expert, pilot and user evaluations after Fall-2020. Process evaluation is usually performed by field experts, designers, trainers or target audience as a result of examination and/or use. At the end of this examination, the deficiencies and positive aspects of the developed system are revealed. In process evaluation, an expert or pilot evaluation is used to collect more quantitative and qualitative data. Expert evaluation is done by getting opinions from field experts and/or by comparing and scoring criteria with software in terms of certain qualifications. Pilot evaluation, on the other hand, is based on collecting data through questionnaires, tests and/or observations after the software is used by the target audience. Expert evaluation was carried out with 6 people who are easily accessible in accordance with the appropriate sampling method, who are experts in the field were asked to use UZEP sufficiently enough time and report the opinions. The pilot evaluation was conducted with the staff working in distance education center who stayed outside the developer team. Finally, user opinions were collected and evaluated. Users consist of three categories: administrators, lecturers, and students.

FINDINGS

The UZEP platform developed in this research has been systematically evaluated by expert, pilot and user evaluations. These evaluations including discussions are presented in this section.

Expert Evaluation

The expert evaluation results are shown in Table 2. Participants in the expert evaluation are 2 professors (S1 and S2), 2 associate professors (S3 and S4) and 2 doctor lecturers (S5 and S6), who are experts in the field of computerized teaching technologies or online learning. Among them, two are directors and the other one is vice director in distance education centers at universities. Firstly, they were asked to evaluate the UZEP platform over 5 points in terms of ease of use, perceived usefulness, ease of learn, ease of access and appearance. In the second stage, they were asked to answer the questions about the positive aspects of the UZEP platform after use and what are the aspects that need improvement. Finally, they were asked to compare the well-known and used software such as Moodle, Edx, Google Suite (Classroom, Meet and Forms) by using a table containing criteria including *LMS*, *Virtual classrooms* and *Assessment* features.

Table 2. Comparative expert evaluation of distance learning systems: Moodle, edX, Google and UZEP. Each criterion was evaluated over 5 points, and the values shown in the table show the average of all criteria within a module.

Module	Criteria	Moodle		edX		Google		UZEP	
LMS	Social Tools	√	4.60	√	4.28	√	4.13	χ	4.54
	File exchange	√		χ		√		√	
	Internal messaging	√		√		χ		√	
	Group work	√		√		√		χ	
	Student community build.	√		√		√		√	
	Authentication	√		√		√		√	
	Course authorization	√		√		√		√	
	Registration integration	√		√		√		√	
	Student tracking	√		√		√		√	
	Curriculum management	√		√		√		√	
	Course catalog	√		√		χ		√	
	Data import/export	√		√		√		√	
	Client browser request	√		√		√		√	
	Open source web server	√		√		√		√	
	Installation (hosted, local, SaaS, cloud)	√		√		√		√	
	Maintanance (bacups etc.)	√		√		χ		√	
	Mobile access	√		√		χ		√	

	Interactive white boards	√		χ		√		√	
	Chat	√		χ		√		√	
	Streaming media	√		χ		√		√	
	Session recording	√		χ		√		√	
	Streaming audio and video	√		χ		√		√	
Virtual Class.	Screen sharing	√	3.50	χ	0	√	4.57	√	4.52
	File sharing	√		χ		√		√	
	Breakout rooms	χ		χ		√		√	
	Polling	χ		χ		χ		√	
	Attendance and ntifications	√		χ		√		√	
	Live video presentations	χ		χ		√		√	
	Attendee management	√		χ		√		√	
	Coursework grading	χ		√		χ		χ	
	Exam engine	√		√		χ		√	
	Survey management	√		√		χ		√	
	Test building	√		√		√		√	
Assessment	Test scoring	√	4.70	√	4.38	√	3.98	√	4.63
	Testing	√		√		v		√	
	Grading	√		√		√		√	
	Assignment	√		√		χ		√	
	Built in assessment tools	√		√		χ		√	
	Quizzes	√		√		χ		√	

According to responses from experts (see Table 2), it is seen that UZEP is easy to use and has a simple structure (S1, S3, S4 and S6). For example, an expert (S1) states that the overall interface is simple, it is beneficial in many ways. It is certain that it will provide convenience for individuals with low IT literacy, who feel inadequate in using the system or do not prefer a complex environment. The other two experts (S3, S4) highlight the simple design of the relevant modules to meet the target and the need. Another expert (S6) emphasized that the ease of use and management of UZEP is the most positive aspect, stating: It is meaningful that it can be processed immediately by higher education institutions where the need is felt especially for emergencies such as pandemic. The other positive aspects highlighted by the experts on UZEP were emphasized as follows:

> *It is an important and positive aspect that there are modules that will allow the realization of all the activities necessary for a course to be carried out with distance education and that these modules are offered with a single password and a single software (S2).*
>
> *One of the important advantages is that it is very fast to be ready for use and that it has synchronization interfaces with university information systems (S5).*
>
> *Especially in curriculum management and transferring student records (course-student matching, etc.) to the system, its easy-to-manage infrastructure and modules suitable for higher education ecosystem are one of the most important features that distinguish UZEP from other equivalent systems (S6).*
>
> *It is very beneficial to automatically associate the student and lecturer registered to their courses once in the platform with all created activities such as live lectures, materials, announcements and exams, and access with one click (S4).*
>
> *In addition to the realization of live lessons, automatic recording, being open to watch again from the same place, reporting of participation based on person both for alive lectures and for replay are the positive aspects of UZEP in terms of simultaneous learning (S5, S6).*

> *The exam module does not contain unnecessary details and has a direct target-oriented structure. Creating a question bank and preparing questions in the most frequently used types makes it easy for teaching staff in terms of measurement and evaluation (S6). In addition, it is advantageous to give different points to the questions and to generate different questions for the same gain for different users with equivalent questions for an outcome (S1).*
>
> *The reporting module provides access to information on students' performances needed for higher education institutions. The features that make UZEP stand out are that system usage statistics can be easily obtained on the basis of both institutional and individual courses, and the reporting module does not burden the system (S3, S6).*

All these expert opinions have shown that UZEP serves its purpose in terms of being easily prepared, easy to use and used by users with low IT knowledge in higher education institutions that switch to emergency online learning during the pandemic period. In addition, experts made suggestions for improvement. The most important of these suggestions is the lack of communication and social tools. One of the field experts, (S6) said, "*There are no modules with the necessary tools for students to communicate and socialize over the system. Therefore, it can be suggested to carry out discussion and reflection activities, and to integrate a messaging module into the system where students can communicate with both the instructor and their peers*". Other suggestions are as follows:

> *On the question bank page, a question search function can be added according to the question type and difficulty level. The variety of exam types such as portfolio and project can be added (S1, S2, S3, S6).*
>
> *Although the system has a reporting feature, it does not have a learning analytics module. In the later stages, it can be ensured that students' interactions and learning performance with lecture pages, virtual classroom sessions, material pages and exam activities can be followed on a panel (S4, S6).*
>
> *In general, it offers fewer outputs than Moodle in terms of reporting. It is not easy to process the data to generate reports in Moodle, but at least it may be good to report which files (uploaded materials) have been viewed in the system and how long students have spent in a virtual class (S4, S6).*
>
> *When creating a virtual classroom, a labeling feature can be activated regarding which subject or unit it is related to (S6).*
>
> *It will be beneficial if HTML5 compatible contents can be uploaded to the system and made playable on the system (S5, S6).*
>
> *The UZEP logo can link to the home page. Student number or ID numbers can also be added on the Students tab (S6).*

As a result of expert opinions, it has been revealed that the system needs to be improved in reporting, assessment and evaluation modules. These modules have been prioritized in development and update studies in the future.

Pilot evaluation

The pilot evaluations were conducted by people who are not part of the UZEP development team, but who do work related to distance education at the university where UZEP was developed. Pilot evaluations were made urgently due to the pandemic, but later on, when the real system was activated, other evaluation methods were used. The feedback generated as a result of the pilot evaluations was immediately used in the development processes. Thus, significant improvements were made during local tests before the system was put in fully service.

User evaluation

UZEP users are roughly divided into three groups: administrators, lecturers and students. In this section, the opinions of each user group have been collected and evaluated. Administrator evaluation was carried out using widely used questionnaire questions (Wang et al., 2007). 22 distance education center managers who were responsible for ensuring the use of the UZEP platform in 12 different universities were participated to the survey. Of these participants, 13 are men and 9 are women. The ages of the participants ranged from 21 to 70 and the average was found to be 37.73 (Std.Dev. = 9.34). 5 of the participants are faculty members and the rest are lecturers. Respondents were asked to rate each question about UZEP on a scale of 1-5 where 1- bad, 2 - poor, 3 - moderate, 4 - good, and 5 - very good. The results of the questionnaire and the mean and standard deviation values for the items are given in Table 3.

Table 3. Administrator survey results conducted with institution representatives that use the UZEP. The respondents were asked to rate each question about UZEP on a scale of 1-5, where 1 is bad and 5 is very good. Table shows the mean value and the standard deviation of the responses.

No	Survey Question	Mean	Std.Dev.
1	UZEP is easy to learn and use	4.18	0.665
2	UZEP is user-friendly	3.59	0.854
3	UZEP provides interactive features between users and system	2.86	1.082
4	UZEP provides a personalized information presentation	3.00	0.926
5	UZEP has attractive features to appeal to the users	2.87	0.990
6	UZEP provides high-speed information access	3.36	0.954
7	Adequate information was presented for the use and integration of UZEP	3.41	1.182
8	UZEP provides a proper level of on-line assistance and explanation	3.23	1.478
9	The information we needed about integration was presented at the right time	3.41	1.368
10	UZEP team provides high availability for consultation	3.64	1.255
11	UZEP team responds in a cooperative manner to your suggestion for future enhancements	3.50	1.336
12	UZEP team provides satisfactory support to users using the e-learning system	3.46	1.439
13	The frequency of use UZEP is high	3.14	1.037
14	Most of the users bring a positive attitude or evaluation towards UZEP	2.91	1.065
15	You think that the perceived utility about UZEP is high	3.09	1.377
16	You are satisfied with UZEP	3.23	1.412
17	UZEP helps you think solve through educational problems	3.05	1.431
18	UZEP enables the universities to respond more quickly to change	2.96	1.253
19	UZEP helps the universities provide better education or services to students	3.09	1.151
20	UZEP helps the universities save cost	3.18	1.097
21	UZEP helps the universities to achieve its goal	3.05	1.090
22	As a whole, the performance of UZEP is good	3.14	1.167
23	As a whole, UZEP is successful	.318	1.097
24	By using UZEP, we did not have to buy a server	3.27	1.032
25	UZEP is a distance education platform open to development	3.86	1.082

When the results of the user surveys were examined, it was shown that the participants' answers to the 22 items out of 25 were above the midpoint but 3 items were below. The 3 items with the highest scores in this survey were determined as UZEP is easy to learn and use, UZEP being a distance education platform open to development and UZEP team provides high availability for consultation. These findings show that UZEP has been developed appropriately for use in the emergency distance education period, that it is open to development will continue to be used with features to be added after the pandemic period, and that the team is easily accessible, making it easier to find solutions to the problems encountered. In addition to all these, the items UZEP enables the university to respond faster to change [2.96], Most of the users have a positive attitude or evaluation towards UZEP [2.91] and UZEP has attractive features to appeal to the users [2.87]. These items were found to be lower than the midpoint. It shows that university administrators who are also users of UZEP have deficiencies in responding quickly to change, developing a positive attitude and having attractive features. In the meeting with the relevant people, they expressed their opinion that the presence of innovative and remarkable support and communication tools and measurement tools on the UZEP platform will close this gap. In this respect, UZEP developments were decided to be in this direction.

Lecturer Evaluation

In this evaluation, a satisfaction questionnaire was applied to the lecturers who conducted their courses at UZEP during one academic semester. The academic staff satisfaction questionnaire was conducted via forms on the Internet. The questionnaire was shared as an announcement from the system to 51 lecturers, 30 people filled the questionnaire and 29 responses were found to be acceptable. 12 of the instructors who filled out the questionnaire are women, 14 are men; 18 of them are lecturers and 11 are doctor lecturers. While 26 of the participants felt moderately competent in using technology, 2 felt very adequate and one was less sufficient, and only two participants stated that they had previous experience of teaching with distance education. While the ages of the participants ranged from 25 to 50, the average was found to be 36.17.

The questionnaire included 10 questions in 3 basic dimensions, which were determined as satisfaction for the *1. Distance learning process*, *2. Meeting expectations* and *3. Usefulness of the system*. Sample items for the dimensions in the questionnaire are as follows: "*I am pleased to do my lessons*" in dimension 1, "*I was able to perform the measurement that I needed in my classes*" in dimension 2, and "*I carried out my lessons easily*" in dimension 3. Internal consistency coefficients (based on Cronbach's alpha) for the three dimensions of the questionnaire were found as $\alpha = 0.82$ for dimension 1, $\alpha = 0.75$ for dimension 2 and $\alpha = 0.76$ for dimension 3.

During the lecturer evaluation, when asked to score the learning management system (LMS), the virtual classroom software and the assessment software in UZEP between 1 and 5; it was observed that the mean of their their responses are 3.48, 4.24 and 3.90 respectively. In this respect, the instructors gave highest scores to the virtual classroom software, then the assessment software and the lowest scores to the learning management system. These scores show that making the LMS on the platform simpler by considering emergency distance education falls short of meeting the expectations. However, the fact that all scores are above average shows that all components of the platform are found functional.

Student Evaluation

A questionnaire was applied over the system to 150 students studying in an associate degree program of a university and participating in the emergency distance education process due to Covid-19 pandemic. The students study in the same education unit throughout a semester. While 115 people filled out the questionnaire, the answers of 111 students were used as acceptable. Of the students who participated in the application and filled out the questionnaire, 52 were women and 59 were men. 63 of the participating students are first year and 48 are second year students. All of these students are those who have not experienced distance education before the pandemic, and their ages vary between 18 and 24, the average is 20.28.

A modified version of the instructors' questionnaire was used with 10 questions in all dimensions for 3 basic dimensions. The sample items for the dimensions are I am pleased to take my courses in this platform for dimension 1, I have learned sufficiently in the lessons for dimension 2 and I easily accessed the virtual classes and replays for dimension 3. The internal consistency coefficients of the questionnaire were found as $\alpha = 0.84$ for the distance learning process dimension, $\alpha = 0.89$ for meeting the expectations and $\alpha = 0.73$ for the usefulness of the system, respectively.

During the student evaluation, when they were asked to score each dimension between 1 to 5, a mean of each dimension were found 3.69, 3.12 and 3.72 respectively; it is seen that satisfaction in all three dimensions is higher than the midpoint. In this respect, it has been understood that student satisfaction is positive but not very high. It has been understood that especially students need social tools to communicate with their peers in order to meet their expectations. It was also revealed that in the failures should be reduced in the measurement and evaluation module. In addition, it has been requested to facilitate an easy access method to reach teaching staff. In this respect, the processes of improving the measurement system and adding instant communication mechanisms to the system have been put forward.

DISCUSSIONS AND CONCLUSION

With the Covid-19 coronavirus pandemic, many universities in the world were caught unprepared for the sudden transition from face-to-face training to remote teaching. In order for universities to switch to remote teaching, either they own proper on premise infrastructure and software or they use available cloud based systems. The first solution is very expensive and is not suitable for emergencies if the institution not having before, and the second one has some problems dealing with the confidential data. Hence, lack of proper online learning systems for higher education institutions caused problems at some countries, as happened in Turkiye. On the other hand, transferring users' records, complete curricula of departments and creating weekly schedules of online courses on a platform are stressful tasks and require teamwork. Meanwhile, establishing and managing online learning systems requires high expertise in both informatics and education field.

In this paper, a new online learning platform, called UZEP, is presented to overcome these problems for higher education institutions. UZEP has been developed using Education as a Service (EaaS) cloud model, hence it does not require any kind of infrastructure from its clients, and it can be used without installation. UZEP offers interfaces that prioritize easy learning and use, so it can be switched on quickly in emergency situations. It also provides multiple mechanisms such as advanced APIs and file upload for integration to any university management system. Due to its cloud architecture and container technologies, UZEP scales much better than the other competitor platforms like Moodle, and comply with laws and policies for confidential data.

The ultimate goal of the research is to meet the remote teaching platform needs of many universities in a country or a region by sharing the IT resources. In this way, universities could continue their training activities even if they do not have a necessary infrastructure. UZEP has been developed for this purpose and its performance evaluated by surveys conducted at various levels.

In the evaluation, the experts were asked to compare Moodle, Edx and Google Suite with UZEP in terms of their features. As a result of the comparison, it was seen that Edx had the lowest average score. The purpose of MOOC software (Edx), a massive, open, and online delivery of open course resources, prioritizes skill acquisition and certification in open and online courses (OpenCourseWare, 2006; Bozkurt, 2015). In this regard, UZEP is better suited for distance education applications in higher education.

On the other hand, Google Suite provides fast and easy access to learning content, collaboration, secure cloud storage, management, and a communication platform that enables an effective, paperless online classroom (Apriyanti et al., 2019; Sudarsana et al., 2019). Compared to G-Suite, UZEP lacks social networking and online collaboration components, while G-Suite is one of the most powerful software in this regard. It shows that G-Suite offers more effective solutions than UZEP in terms of collaboration components.

Moodle has been widely known due to its flexibility and open-source nature (Rahim et al., 2018). Moodle contains many features in its structure, which consists of 6 modules. For example, communication modules include file sharing, internal and external discussion forums via email, and real-time chat. Student engagement modules include a workshop module, a group work module, a student portfolio module, and a self-assessment module (Kumar et al., 2011). Compared to Moodle, UZEP is shown to have shortcomings in terms of social networking and group work, as well as grading coursework. However, when evaluating the whole, it appears that UZEP's integrated structure stands out in terms of the learning management system, virtual classroom, and assessment and grading. Uzep's main goal is to help universities quick transition to distance education in emergency situations, and its integrated and scalable structure have been identified as important advantages.

On the other hand, this study has some limitations that should be considered when evaluating the results. One of these limitations is that the data was collected using a self-reported questionnaire and compared and analyzed only with 4 LMS software (UZEP, Moodle, Edx and Google Suite). An extended comparative study can be conducted with other LMS software as well. In addition, UZEP was evaluated during the pandemic period in which the emergency demand was very high, hence another evaluation study can be done after this period. Moreover, it was seen that there was a need for improvement in the exam and communication modules based on the findings obtained as a result of the use of field experts, administrators, teachers and students. In this respect, it has been planned to use artificial intelligence techniques to support both in the security and in the assessment parts of the exam module. Social media and communication channels with interactive learning environments and materials will be included UZEP in the future studies.

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DIGITAL DIVIDE AND EMERGENCY REMOTE EDUCATION: RECONSIDERING THE USE OF EDUCATIONAL RADIO DURING THE PANDEMIC

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ABSTRACT

In this article, the concepts of interaction and digital divide in emergency remote education practices implemented due to the Covid-19 global pandemic are discussed, and the increasing importance of radio as a traditional mass communication tool in bridging the digital divide and structuring an interactive learning process is emphasized. In this article, the concepts of interaction and digital divide in emergency remote education practices implemented due to the Covid-19 global pandemic are discussed, and the increasing importance of radio as a traditional mass communication tool in bridging the digital divide and structuring an interactive learning process is emphasized. In this exploratory study, the main aim is to see the usefulness of university radio for education during the pandemic process by looking at the experiences gained during the Covid 19 pandemic period. The study examines the program preferences of the participants and reveals better program schedules and program types/themes that will be useful during the emergency education period. When the radio listening habits of Eskisehir Technical University students and academics are evaluated within the scope of emergency distance education applications, it is seen that radio broadcasts can be used as a powerful tool against the digital divide. Research findings show that there is a significant relationship between academic and students' radio listening time. The factor analysis showed also revealed different factor groups for academics and students. Within the framework of radio program types, six basic factors were determined for both groups. When the learner-instructor interaction is evaluated within the framework of both broadcast times and broadcast types, it is understood that the two-way interaction process can be structured within this framework. The abstract should be about 150-200 words. The abstracts of the research papers should include the purpose, methodology, and results while the abstracts of theoretical papers should provide the general framework, special contributions to the literature, and major conclusions. The abstract should not contain any undefined abbreviations or unspecified references.

Keywords: Covid-19 pandemic, digital divide, educational radio, emergency remote education.

INTRODUCTION

The Covid-19 pandemic process, which started in December 2019 in Wuhan, China and has been affecting the whole world. The mandatory practices and policies implemented during covid-19, and the social life because of covid-19 that people left out, revealed that the covid 19 pandemic process shouldn't be only considered as a health issue. One of the social environments in which the detachments due to social isolation and abstraction are experienced deeply during the pandemic period came from the education sector and its components. Due to the closures of educational institutions and the suspensions of face-to-face education, the education and training process of 1.6 billion students, which corresponds to half of the student population from all education levels, was heavily interrupted. (UNESCO, 2020a; UNICEF, 2020) The number of students who were affected by the interruption of education has reached up to 25 million students across Turkiye. Among the 25 million students, the total number of students at all levels of education, 7,198,987 belong to higher education (UNESCO, 2020b).

To compensate for the interruption of education due to the pandemic, since education is a fundamental human right, emergency remote education (ERE) practices were quickly started for implementation all over the world by many educational institutions (Bozkurt, 2020; 114).

While the emergency remote education practices are implemented two main concepts are noteworthy: The first one is the concept of interaction, and the other one is the concept of digital divide, which negatively shapes the process for learners as well as teachers.

EMERGENCY REMOTE EDUCATION IN THE CONTEXT OF INTERACTION AND DIGITAL DIVIDE

Remote education is a method that includes learning forms presented electronically in environments such as multimedia, interactive media, hyperlink, rich media environment, as well as applications and models that occur simultaneously and asynchronously. (Yamamoto & Altun, 2020; 31) Within the education system that switched to the emergency remote education model due to the Covid-19 pandemic, for learners who find themselves in an online classroom environment in remote education after being used to face-to-face interaction ensured by the traditional classroom environment, the sense of community that decreases as a result of physical distance brings with it the feeling of not belonging to the community and the feeling of exclusion which can result in students leaving the programme. (Ilgaz & Askar, 2009; 28) Interaction is an essential factor that supports both the community building and the learning process. (Ilgaz & Askar, 2009; 29) Researchers who have been carrying out studies on the perception of remote education state that, for effective learning, the basic thoughts about the course content and the willingness and aptitude to personal observation for the comprehension of the content, as well as the student's perception of the effectiveness of social interaction, affect the learning outcomes. (Ibicioglu & Antalyali, 2005; 327) As the physical distance and asynchronous education process in remote education may cause the student to feel that he/she does not belong to an educational community and to feel excluded, this may result in the student leaving the programme. (Ilgaz & Askar, 2009, 28)

In a study conducted on remote education by Kaysi and Aydemir; it is stated that, in remote education, in addition to the interactions between the learners or with the instructor of the course, other types of interaction are also weak, and that interaction is an essential component in the formation of attention and motivation towards the lesson. (Kaysi & Aydemir, 2017; 786) Afsar and Buyukdogan, in their study that included the evaluations of students on remote education during the pandemic process, emphasized that the students stated that their communication with the lecturer in remote education became difficult and that the lack of in-class interaction negatively affected their education. (Afsar & Buyukdogan, 2020; 177-178) In a different study, it is emphasized that when learners and/or instructors accustomed to face-to-face education and learning methods are not competent in the use of technology, the remote education process becomes challenging and issues such as inefficiency arise due to deficiencies such as infrastructure etc. in the channels that offer remote education. (Yamamoto & Altun, 2020; 31) In order for the remote education process to result in effective learning/teaching and achieving successful results, it is understood that there is a need for interaction between the student and the teacher and between the student and the course materials. Therefore, it would be fair to emphasize that the use of communication technologies that will provide interaction is important to achieve successful results in remote education.

In a study conducted by Altuntas et al.(2020), on the level of perception of university students regarding their learning experiences in the remote education system implemented during the pandemic process; the fact that the hypothesis measuring the social factor could not be confirmed showed that the remote education process did not have any contribution on the relationship between students. Based on this result, the authors of the study emphasized that to ensure institutional belonging and motivation in the pandemic process in universities, internal communication should be structured in the most correct way with the students as well as academic and administrative staff, and communication channels that will protect the institutional image should be used. (Altuntas et al., 2020; 21-22) As the result of the developing technologies to be used in remote education, it is thought that learners will have many opportunities such as self-directed learning, learning at their own pace, accessing information at the desired place and time, and establishing stronger communication between individuals involved in the education process. (Gokmen et al., 2016; 42)

It seems essential for the successful management of remote education, which has become a requirement in higher education due to the Covid19 pandemic that communication technologies are used and that the method and application contain interaction in terms of providing motivation and belonging.

Within the framework of the two-way communication model of remote education, there is a system in which students and teachers communicate with each other with audio or video calls in environments where learning and teaching activities take place. (Arat & Bakan, 2011; 367-368) Two-way communication models used in remote education are classified under four headings. It is possible to classify these as two-way radio, two-way teleconferences, two-way interactive computer, and two-way mixed application models. (Cam, Gunduz & Isman, 2011; 628) Two Way Radio Application Model is ensured by offering remote education-teaching services to students in different regions by having audio conferences via radio and radio broadcasting is established in such a way that there is communication and interaction between teacher-student and student-student. (Cam, Gunduz & Isman, 2011; 628) In this model, the student can immediately ask the teacher about the subjects that he/she does not understand about the lesson and the teacher can immediately answer the question asked out loud, and the motivation of the student can be kept high as he/she can get immediate feedback. (Cam, Gunduz & Isman, 2011; 628) In this model with two-way voice communication, remote education can be offered to students at a low cost, and it can also cause permanent behavioural changes in students as the result of the mutual interaction provided. (Cam, Gunduz & Isman, 2011; 628)

It is considered essential for universities to use technologies that will provide two-way communication to strengthen the institutional belonging of universities to students and academicians and for the remote education process to produce successful results. It is inevitable for universities to attach importance to investments in technological infrastructure while determining the methods and models to be used in remote education applications, which have become mandatory during the pandemic process and are expected to continue, and the use of radio, TV, and internet-based communication channels in remote education in such a way to allow two-way interaction. Considering that the infrastructure, equipment, and installation costs of such technologies might be challenging for the budget of universities, radio can be used as the technological communication tool that will increase the two-way interaction in remote education, strengthen institutional belonging and can be implemented quickly. When compared to other mass media, it will be fair to say that radio is more affordable in terms of installation and operation, which provides convenience and is preferable in this sense.

Another essential concept that determines the success of process as much as interaction is the digital divide. "Digital divide", in general terms, is about the differences in access to new digital technology, and variations in access to shared information in locally and globally distributed digital communication channels. Regarding the concept of digital divide, concepts such as digital inequality, digital division, digital differences, digital gap, digital separation, and digital detachment are used (Atilgan, 2003; Ozturk, 2005; Sen & Akdeniz, 2012; Yildiz & Seferoglu, 2012; Kalayci, 2013). In English language, concepts such as digital divide, digital division, and digital gap are used. (Organization for Economic Co-operation and Development [OECD], 2001) The digital divide does not only refer to access to digital technologies but also points to the differences between those who have access to new forms of information technologies and those who do not (Van Dijk, 2006; 226). As a result, such a divide brings with it the problem of an unequal distribution of wealth and welfare as well. The origin of the concept dates to the 1990s, and reports (1995, 1998, 1999, 2000) by the US National Telecommunications and Information Administration show that differences in access to new digital technology favour male, educated, affluent, white, young, urban residents. In parallel with and following these reports, several studies provide further insight into the causes and consequences of this divide and how it has developed over time. Studies conducted to focus on two main topics. The first perspective examines the issue in the socio-economic dimension related to gender, age, education, and racial differences. (Tien & Fu, 2008) Other studies examine the digital divide in spatial dimension and focus on the rural-urban dimension of the matter. (Warren, 2007; Raju, 2004) Since the late 1990s, the digital divide, which is a term commonly defined as the gap between those with and without computer and internet access, has been a central issue in the scientific and political agenda in terms of new media development. The divided can also be viewed spatially as global a phenomenon, where the main approach is on the differences between developed and developing countries (Rye, 2008; 172). When we examine the concept of the digital divide in the 21st-century world, it is noteworthy that while the gap is closing in the most developed countries in terms of physical access, the digital divide regarding the use of digital skills and applications continues to exist even widens. (Van Dijk, 2006; 229)

When we evaluate emergency remote education in the context of interaction and the digital divide, the digital gap should be removed so that people can be given equal opportunities to communicate and support their quality of life. While the digital divide poses an educational barrier against learners who do not have access to technology, it also plays an important role in the formation of socio-economic and educational gaps. Closing this gap will accelerate individuals' ability to learn, share, interact and solve problems. (Block, 2010)

RADIO IN EMERGENCY REMOTE EDUCATION

Radio ensures easier, much more affordable, and faster access to information for learners than high-tech communication media tools. Among the findings of a study conducted on the radio listening habits of university students is that students attach importance to the functions of the radio, especially in terms of updating information and awareness, and that most of the young people prefer to listen to the radio from their mobile devices with headphones while surfing the internet or busy doing other activities. (Eken & Gezmen, 2020; 129-130). The information-sharing process is changing towards learner-centred learning environments and collaborative real-life interactions with interactive radio programs in remote education. (Yuzer & Kurubacak; 2004) The integration of radio with digital-based applications has given radio a much more functional dimension in terms of interaction and mutual communication and has led to the radio having a structure that can carry learners from a passive position to an active position while fulfilling its educational function. (Tufan, 2014; 112) Remote education with radio is an alternative education system used in many countries such as Canada, China, France, Germany, Japan, and India, and especially in the USA and England. As a result, educational radio broadcasts have started a new era in remote education with their ability to easily transmit audio elements for mass broadcasting, regardless of budget, time, and region (Kiyik Kicir et al., 2019; 12). Radio does not require a special place and a dedicated time frame as television or other mass media. Listeners can reach radio channels more easily and quickly than other mass media and listen to the radio while continuing doing their daily tasks. In addition to the foregoing, radio is a communication tool that will allow fast two-way communication and interaction in remote education. Implementing the use of radio as an auxiliary tool while designing remote education, adding audio, effects, and music elements to the educational materials, and designing them in radio format will be a motivation-increasing factor. Considering the individual learning environment of remote education, the fact that radio is a personal tool and that it will provide an individual interaction for the student should also be considered as the advantage of using radio in remote education. As no one can come between the radio and the listener, it will help the student to focus on the educational content on the radio individually. While designing remote education in a synchronous and asynchronous manner, the active use of radio in both parts will not only provide student-teacher interaction but also allow the student to have the opportunity to learn individually anywhere and anytime without any restriction of space and time. Radio, integrated with mobile technologies, will provide access to education from anywhere and the learner the opportunity to receive education at any time of the day, and in cases where there is a lack of information, it will also provide the advantage of learning the subject for the student. (Kiyik Kicir et al., 2019; 10)

Studies conducted on this subject reveal that radio is an important educational channel in the development of dialogue and innovation from past to present. Radio is being widely used as an educational tool in developing countries. Published reports confirm that educational programs on a wide variety of topics are supported by radio broadcasting in many different countries such as: Thailand, to teach mathematics to school children, India, for rural development, Swaziland, for public health purposes, Mali, for literacy training, Columbia, for various programs, Mexico, for literacy training and other programs, Nigeria, for management courses for the agriculture sector, Kenya, in support of correspondence courses, Nicaragua, for health education, The Philippines, for nutrition education, Guatemala, in order to promote changes in farming practices and to improve production, Sri Lanka, for family planning and health, Trinidad and Tobago, to promote knowledge of breastfeeding, South Korea, in support of family planning, Botswana, for civics education, The Dominion Republic, in support of primary education, Paraguay, to offer primary school instruction, are the education programs designed in different parts of the world until the 90's (NG Nwaerondu & G. Thompson, 1987). Studies conducted reveal that there is no single "best" format in terms of educational radios. Every situation where educational radio is used may include unique features that will affect instructional design processes. In the study conducted by Yuzer and Kurubacak, the structuring of the strategic technology plan is mentioned as the first step within this framework. Mixed broadcasting strategies to be used in educational radio programs support learners in exchanging their real-life experiences with the real-life experiences of others. This interactivity affects and improves learner development. Free exercises of the high rhythm of real-life through experience and knowledge sharing process between learners and the community develop people's critical skills and competencies in remote education. (Yuzer & Kurubacak, 2004) Therefore, in the article in which the answer for the question "Is an educational university radio model possible that prioritizes learner-instructor, learner-content, learner/learner, learner/material/institution interaction?" is sought, in the context of interaction and digital divide concepts within the framework of emergency remote education applications, the use of radio for educational purposes as a tool that prevents access restrictions caused by interaction and digital divide in emergency remote education is considered extremely important.

METHOD

Purpose, Limitation and Population

In this exploratory study, the main aim is to see the usefulness of university radio for education during a pandemic by looking at the experiences gained during the Covid 19 pandemic period. This study investigates the radio programme listening preferences of Eskisehir Technical University students and academics. The expectation from the study is that by investigating programme preferences of participants, a better programme schedules and programme types/themes can be created to be useful on an emergency education period.

In this study the population of the listeners of the Eskisehir Technical University radio is estimated at 14.000. Sample size is calculated by the following formula:

$$n=\pi(1-\boldsymbol{\pi})(z/E\ )\text{^}2$$

In the equation, where π represents the population proportion for a parameter to be estimated which usually taken as 0.50, such as the gender of the participants, z is the standard normal value from the standard normal distribution for the given confidence level, and E is the margin of error. The sample size formula requires the margin of error and level of confidence for the estimated parameters. Since this is a social study and there is no previous study to find a prior estimated values for the parameters, the acceptable margin of error for the parameter estimate is chosen as 5%. The confidence level of the estimation is chosen as 90%. The z value from the standard normal distribution for 90% confidence level is 1.65. Let's put these values in to our formula as follows (Groves 2009).

n=0.50(1-0.50)(1.65/0.05)^2=272.25≅273

Therefore, the minimum sample size is 273. The questionnaire is sent to in total 14000 students and academics via institutional e-mail. After initial cleaning and organization of the survey responses, it was seen that 418 participants had been listeners of the radio. In this study, only real radio listeners are investigated. The expected minimum sample size was 273, therefore the minimum sample size required for the study is satisfied.

The first part of the survey is created for demographic information of the participants. The second part of the questionnaire consisted of questions on the radio program listening times of academics and students. The third part of the questionnaire included a 20-item scale to determine the radio program type preferences of the participants. Among the 418 participants, 78.9% were students and 21.1% were academics. The main limitation of the study is to find the exact listeners of radio during the pandemic period since the pandemic period broke the usual behaviours of individuals. In the following sections some of the main results are given.

Radio Listening Times

Table 1 show the contingency table for participants for weekday listening times vs listener's occupation (academic or student). Table 2 gives the result of Chi-square test for the contingency table given in Table 1. As can be seen by the frequencies cross tabulated in Table 1, there is a statistically significant relationship between weekday listening times and occupation (X^2=32.507; p < .001).

Table 1. Contingency table for Radio Listening Times on Weekdays of Academics and Students

			Student	Academic	n
How many hours a day do you listen to the radio on average on weekdays?	0-1 hour	Count	212.00	31.00	243
		Adj. Residual	4.90	-4.90	
		p-value	0.00000096	0.00000096	
	1-2 hours	Count	78.00	28.00	106
		Adj. Residual	-1.57	1.57	
		p-value	0.116	0.116	
	2-4 hours	Count	28.00	16.00	44
		Adj. Residual	-2.63	2.63	
		p-value	0.0085	0.0085	
	more than 4 hours	Count	12.00	13.00	25
		Adj. Residual	-3.91	3.91	
		p-value	0.0000923	0.0000923	
Total		Count	330	88	418

Table 2. Radio Listening Times on Weekdays of Academics and Students Chi-Square test

	Value	d.f.	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.507[a]	3	.000
Likelihood Ratio	30.023	3	.000
Linear-by-Linear Association	32.270	1	.000
N of Valid Cases	418		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.26.

Table 3 show the contingency table for participants for weekend listening times vs listener's occupation (academic or student). Table 4 gives the result of Chi-square test for the contingency table given in Table 3. As can be seen by the frequencies cross tabulated in Table 3, there is a statistically significant relationship between weekend listening times and occupation ($X^2=23.270$; $p < .001$).

Table 3. Contingency table for Radio Listening Times on Weekends of Academics and Students

			Student	Academic	
How many hours on average do you listen to the radio on weekends?	0-1 hour	Count	205.00	40.00	245
		Adjusted Residual	2.82	-2.82	
		p-value	0.0048	0.0048	
	1-2 hours	Count	87.00	20.00	107
		Adjusted Residual	.69	-.69	
		p-value	0.4901	0.4901	
	2-4 hours	Count	25.00	15.00	40
		Adjusted Residual	-2.68	2.68	
		p-value	0.0073	0.0073	
	More than 4 hours	Count	13.00	13.00	26
		Adjusted Residual	-3.74	3.74	
		p-value	0.00018	0.00018	
Total		Count	330	88	418

Table 4. Radio Listening Times on Weekends of Academics and Students Chi-Square test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	23.270a	3	.000
Likelihood Ratio	20.121	3	.000
Linear-by-Linear Association	19.880	1	.000
N of Valid Cases	418		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.47.

In Table 5 and Table 6, the preferences of the participants are cross tabulated by the amount of radio program listening vs occupation. According to Chi-Square test statistic, there is a statistically significant relationship between radio program listening times and occupation ($X^2=24.817$; $p < .001$).

Table 5. How Many Minutes Do You Listen To A Radio Program On Average vs Occupation

			Student	Academician	
How many minutes do you listen to a radio program on average?	0 - 15 min.	Count	75.00	8.00	83
		Adjusted Residual	2.92	-2.92	
		p-value	0.0035	0.0035	
	15 - 30 min.	Count	108.00	37.00	145
		Adjusted Residual	-1.52	1.52	
		p-value	0.1285	0.1285	
	30 - 45 min.	Count	82.00	11.00	93
		Adjusted Residual	2.56	-2.56	
		p-value	0.01046	0.01046	
	45 - 60 min.	Count	32.00	16.00	48
		Adjusted Residual	-2.15	2.15	
		p-value	0.0315	0.0315	
	More than 1 hour	Count	23.00	15.00	38
		Adjusted Residual	-2.86	2.86	
		p-value	0.00423	0.00423	
Total		**Count**	**320**	**87**	**407**

Table 6. Listening Time to the Radio Program Chi-Square Test

	Value	df	Asymptotic Significance
Pearson Chi-Square	24.817[a]	4	.000
Likelihood Ratio	25.347	4	.000
Linear-by-Linear Association	10.917	1	.001
N of Valid Cases	407		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.12.

Findings Regarding the Radio Program Types/Themes

The third section of the questionnaire includes questions to find towards participants most wanted types/themes of programmes. The Participants are given a choice to show their level of agreement with 20 items and radio programme types/themes via 5-point Likert scale. The 5-point Likert scale is created as 1- It should definitely be included, 2- It can be included, 3- No idea, 4- Does not matter and 5- It should not be included. The reliability of the answers given to the statements are measured by Cronbach's alpha value. The higher the value of this coefficient, which is between 0 and 1, the more consistent the participants be, and the more reliable the results be. For 20 items, Cronbach's Alpha coefficient is calculated as 0.832 for the student group and 0.848 for the academics group. As it can be seen from these values, the participants answer to these 20 items is accepted as reliable.

Factor Analysis

20 program items were analysed by Exploratory Factor Analysis to determine sub-factors or create themed sub-categories. These 20 items can be seen in Table 11. Factor analysis is a statistical method used to transform a group of variables into new uncorrelated variables. (Ozdamar, 2004). First Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity are applied to see the data's suitability for exploratory factor analysis. A high KMO value indicates that each variable in the scale can be predicted perfectly by other variables (Kaiser, 1974). To ensure sample adequacy, the KMO value must be above 0.5. In this study, KMO was 0.766 for the student group and 0.664 for the academic group. Both values indicate that the results from 20 items suitable to carry out factor analysis. Bartlett's Test of Sphericity was used to test the suitability of the data for factor analysis. Bartlett's Test of Sphericity tests the probability of high correlations between at least some of the variables in the correlation matrix. In the analysis, the X^2 value of Barlett's Test of Sphericity was calculated as 1249.885 (p=.000) for the student group and 612.187 (p=.000) for the academic group, and these values are statistically significant with 95% confidence. The results of the Kaiser-Meyer-Olkin Test and Barlett's Test of Sphericity for students and academics are given in Table 7 and Table 8, respectively.

Table 7. Kaiser-Mayer-Olkin (KMO) and Bartlett's Test (Student)

Kaiser-Meyer-Olkin Sample Adequacy Test		.766
		1249.885
Bartlett's Test of Sphericity Approximate Chi- Square	Degree of freedom (df)	190
	Significance	.000

Table 8. Kaiser-Mayer-Olkin (KMO) and Bartlett's Test (Academic)

Kaiser-Meyer-Olkin Sample Adequacy Test		.664
		612.187
Bartlett's Test of Sphericity Approximate Chi- Square	Degree of freedom (df)	190
	Significance	.000

Principal component analysis was used to determine the initial factor loadings in exploratory factor analysis. The explained variance table of the factor analysis of student and academic groups and their rotated factor analysis values are presented in Table 9 and Table 10 respectively. In factor analysis, the equamax rotation method, which the number of variables that load highly on a factor and the number of factors needed to explain a variable are minimized, is used.

Table 9. Explained Variance Table for Student

Factorrrror	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotated Sums of Squared Loadings		
	Total	Var. (%)	Cum. (%)	Total	Var. (%)	Cum (%)	Total	Var. (%)	Cum. (%)
1	5.018	25.092	25.092	5.018	25.092	25.092	2.547	12.736	12.736
2	2.200	11.000	36.092	2.200	11.000	36.092	2.421	12.104	24.840
3	1.738	8.688	44.780	1.738	8.688	44.780	2.331	11.655	36.494
4	1.395	6.976	51.756	1.395	6.976	51.756	1.879	9.395	45.889
5	1.125	5.623	57.380	1.125	5.623	57.380	1.697	8.483	54.373
6	1.012	5.062	62.442	1.012	5.062	62.442	1.614	8.069	62.442
7	.955	4.773	67.215						
8	.933	4.663	71.878						
9	.791	3.956	75.834						
10	.705	3.527	79.361						
11	.630	3.150	82.511						
12	.550	2.749	85.260						
13	.504	2.520	87.780						
14	.484	2.421	90.201						
15	.446	2.231	92.432						
16	.422	2.110	94.541						
17	.338	1.690	96.231						
18	.306	1.532	97.763						
19	.252	1.260	99.023						
20	.195	.977	100.000						

Table 10. Explained Variance Table for Academic

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotated Sums of Squared Load-ings		
	Total	Var. (%)	Cum. (%)	Total	Var. (%)	Cum. (%)	Total	Var. (%)	Cum. (%)
1	5.875	29.376	29.376	5.875	29.376	29.376	3.191	15.956	15.956
2	2.452	12.262	41.638	2.452	12.262	41.638	2.592	12.960	28.917
3	1.876	9.378	51.016	1.876	9.378	51.016	2.491	12.454	41.370
4	1.684	8.418	59.434	1.684	8.418	59.434	2.485	12.426	53.796
5	1.477	7.387	66.821	1.477	7.387	66.821	1.857	9.286	63.082
6	1.060	5.299	72.120	1.060	5.299	72.120	1.808	9.039	72.120
7	.885	4.423	76.543						
8	.837	4.183	80.727						
9	.747	3.733	84.459						
10	.569	2.844	87.303						
11	.501	2.503	89.806						
12	.413	2.066	91.872						
13	.387	1.935	93.807						
14	.299	1.494	95.300						
15	.277	1.385	96.686						
16	.241	1.205	97.891						
17	.150	.751	98.642						
18	.127	.635	99.277						
19	.092	.461	99.738						
20	.052	.262	100.000						

In Table 9 of students explained variance, 62.442% of the total variance is explained with 6 factors. These 6 factors combine different themed programmes into same categories. In the student group, the first factor accounted for 12.736% of the total variance, the second factor accounted for 12.104%, the third factor accounted for 11.655%, the fourth factor accounted for 9.395%, the fifth factor accounted for 8.483% and the sixth factor accounted for 8.069%. As it is shown in Table 10 for academics, 72.120% of the total variance was explained with 6 factors. In the group of academicians, the first factor accounts for 15.516% of the total variance, the second factor for 12.960%, the third factor for 12.454%, the fourth factor for 12.426%, the fifth factor for 9.286% and the sixth factor for 9.039%. To convert the expressions in the questionnaire into interpretable meaningful groups, factor rotation was performed. At this stage, a rotation factor matrix was created for both groups with 6 factors. Factor loading matrix consisting of 20 items are given in Table 11 and Table 12 for students and academics, respectively.

Table 11. Rotated Component Matrix for Students

	F1	F2	F3	F4	F5	F6
National news	.870					
Local news	.806					
Economy programmes	.631					
Health programmes	.587					
Non- formal education programs		.781				
Formal education programs		.740				
Knowledge and skills radio programs		.589				
Sports documentaries		.524				
Music programs with DJ			.764			
Comedy-Talk show programs			.695			
Non- stop music programs			.620			
Concert broadcasts			.503			
Youth programs						
Culture and art programs				.861		
Radio theatre				.629		
Science programs				.501		
Sectoral programs					.799	
Talk programs with university administrators					.663	
Magazine programs						.766
Competition programs						.552

The items constituting the 6 factors are listed below based on their importance levels:

Factor 1: This factor has a variance of 12.736%.

National News, Local News, Economics Programs, Health Programs

Factor 2: This factor has a variance of 12,104%.

Non-Formal Education Programs, Formal Education Programs, Knowledge and Skill Programs, Sports Documentaries

Factor 3: This factor has a variance of 11.655%.

Music Programs with DJ, Comedy-Talk Show Programs, Nonstop Music Programs, Concert Broadcasts

Factor 4: This factor has a variance of 9.395%.

Culture and Art Programs, Radio Theatre, Science Programs

Factor 5: This factor has a variance of 8.483%.

Sectoral Programs, Talk with University Administrators Programs

Factor 6: This factor has a variance of 8,069%.

Magazine Programs, Competition Programs

According to the factor analysis for the students, availability of news programs in a university radio in compliance with the functions of the radio is seen as the most effective factor. The next important factor is the factor associated with the use of radio for educational purposes. Considering the entertainment function of the radio as well, it is seen that the 3rd factor is entertainment programs covering music broadcasts, and the 4th factor is conversation and direct presentation programs where information is shared. The types of programs that students want to meet their sectoral and institutional knowledge needs are presented as the 5th factor. It is among the findings that magazines and competitions, which are radio programs for the entertainment function of the radio and for the relaxation of the listener, are deemed as the 6th Factor. This ordering automatically gives an indication about the type of programmes importance among students, and eventually this gives a chance to broadcaster what to do in order to increase radio listeners if the schedules are created according to these results.

Now let's look at the results of academics. Table 12 gives the rotated component matrix of 6 factors for academics.

Table 12. Rotated Component Matrix for Academics

	F1	F2	F3	F4	F5	F6
Science Programs	.828					
Sectoral programs	.753					
Culture- art programs	.723					
Talk with University Administrators Programs	.677					
Health programs	.559					
Non- formal education programs		.892				
Formal education programs		.890				
Knowledge and Skill Programs		.600				
National news			.888			
Local news			.879			
Economy programs			.549			
Comedy-Talk Show Programs				.775		
Competition Programs				.691		
Youth programs				.672		
Magazine programs				.561		
Non- stop music programs					.673	
Music Programs with DJ					.628	
Concert Broadcasts					.540	.670
Radio Theatre						.621
Sport Documentaries						.503

The items constituting the 6 factors are listed below based on their importance levels:

Factor 1: This factor has a variance of 15.596%.

Science Programs, Sectoral Conversation Programs, Culture and Art Programs, Conversations with University Administrators Programs, Health Programs

Factor 2: This factor has a variance of 12,960%.

Non-Formal Education Programs, Formal Education Programs, Knowledge, and Skill Programs

Factor 3: This factor has a variance of 12.454%.

National News, Local News, Economics Programs

Factor 4: This factor has a variance of 12.426%.

Comedy-Talk Show Programs, Competition Programs, Youth Programs, Magazine Programs

Factor 5: This factor has a variance of 9.286%.

Nonstop Music Programs, Music Programs with DJ, Concert Broadcasts

Factor 6: This factor has a variance of 9.039%.

Radio Theatre, Sports Documentaries

For academics, the first factor involves programs in which the informing function of the radio is observed, and sectoral integration is ensured. The second factor is the combination of educational programs. Whereas the 3rd factor is seen as the combination of the program types in which the information and news sharing themes are the essentials. It is seen that, after the fourth factor, the programs that correspond to the entertainment and relaxation functions of the radio are started to be considered. The factor analysis emphasis that, availability of science and related methods is seen as the most effective factor. The next important factor is the factor associated with the use of radio for educational purposes. Considering the entertainment function of the radio as well, it is seen that the fourth factor is entertainment programs covering music broadcasts, and the fifth factor is conversation and direct presentation programs where information is shared.

CONCLUSION

With the Covid-19 global pandemic affecting the whole world, education has been one of the main structures which most affected by this process. The most important educational limitations of educational institutions, which quickly integrated into emergency remote education practices, were interaction and digital divide. Interaction is used in four different ways in the learning process (Tuovinen 2000; 16). These can be listed as learner-content, learner-instructor, learner-learner, and learner-material/institution. Considering the importance of strategic planning of design processes in implementing these four interaction types together for educational institutions that are rapidly integrated into emergency remote education applications, when the design process of audio-visual education materials is compared with the design process of visual education materials, it is seen that faster, easier and more affordable design solutions are possible. Given the fact that even though digital divide is narrowing in instrumental dimension in many different parts of the world, it is still widening in terms of skills and competencies, radio draws attention as a powerful tool that provides equal access to education, enables the interaction process to be structured synchronously or within the framework of the asynchronous use of learning, tutorials and materials at any time. (Mantyla 1999: 19).

Within the scope of the study, which was structured as stated, it is aimed to evaluate the expectations for the use of university radio for educational purposes during the Covid-19 pandemic process and with this aim in mind, the factors affecting the radio programme listening preferences of Eskisehir Technical University academicians and students were identified. During the data collection process of the research, a questionnaire was sent to 14000 people via institutional e-mail. The number of students and academicians who sent a response was 418. The first part of the questionnaire was structured as a systematic classification, in which demographic data were collected. The second part of the questionnaire consisted of collecting data on the radio program listening times of academicians and students. As a result, data on the duration of listening to radio on weekdays and weekends and the duration of focusing on listening to a radio program were collected. The third part included a 20-item scale to determine the radio program types preferences of the audience consisting of academicians and students.

Even though there is a difference in factor rankings in the results of factor analysis carried out for both study groups, it is understood that the expectation from the university radio is the news, information and education functions. Factors related to news, information and education functions are ranked in the first three places in each study group. The factors related to the entertainment function of the radio are mostly seen as the 4th, 5th and 6th factors. In this framework, it is observed that the students and academicians prefer informative program configurations and content sharing on the current affairs. Taking into account the digital divide, which is expressed as the socio-economic barrier against access to digital education, despite the accelerated digital transformation process due to Covid-19 pandemic, it is understood that academicians and students have a positive attitude towards the use of university radio as a tool to support remote education. Considering the radio listening time of students and academicians and the time they listen to a program in the broadcast stream configuration, it is suggested that the time planning for informative programs can be structured as programs that correspond to long-term use. The importance of program durations in terms of genre, purpose and broadcasting period, as well as the target audience, cannot be ignored in the content design process. The findings obtained within the scope of the research indicate that inclusion of radio education programs designed as spot programs which will last between 0-15 minutes in the broadcast stream of the university radio will have a positive effect on the use of radio, and university radios, which determine their broadcasting principles within the framework of the principle of public broadcasting, will ensure equal access to the right to education, which is a fundamental human right, by considering the social benefit thereof, will also provide positive externality.

When the radio listening habits of Eskisehir Technical University students and academicians are evaluated within the scope of emergency remote education applications, it is seen that radio broadcasts can be used as a powerful tool against the digital divide. When the learner-instructor interaction is evaluated within the framework of both broadcasting times and broadcasting types, it is understood that the two-way interaction process can be structured in this framework. In this respect, as stated in the study conducted by Yuzer and Kurubacak, it is considered necessary to establish a strategic technology plan first. The education strategy established within this framework will form the basis of the strategic technology plan, which is considered a functional strategy. In this context, when the educational strategies that centre the learner who actively participates in the learning-teaching process and the research findings are evaluated together, the methods that increase the learner-instructor interaction and do not compress the learning process into mere learning materials, are considered essential in terms of activating internal communication processes, especially during crisis periods when emergency remote education applications are implemented.

According to the findings obtained in this study, it is recommended to consider the following criteria when configuring a university radio for distance education purposes.

1. Against the fact that radio as a traditional mass communication medium has disadvantages in learning processes, it is considered important to integrate radio back into educational processes by considering the digital divide as one of the important obstacles to learning.
2. In order to transform radio as a one-sided communication tool into an interactive learning tool, the structure of web radio broadcasting that allows enrichment with visual materials in educational processes should be integrated into learning processes.
3. It is considered important to enrich the educational program configurations with gamification and radio dramas.
4. In addition to being used as a distance education media in distance education processes, it is recommended to use blended learning in a supportive approach.
5. It is considered important to structure the radio education programs within the scope of blended learning or to structure the radio as a supportive teaching environment by evaluating the learning processes of the Z generation and their radio listening habits within the framework of radio listening time
6. In a university radio, it is considered important to add learning materials to the entire program flow as modules, taking into account the radio listening time of the learners.

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BIODATA and CONTACT ADDRESSES of AUTHORS

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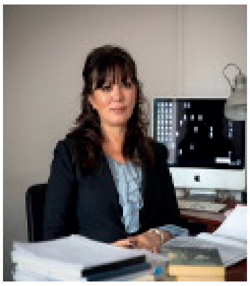

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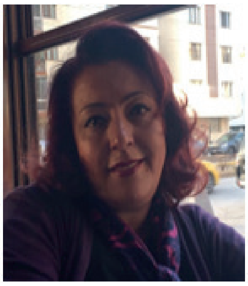

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EXPLORING OPPORTUNITIES FOR EMBEDDING POST-PANDEMIC SCHOOL PRACTICES: LESSON LEARNED FROM COMPULSORY ONLINE LEARNING

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ABSTRACT

Throughout the Covid-19 pandemic, schools were to make emergency shift from full offline to online learning. With limited time given, schools were forced to bring out all their best potential in implementing this online learning. Such situation described the actual abilities, potentials, and challenges of each school in implementing online learning. By adopting a case-oriented multiple-case study, this study aimed at exploring the opportunities of embedding online learning as an integral part of post-pandemic teaching practices in urban and rural school in West Kalimantan province. Data from in-depth interpersonal and group interviews of 22 rural and urban schools, with 66 participants, indicated that both rural and urban schools struggled with teachers' and pupils' unpreparedness to integrate technologies in their learning. To keep classes running, seven teaching – learning scenarios were developed. In doing so, three layers of challenges were identified; primary, secondary and tertiary challenges. To make online learning possible to be embedded in schools' post-pandemic practices, this research reports a number strategic recommendations proposed by participating schools

Keywords: Online learning, distant learning, multiple case study, rural schools.

INTRODUCTION

The outbreak of COVID-19 pandemic had brought both challenges and opportunities to education practices. With all challenges it caused (Roxby, 2020; Cucinotta & Vanelli, 2020; Thomson & Ip, 2020), the pandemic also challenged schools to seek opportunities to make significant improvement to their learning practices (Bahasoan et al., 2020). One of the leaps in learning innovation that has occurred due to the pandemic is the widespread embedment of online learning into traditional offline learning in school. Due to the pandemic, schools were forced to move from offline to online mode in a short period of time. These conditions forced schools to bring out all their best potential in implementing this online learning. If examined in depth, these conditions are very helpful in describing the actual abilities, potentials and challenges of each school in implementing online learning. This will certainly be an objective groundwork for developing post-pandemic learning in rural and urban schools in the province of West Kalimantan. In this regard, post-pandemic learning is characterized by the embedment of online learning as an integral leap innovation and modernization of traditional offline learning in schools in West Kalimantan province.

If properly implemented, online learning might be beneficial improvement for schools to carrying out their learning in a more advanced way. Online learning was praised for some reasons, such as its flexibility in terms of time and space (Yuhanna et al., 2020; Silahuddin, 2015). In addition, it was also regarded as an innovation, which could put pupils in the centre of teaching and learning processes (Dhawan, 2020) since it could (1) save or reduce education costs, especially budget for accommodation and transportation, (2) provide exciting and meaningful experiences for pupils and (3) flexible in terms of time and space (Silahuddin, 2015). In more detailed, Negash et al. (2008), argued that online learning is different from traditional physically face to face classroom. Online learning is believed to have distinctive advantages in terms of accessibility, connectivity, flexibility, and the ability to produce various types of learning interactions, in which teachers and pupils could join from anywhere and anytime they find comfortable (Singh & Thurman, 2019; Yuliana, 2020; Sadikin & Hamidah, 2020; Hartanto, 2016).

The advantages of implementing online learning above could be experienced by schools that are considered ready to embrace technologies in their learning and supported by adequate supporting learning facilities. However, for areas where the quality and availability of learning facilities and the readiness of teachers and pupils vary significantly from one place to another, the practice of online learning was a challenge for each school in improving the quality of pupils' learning. One of the areas with significant variations in the availability of various online learning supporting facilities was in West Kalimantan province, where this research was conducted. In this regard, the damaged infrastructures and low socioeconomic status of pupils made online learning might have been challenging to apply. As Taradisa et al. (2020) and Dwi et al. (2020) report indicate that the damaged infrastructure and the low socioeconomic status make online learning perhaps challenging to be embedded on schools' practices. Moreover, the nature of online learning which requires ICT skills, experienced personnel, and adequate support in terms of learning infrastructures and facilities might make it even more challenging to adopt for rural schools (Silahuddin, 2015). Given those challenging situations, it does not mean that online learning cannot be integrated as an integral part of learning at school at all. Behind the existing challenges, there are opportunities that can be maximized for developing better-implemented online learning. Insight drawn from the already implemented online learning can be used as the groundwork for developing online learning that can be applied massively and embedded in routine post-pandemic school learning in West Kalimantan province.

To adapt to the new learning model, school could have played significant roles (Huda, 2019; Komariah & Triatna, 2004), even though not all schools could do so (MacBeath & Mortimer, 2001). In West Kalimantan province, for example, schools' readiness to embrace online learning mode in urban and rural areas was varied quite widely (Irwan, 2020). To face the challenges, each school should be assisted with strategic supports. To do so, we found it necessary to map out strategies developed by rural and urban schools in implementing online learning during the pandemic, to analyze the challenges they faced, and to identify the opportunities for improving future online learning implementation. These data will be crucial for evaluating and enhancing future online learning, which could be embedded in the post-pandemic school practices.

A number of aspects of online learning implementation have been researched lately (Bestiantono et al., 2020; Deepika, 2020; Adnan & Anwar, 2020; Dube, 2020; Sulisworo et al., 2020; Unda, 2012; Setyawan, 2020; Kebritchi et al., 2017; Febrianto, 2020; Dhawan, 2020; Sun & Cen, 2016). In this respect, we believed that this research was distinguished from those previous researches for several characteristics, as this research (1) investigated not only how schools implemented online learning during covid19 pandemic, but also to map the challenges they faced and to identify potential improvements for future online learning implementation, (2) involved wider perspectives as sources of information; teachers, pupils and school leaders and (3) involved schools in both rural and urban areas as research subjects, which made the findings of this study were drawn from a fine-grained process that considered the complexities of contextual and local challenges and potentials in rural and urban schools in implementing compulsory online learning.

Taking the gaps above as consideration, we had developed three research objectives, which shaped every process undertaken in this research, namely to (1) describe how rural and urban schools practiced online learning during the pandemic, (2) map challenges they faced, and (3) identify potential improvements for future online learning implementation. The findings of this study have the potential to enrich references and insights regarding the implementation patterns of online learning in the context of schools in the province of West Kalimantan, Indonesia. Such information could be used as a groundwork for decision-makers and future researchers to evaluate and improve future online learning practices in rural and urban schools as the embedment of their post-pandemic learning practices.

METHOD

This research is a case-oriented multiple-case study (Ragin, 1997; Ary, et al., 2010; Sugiyono, 2012; and Yin, 2003), with a qualitative approach (Nassaji, 2015 & Ary, et al., 2010). This research aimed at exploring the potential of improving future online learning practices in West Kalimantan province as an embeded portion of post-pandemic school practices, by taking lesson from the implementation of compulsory online learning during covid19 pandemic.

The decision to employ multiple case studies was based on the belief that such research design could provide rich contextual details regarding typical online learning implementation strategies, challenges, and potentials for future improvement in each case study school (Woodside, 2010; Gerring, 2007; Adelman et al., 1980 in Cohen, 2005; Hitchcock & Hughes, 1995; Cohen et al., 2005).

Participants

This research involved 66 teachers and school leaders from 22 schools across West Kalimantan province. The participants of this research were selected using the purposive selection technique (Santoso 2004; Puspitasari, Suliantoro & Erlianna, 2011; Notoatmodjo, 2010), to represent schools from rural and urban areas and to accommodate stakeholders in each school. The participants of this research are described in Table 1 below.

Table 1. Respondents' number in rural and urban schools

	Rural (8 Schools; S1 – S8)	Urban (14 Schools; S14 – S22)	Total
School Leaders (SL)	8	14	22
Teachers (T)	8	14	22
Pupils (P)	8	14	22
Total Participants	24	42	66

Data Collection and Analysis

To collect the data, a direct communication technique, in the form of the semi-structured interpersonal and group interview were employed. Such technique was adopted in order to provide deep comprehensives data regarding online learning implementation scenarios, challenges, and improvement potential in each school (Galletta, 2013; Hatch, 2002; Francisco & Barcelona, 2020; Mussardo, 2019). The data collection tool used in this study was an interview guidance sheet which contained general research information, informants' privacy concerns, interview procedures, and interview questions (McGrath et al., 2019).

To describe schools' strategies to implement compulsory online learning during covid19 pandemic, along with their challenges and recommendation for future improvements, two stages of data analysis procedures were employed. In the first stage, we used thematic analysis (Nowell et al., 2017; Braun & Clarke, 2006) to each respondents' responses in each school (Fereday & Muir-Cochrane, 2006) to draw conclusion regarding online learning implementation in each case-study school. In the second stage, we compared the data collected from each school using Cross Case Analysis (CCA) (Cruzes & Runeson, 2015; Ragin, 1997 in Khan & Wynsberghe, 2008) to draw conclusion based on school geographic locations (rural and urban).

The Scale

To establish robust assertion of data quality, and hence the finding of this research, three strategies were applied, namely, triangulation of data sources (Creswell, 2014; Miller, 2000), probing strategies (Galletta, 2013; Gray, 2004), and respondents' clarification and confirmation (member checking) (Creswell, 2014). In addition, before being used, the interview questions and procedures were validated by experts to ensure the construct validation of the questions. In addition, the questions were also piloted by involving teachers, pupils, and school leaders from relevant schools.

FINDINGS

Schools' Strategies to Keep School Running during Covid-19 Pandemic Outbreak

With the adaptation to health protocols during the pandemic, schools designed and implemented various learning strategies to keep their school running. Each design was developed based on potential and challenges in each school. Data analysis showed seven learning scenarios created and implemented by participating schools, as follows.

Learning Scenario 1

Data analysis suggested that two out of 22 participating schools implemented learning in scenario 1, namely S9 and S14. S9 was a state school, while S14 was a private one. Both schools were urban schools located in the capital city of West Kalimantan province. The learning pattern of the schools can be observed in Figure 1 below. As can be observed from the figure, the entire processes of the learning were carried out in an online setting (S11SL; S14T; S9P; and S9SL). The class was carried out regularly from Monday to Friday, with a shorter duration.

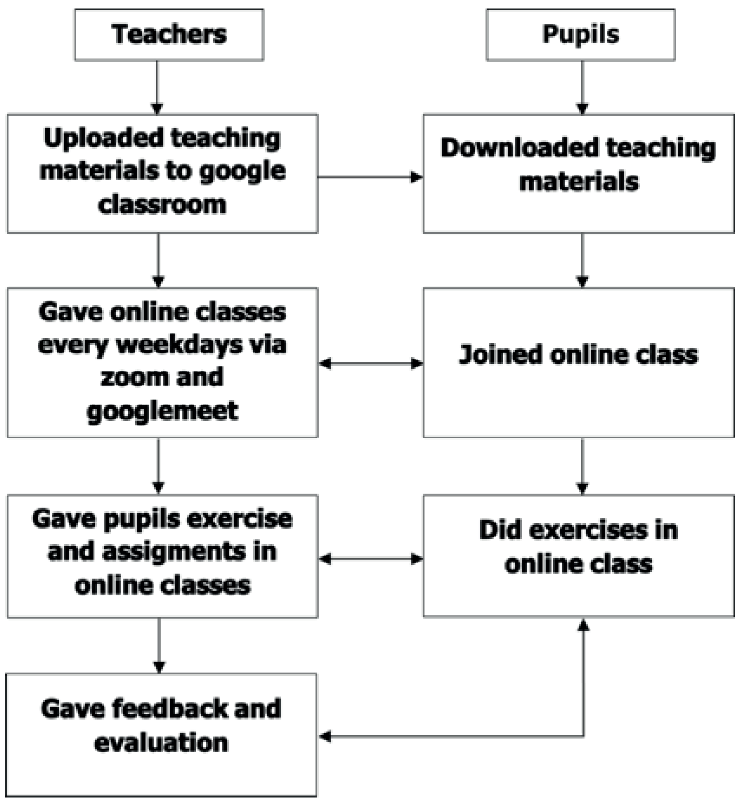

Figure 1. learning scenario 1

Learning Scenario 2

Scenario 2 combines synchronous and asynchronous online learning (Negash et al., 2008). Data analysis results suggested six schools implemented such learning procedures, namely S12, S13, S15, S16, S17, and S19. The schools were located in urban areas where adequate online learning supporting facilities were available. However, the lack of pupils' and teachers' readiness to adopt full online learning made them add a portion of asynchronous mode in their learning (S12P; S12T; and S16SL). The processes of teaching-learning in this type were presented in Figure 2 below.

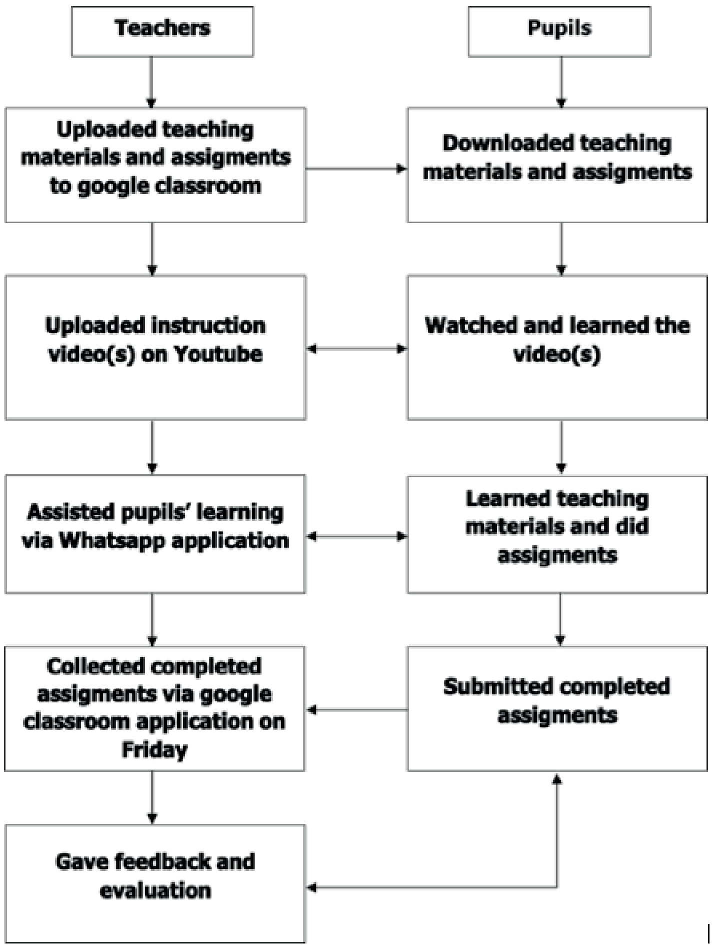

Figure 2. learning scenario 2

Learning Scenario 3

Scenario 3 combined online and offline procedures. It was implemented by five schools; three urban schools (S11, S20, and S21) and two rural ones (school S2 and S3). The schools had proper internet access and adequate infrastructure to travel to school. However, the limited internet data possessed by many pupils and teachers and a heavy lockdown policy in the schools' surrounding areas made them choose to implement such a learning design. What was reported by a teacher (T) from School 11 (S11) below described how limited internet data had been one of the major challenges for the five schools above.

Online learning required a large amount of internet data, especially if it was done via video conferencing. Just for a day of learning, if a full video call was applied, it required a lot of internet data. If it was done continuously, it could be very burdensome. Not only pupils, but many teachers also complained about this (S11T).

To get around this challenge, these schools chose to apply learning scenario 3 as an alternative. As can be observed from Figure 3 below, the learning procedure did not adopt video conferencing in the learning practices, which the schools claimed could spend much internet data.

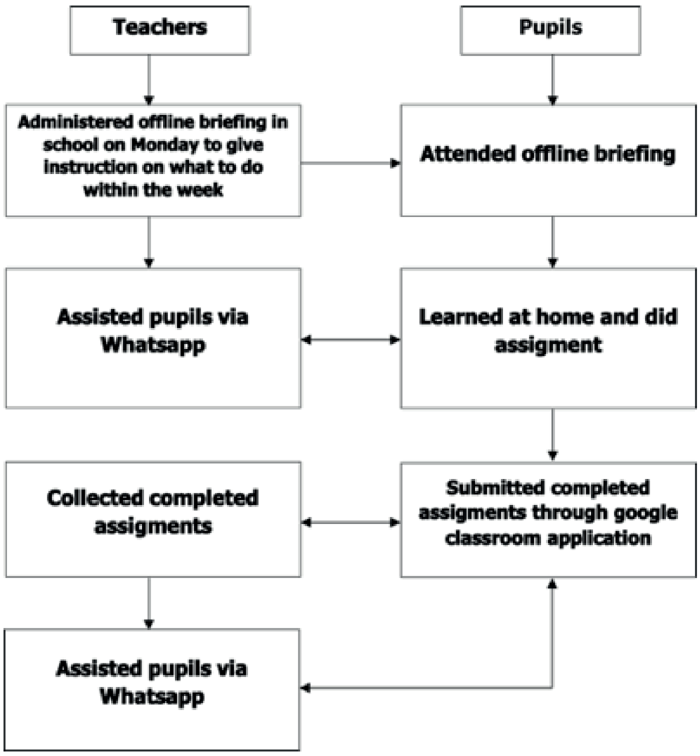

Figure 3. learning scenario 3

Learning Scenario 4

Two rural schools (S4 and S7) faced more complicated challenges than those implementing blended learning type I. In addition to having limited internet data, the schools reported that many of their pupils did not possess essential online learning facilities and devices, such as mobile phones, laptops, or computers, and the absence of a cellular network. As shown in Figure 4, video conferencing was also not adopted in this learning design.

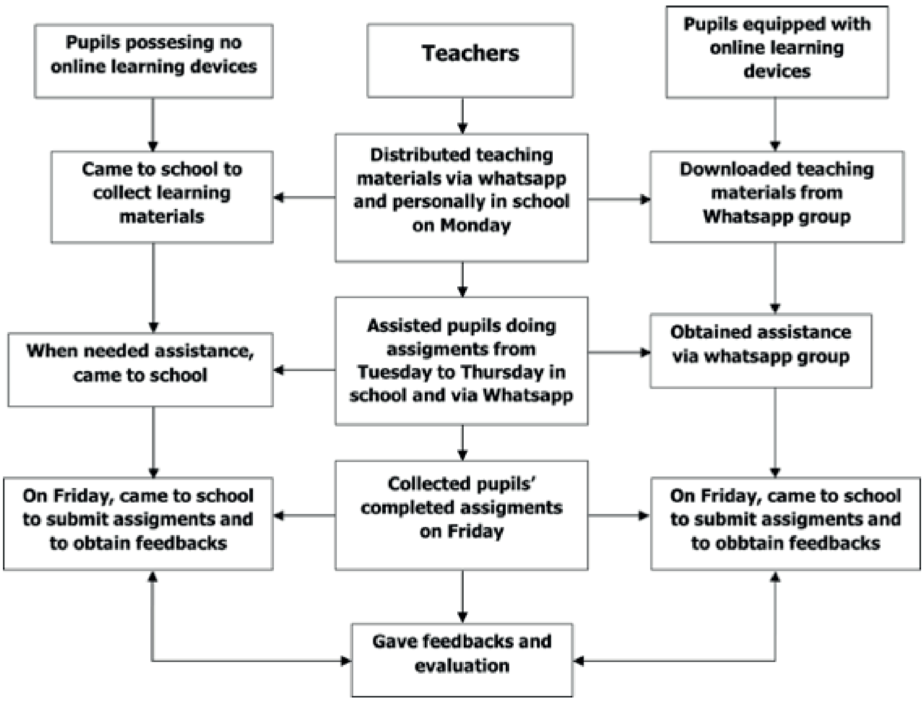

Figure 4. learning scenario 4

Learning Scenario 5

Three urban schools (S10, S18 and S22) decided to implement learning scenario 5 based on their belief that full online learning could not facilitate their pupils' learning development optimally. They argued that teachers and pupils should be given sufficient training to implement online learning before implementing it fully. In addition, the learning supporting facilities should also be provided preferably before shifting to online learning. In this type of learning, pupils come to school alternately based on the year of entry. First-year pupils come to school for offline classes in the first week. Then, second-and third-year pupils came on each month's second and third week, respectively. When not in offline classes, pupils participated in online learning. The teaching-learning process of Blended Learning Type III can be learnt from Figure 5.

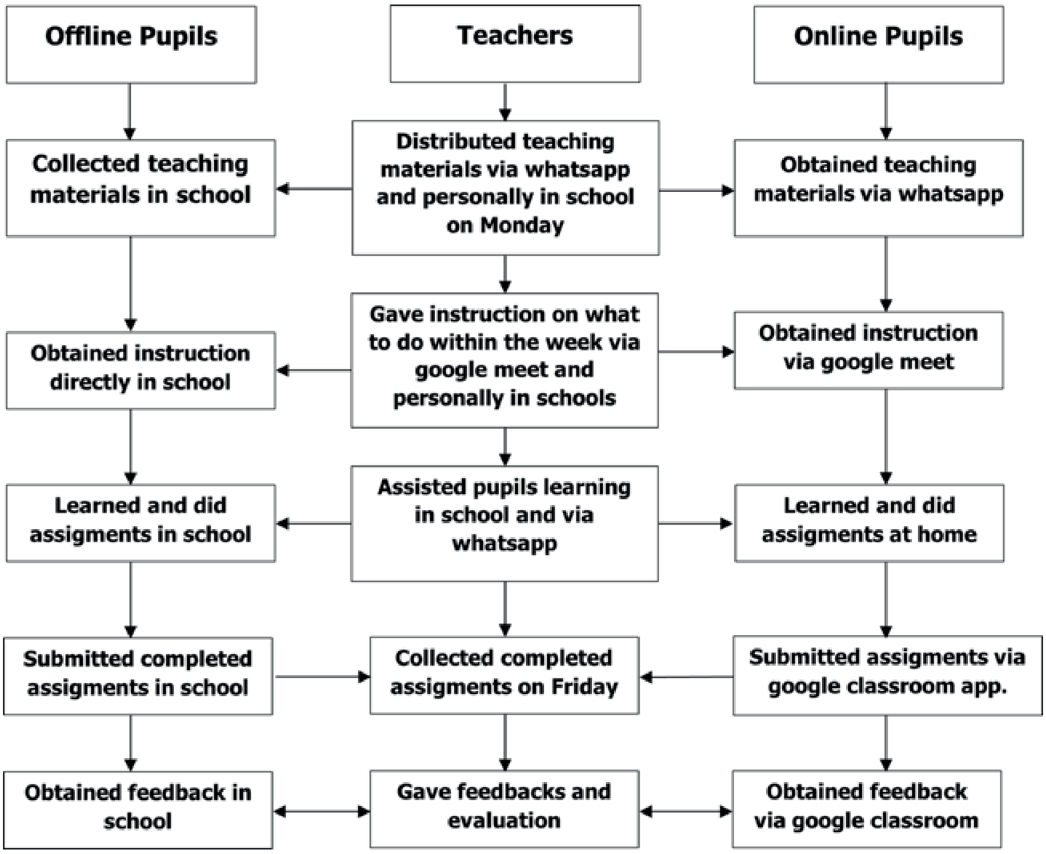

Figure 5. learning scenario 5

Learning Scenario 6

This option was chosen by two rural schools (S5 and S6) considering that online learning was not possible to carry out, due to limited learning support facilities, such as internet networks, power sources during the day and online learning tools (i.e., computers, laptops, or smartphones), in teachers' and pupils' homes. However, the schools were supported by the adequate quality of infrastructures so that pupils and teachers could come to school on the days scheduled by the schools to join offline briefing. As can be learned from Figure 6 below, in this learning design, pupils were let to learn and did assignments independently at home. While doing so, teachers did not provide any assistance to pupils.

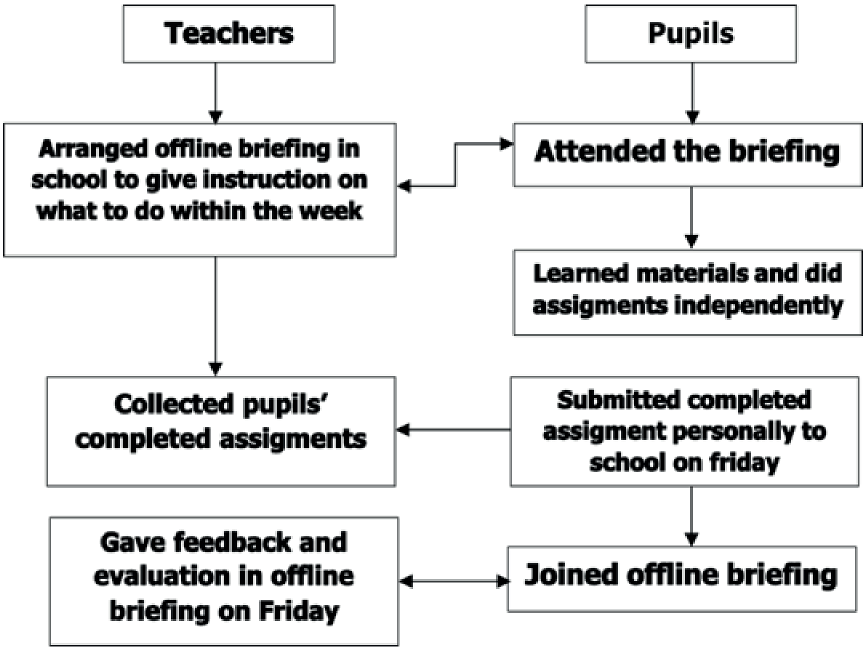

Figure 6. learning scenario 6

Learning Scenario 7

This model, which was implemented by S1 and S8, was almost similar to learning scenario 6. The difference was that learning scenario 7 was conducted in pupils' homes instead of school. In this regard, as shown in Figure 7 below, instead of asking pupils to come to school on Monday and Friday, schools sent teachers to visit pupils in their homes. To do so, pupils in similar neighbourhoods formed a study group in the house of one of the group members. On Sunday, visiting teachers came to distribute learning materials and assignments and provide instruction on what to do within the week. The learning scenario 7 procedures could be learned from Figure 7.

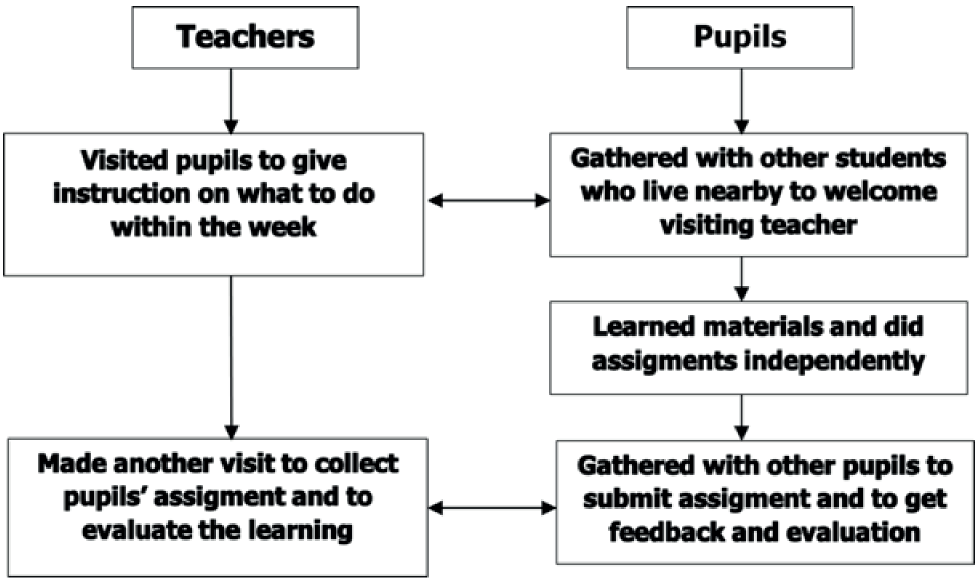

Figure 7. learning scenario 7

Learning Challenges

In running their teaching and learning process during the covid 19 pandemic, both rural and urban schools reported that they had faced many professional challenges. In general, as can be observed from Figure 8 below, the challenges were categorised into three types; typical rural school challenges, typical urban school challenges, and common challenges (faced by both rural and urban schools).

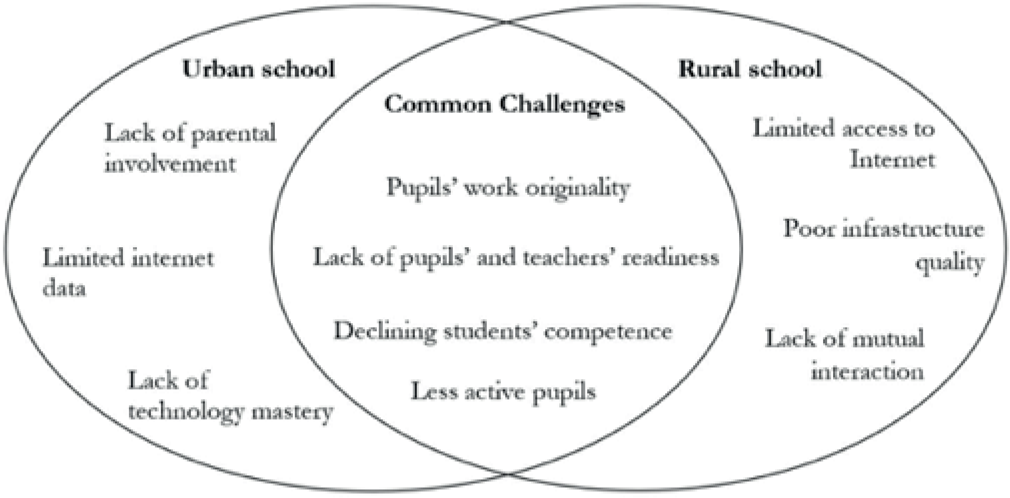

Figure 8. Rural and urban schools learning challenges

Online Learning Challenges in Rural Schools

Limited Access to Internet

All rural schools have reported limited access to the internet as one of the main obstacles in implementing online learning in their schools. There were three reasons for the challenge: lack of internet network coverage, lack of internet data, and lack of online learning devises possession. In connection with the lack of access to the internet network, the rural schools above reported that this problem occurred because a number of pupils and their teachers lived scattered in surrounding villages, outside the village where the school was located, which were not covered by the internet network. To be able to access the internet, they had to go to a specific location or looked for a high place. In addition to the lack of networks, access to the internet was also hindered by pupils' lack of internet data and possession of online learning devices, such as laptops, computers, or smartphones. '…most of pupils in my school did not have smartphone or computer, such situation made online learning implementation almost impossible to do' (S2SL). Such a situation made the above schools have to design special learning procedures to keep schools running during the pandemic.

Poor Infrastructures to Reach School from Home

Most roads in rural areas were damaged, including in most rural schools participating in this research. Given such a situation, pupils could not regularly come to school or other places where internet services were available. A statement from a pupil from S6 below described how poor the infrastructures in most rural areas were. …actually, the distance from home to school is not far, only about 16KM, but it takes more than 2 hours because the road is damaged (S6P).

Building Mutual Interaction between Teachers and Pupils

The lack of internet access, cellular networks, and adequate infrastructure, as reported above, made it difficult for teachers to establish reciprocal communication with pupils (S4T; S2T and S5T). Communication could only be done when pupils came to school, or when teachers visited pupils in their homes. Such a situation made teachers could not monitor and support pupils' learning at home.

Online Learning Challenges in Urban Schools

Lack of Internet Data

A pupil (P) from school 10 (S10) indicated that urban pupils struggled with limited internet data to join online classes. The massive internet usage in online learning practices (i.e, for video conferences and downloading learning materials) made the need for internet data to rise significantly (S11P; S11T; S18P; S17SL; and S17T). This situation made online learning processes that consumed much internet data (i.e, video calling) was limited (S10SL; S13T; S13SL; and S14SL).

Class Duration was too Short

As reported above, urban pupils' lack internet data led schools to shorten their class durations from usually 50 to 60 minutes per lesson hour to only 30 to 40 minutes (S9T; S9T; S11T; S11SL; and S18SL). Such a decision was seen as a problem by urban teachers. A teacher from S9 (S9T) described that the time allocated to run the class in online mode was too short. They had to modify their lesson plans and adjust them to fit around 30 minutes classes. She found that such duration was not practical to deliver her teaching materials.

Lack of Parents' Involvement to Support Pupils' Learning

The duration - shortened online class could have been made more effective if parents could play more significant role in supporting pupils' learning, since, during pandemic, pupils spent more time at home than in schools. Parents could have replaced teachers' parts in supporting pupils learning in certain extents. However, as learned from the data analysis, parents did not do so (S14P; S14SL; S22SL; S18T and S14T). S22SL, for example, reported that parents tended to let their children learn independently, as they did in regular class before the pandemic.

Common Challenges: Issues in Implementing Online Learning in Rural and Urban Schools

Lack of Teachers' and Pupils' Readiness to Embrace Online Learning

Data analysis revealed that teachers and pupils in urban and rural areas had not been fully ready to implement online learning as daily learning routines. Teachers were less skilled in operating online learning platforms such as video call applications and learning management systems (S7SL; S13SL). In addition, teachers were also found did not fully ready to design online learning, as indicated by their lesson plans which were still strongly influenced by offline learning procedures (S12SL; S12T; S2SL).

Less Active Pupils in Online Class

Both rural and urban school reported that pupils tended to be less active in online class than in offline one. In this regard, they said that pupils less responsive in online class discussion (S1T; S8T), tended to be late in joining class (S1T; S14T; S20T) and be late in submitting their completed assignment (S2T; S11T; S21T). For rural schools, as they reported, only a few pupils appeared during the offline session, in which pupils were expected to come to school (S1T; S4T; S6T). Such a situation was contradictory to offline class in which pupils tended to be more active in coming to schools (S1T; S4T; S6T; S17T).

The Decline of Pupils' Ability to Understand Lesson

A number of learning challenges reported above were believed to correlate with decreasing pupils' ability to understand the lesson. Compared to offline classes, as reported by both rural and urban schools, pupils tended to take longer to learn a lesson in an online class (S10T; S17T; S3T). As the consequence, pupils' achievement in many assessments set by teachers tended to be lower (S3T; S17T).

Difficulty in Ascertaining the Authenticity of Pupils' Works

The last common challenges faced by rural and urban schools was ensuring the originality of pupils' works. Since most of pupils' assignments were done independently at home, teachers in rural and urban schools claimed they had difficulty monitoring pupils' work (S6SL; S3T). Such a situation caused teachers not to ascertain whether the pupils were doing their work as expected or assisted by others. In some cases, teachers found that the quality of assignments performed by certain pupils at home showed an unreasonable rate increase. The quality of assignments done at home was much better than that done by the same pupils in class, under the teacher's direct supervision. The unusual results were questioned by teachers, especially regarding their originality (S6SL; S3T; S1T). The following statement from the teacher (T) from S1 outlined the other teachers' opinions.

We often find homework submitted by pupils yields excellent results. In fact, in class, the pupil was mediocre. The pupils' results were not that good. This of course, made us wonder whether it was the work of the pupils themselves or done by someone else (S1T).

Recommendations for Future Improvement: Schools' Perspectives

Improving Teaching and Learning Facilities

Providing better internet quality was the first recommendation proposed by both rural and urban schools (S20SL; S14SL; S14T; S14P; S20SL; S20P; S21P; S2P; S3SL; and S3T). In this regard, they believed that the lack of internet quality had made the online learning process challenging. The improvement of network quality, according to the schools, would be better if relevant authorities also provide free internet data for both teachers and pupils (S14T; S14P; S20P; S21P; S12SL; S12T; S12P; S11SL; S11T; S11T; S4SL; S4P; S5T; S5S; and S6SL). The next recommendation from rural and urban school concerning the teaching and learning process was about providing other learning facilities in schools, such as computers, laptops, smartphones, and other learning sources, including books and research reports (S14P; S14SL; S14T; S20SL; S20T; S20P; S12SL; S12T; S13T; S11T; S2P; S3SL; S3T; and S3P). In addition to those recommendations, rural schools proposed relevant authorities to provide a specific learning management system (LMS) that was easier to operate and could comply with low-quality internet (S5T).

Increasing Technology Mastery

Both rural and urban schools agreed that further systematic continuous trainings would be needed to improve pupils' and teachers' skills in administering online learning. The first required training by the teachers was concerning operating and integrating technologies into learning (S14P; S14T; S15T; S20SL; S22T; S20T; and S3T). In addition, teachers also proposed continuous training on designing and assessing online learning. In this regard, they reported that those two aspects were the most confusing parts in administering online learning (S14T; S11SL; S2T; and S3SL).

Lesson Delivery Adjustments

To make teaching material delivery during online classes better, several recommendations have been given by rural and urban schools. Urban school pupils, for example, proposed to lengthen the online class duration to have a longer time to discuss and understand teaching materials (S14SL; S14P; and S20P). In addition, they also suggested the feedback sessions be done more frequently so that they could evaluate their learning and assignment immediately (S14P; S20P; and S19P). Furthermore, the pupils also advised that the techniques of delivering the material should be designed more attractively so that it would not be boring and uninteresting for them (S14P; S20P; S19P; S21P; and S11P). In a similar vein, both teachers and leaders of urban schools also proposed a number of improvements for future online learning implementation, including (1) developing uniform learning evaluation technique (S20SL; S14T; and S4SL), (2) developing uniform Learning Management System (LMS), so that they could learn to each other, even across schools (S20T), (3) using videos to upload to the internet, so that pupils' could watch anytime they want (S14T), and (4) providing uniform learning assessment forms (S5T and S3T).

Building Closer Relationships with Parents

Rural and urban schools suggested that parents play more roles to improve future online learning. Urban schools, for example, argued that involving parents could help to facilitate and monitor their children when learning at home (S12SL; S13T; S11T; S14T; S20P; S20T; and S13T). For rural schools, parental involvement will be needed to direct pupils to study at home, do assignments, and ensure they attend offline classes as scheduled (S2SL; S3T; S3P; and S2SL).

DISCUSSIONS AND CONCLUSION

The Variations of Teaching Designs Developed Illustrated the Magnitude of the Challenges of Online Learning in Schools

Implementing full online learning in West Kalimantan ptovince, Indonesia, during COVID-19 pandemic was indeed found challenging. The high expectation from the government for this online learning to run as expected (Nadeak, 2020), did not live up to the reality. The facts revealed that doing so seemed easier said than done in rural and urban schools. As presented in finding section above, seven learning designs had been developed and implemented by schools to run their class during the pandemic. Of the seven learning designs, only one fitted the definition and procedures of online learning, while the rest referred to blended and distance offline learning models (Hartanto, 2016; Negash et al., 2008; Singh & Thurman, 2019; Silahuddin, 2015). Those wide variations of learning procedures during covid19 above indicated each school's wide variety of contextual challenges. In this respect, as can be learnt from the findings above, schools had to design various learning strategies considering their typical challenges and strengths to keep their school running during the pandemic. Such challenges were undoubtedly a barrier for schools to implement online learning optimally.

The findings regarding the learning strategies applied by those schools reported above confirmed the existing research findings which argue that (1) the transition from offline to online learning is indeed a challenging process (Agarwal & Dewan, 2020; Deepika, 2020; Kebritchi et al., 2017; Setyawan, 2020), especially for rural and urban school in West Kalimantan province, (2) without adequate supporting facilities and adequate schools' skills and experiences in operating online learning tools, schools alone could not be expected to be able to switch to full online learning optimally (Bestiantono, et al., 2020; Simamora, 2020; Kebritchi et al., 2017; Dube, 2020; Handayani, 2020; Taradisa et al., 2020; Rustiani, et al., 2019; Negash et al, 2008; Dwi et al., 2020), and (3) teachers who were skilled in designing online learning lesson plans were also needed so that online learning can run as expected (Adnan & Anwar, 2020; Dube, 2020; Sulisworo et al., 2020; Sutarto, Sari & Fathurrochman, 2020).

Learning Challenges in Rural and Urban Schools: An asymmetric Relation

As reported in the research findings section, many challenges had been reported by schools when implementing online learning. After conducting an in-depth interpretation of each challenge, considering how each occurred, we concluded that there were asymmetric relationships among the challenges. In simple terms, we can say that some challenges occurred because of other challenges that had existed earlier. With that in mind, we classified the reported challenges into three layers; primary, secondary, and tertiary challenges. Primary challenges referred to barriers that had emerged since the beginning of schools starting online learning, while secondary challenges referred to learning barriers caused by primary challenges. Tertiary challenges were caused by primary and secondary challenges either directly or indirectly. As shown in Figure 9 below, the relations among learning challenges by outer curved arrows.

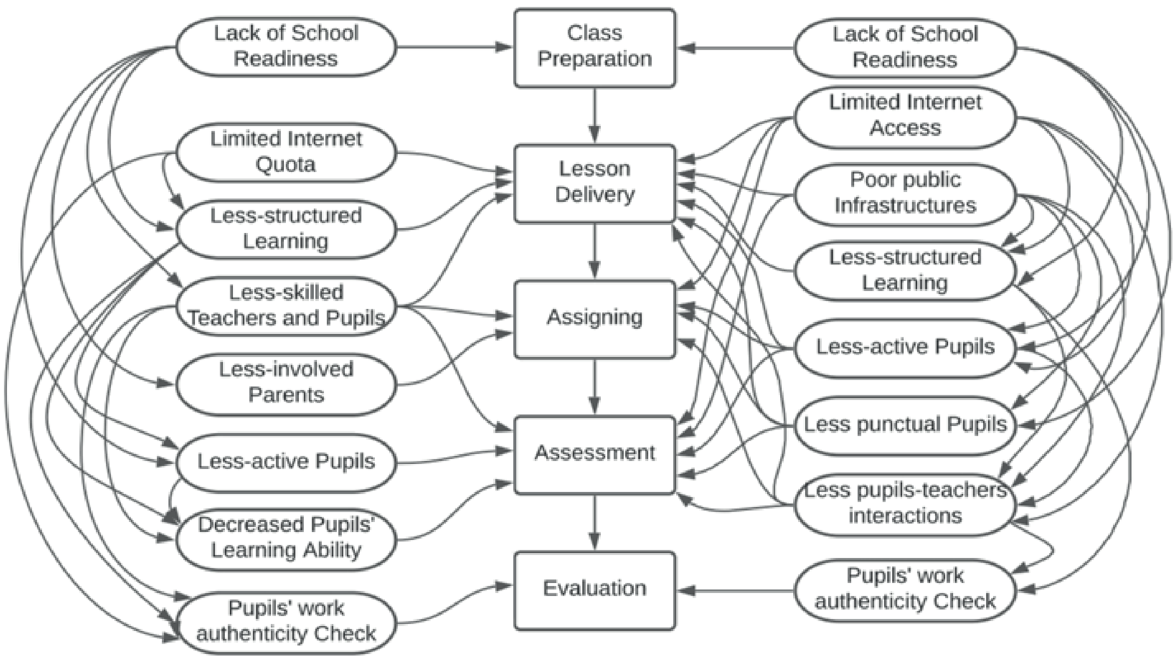

Figure 9. Schools learning challenges asymmetric relations

As can be learnt from Figure 9 above, there were at least five areas of teaching processes interfered with by the professional challenges, from preparation to the evaluation stages. The challenges found at each stage of learning are indicated by inner arrows. Such challenges were believed to have been typical constraints for schools in developing countries (Deepika 2020; Adnan & Anwar 2020; Dube, 2020, Taradisa et al., 2020; Simamora, 2020), therefore, it was not surprising that these challenges were reported by rural and urban schools in West Kalimantan province. The readiness of schools to adopt online learning, for example, greatly determines the success of online learning (Kebritchi et al., 2017). The unpreparedness of teachers, pupils, and parents to collaborate in implementing this learning can determine the failure to enforce online learning. As shown in Figure 9, as a primary challenge, the unpreparedness of teachers, pupils, and parents to switch from offline to online learning made learning problems develop into other issues, which we called secondary and tertiary challenges.

The sudden shift from full offline to online learning made pupils and teachers less ready to embrace online learning. To get used to it, an adaptation period was needed (Adnan & Anwar, 2020). For teachers, their unpreparedness could be seen from their lack of skills in operating technology in online learning. In addition, it could also be identified from the tecahers' ability to design learning according to online learning procedures. For pupils, as also reported by Dwi, et al. (2020) and Deepika (2020), the transition period was found unattractive and boring, that they tended to be less active and could not learn as much as in offline ones. Parents also faced an almost similar problem. To be involved further in supporting their children during online learning, a transition period was also needed. This situation made parents less optimal in supporting pupils' learning at home. As reported by the schools, all of the problems above, either directly or indirectly, became an integrated challenge in implementing online learning and tended to cause a decline in pupils' competencies (Taradisa et al., 2020; Deepika, 2020).

Improving Future Online Learning Implementation: Rural and Urban Schools' Voices

The decision to dismiss pupils from full offline learning mode to online learning was considered uneasy by schools both in rural and urban areas (Mustakim, 2020). Therefore, alternative solutions were needed. In this regard, pupils' and teachers' voices regarding potentials for future improvement were valuable to improve future online learning implementation (Deepika, 2020). In general, the proposed improvements recorded above tended to lead to primary challenges, such as improved learning facilities, increased mastery of technology, improved classroom management under online learning needs and greater parental involvement were the main requirements in improving the quality of online learning in schools.

As discussed above, primary challenges refer to the fundamental challenges that schools faced from the start of their online learning to the end. Therefore, it made sense for schools to focus their proposals on improving these challenges. If they were not solved, it would be tough to improve the quality of future online learning. Handayani (2020), Simamora (2020), Dube (2020) and Bestiantono, et al. (2020) illustrate with the instability of the internet network, limited interaction between teachers and pupils, and limited face-to-face meetings between teachers and pupils, schools cannot be expected to run high-quality online learning. In addition, improving teachers' and pupils' readiness to embrace online learning would also be key steps in improving online learning implementation quality in the future (Kebritchi et al., 2017). To do so, they proposed a number of strategic steps, such as administering dynamic presentations, laboratory tutorials, simulations, conceptual discussions, interaction, and collaboration with pupils to bolster their action, exploration, and knowledge improvement.

The emergency shift from full offline to online learning, as a result of the COVID-19 pandemic, seemed to be a challenging process for schools and parents. It was evident from the results of the analysis conducted in this study, which showed that schools and parents had to strive to keep the learning going in the midst of a number of movement and interaction restrictions. With the aim that, there were at least seven learning scenarios developed and implemented by the schools, ranging from full online learning to modified offline distant learning. The learning scenarios showed the significant variations in the challenges and strengths of each school in urban and rural areas in continuing learning during the pandemic. The scenarios were adapted to the conditions of each school. In doing so, a number of challenges had been reported by schools, ranging from the lack of readiness of teachers, pupils, and parents in implementing online learning, to the lack of supporting facilities. After extraction and interpretation have been carried out, the challenges could be grouped up into three layers: primary, secondary, and tertiary. The three layers of problem had an asymmetric relationship, where the primary challenges caused the emergence of secondary and tertiary challenges either directly or through secondary challenges.

Urban schools mainly dealt with the unpreparedness of teachers and pupils in integrating technologies, which was an integral part of online learning implementation, into their routine learning, as the alternative to regular offline learning. Meanwhile, rural schools seemed to face even tougher challenges, because apart from having to face the fact that their pupils and teachers were not ready to integrate technology in learning, they also had to deal with challenges in the form of limited online learning support facilities such as access to the internet and limited ownership of devices for carrying out online learning. The aspects recommended by the school to be improved above were the main elements of online learning, if fulfilled and improved, the opportunities for online learning to run better in the future will be greater.

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STATE OF RESEARCH ON E-ASSESSMENT IN EDUCATION: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

This study aimed to reveal the trend of research on e-assessment in the field of educational sciences through scientific mapping and bibliometric analyses. For this purpose, the numerical distribution of research on e-assessment, citation analysis, research themes and the change of trend topics were examined. The publications to be examined were selected from WoS database according to PRISMA model, and 911 studies were included in the analysis. VOSviewer, Biblioshiny, Smart Bibliometrics and Leximancer software were used in data analysis. Apparently, there has been a significant increase in the number of research since 2005, and publications have been mostly produced in form of articles and papers. The most cited and the most productive countries are the USA, the United Kingdom and Australia, while the most cited journals are Assessment & Evaluation in Higher Education and British Journal of Educational Technology. An analysis of the keyword map revealed that the themes of technology and motivation, blended learning and collaboration, interaction and innovative approaches, validity and reliability, higher education, quality, basic disciplines and Covid-19 were frequently emphasized in the studies on e-assessment. An analysis of trend topics by years showed that, between 2010 and 2021, the trend topic distribution changed to include topics such as Covid-19, academic integrity, engagement, cheating, case study, and higher education. All these findings reveal that e-evaluation activities have displayed a development and transformation over time with the effect of developing technology, the pandemic, the spread of e-learning, the expansion of communication opportunities and many other factors.

Keywords: E-assessment, online assessment, online evaluation, e-learning, bibliometric analysis.

INTRODUCTION

As a key component for effective learning with an essential role for all educational levels, the assessment process aims to identify students' knowledge, skills and understanding, as well as to promote learning and ensure achievement of intended learning outcomes. Assessment also has an influence over students' approaches to learning and study; assessment process is seen as one of the factors influencing students' perceptions of learning environments (Thomson & Falchikov 1998). It also strengthens the quality of education, facilitating the recognition of the education provided in different institutions. E-assessment is defined as the use of information and communication technologies (ICT) in all processes, from designing assignments to storing results, throughout the assessment process (Joint Information Systems Committee, 2007). Jordan (2013) also stated that the term e-assessment covers the use of computers as part of any assessment-related activity. With the acceleration of e-learning processes, e-assessment practices have become more and more widespread. The rising interest in e-assessment practices and the increasing volume of research on the topic are also associated with the changing nature of higher education and increasing expectations for e-assessment practices (Nicol, 2007).

E-assessment Processes

Besides their numerous advantages and conveniences, e-assessment processes may also cause some limitations and ethical problems due to the misperception-misuse of the process. Opportunity for immediate feedback (Rolim & Isaias, 2019), flexibility to provide different feedbacks (Nikou & Economides, 2018), advantages in terms of spatial access (Peytcheva-Forsyth et al., 2018) and the ability to increase opportunities for self-reflection (Whitelock et al., 2015) are some of the unique advantages offered by e-assessment. On the other hand, Peytcheva-Forsyth et al. (2018) stated that e-assessment practices also have some inherent challenges such as cheating, copying, plagiarism and fake identity, which may reduce the quality of online learning and assessment. Mellar et al. (2018) used student authentication and authorship checking systems in their study to address cheating, which is one of the major problems in e-assessment processes. They noted in their study that most of the teachers considered cheating as a big problem in e-assessment, while student authentication was not perceived as a big problem in well-controlled proctored assessments, and that author checking is important to prevent plagiarism. There have still been a lot of research on different topics in the field of e-assessment, such as effectiveness of assessment, fairness of exams, e-assessment procedure, quality assurance and pedagogical principles (Conn &Norris, 2005; Flavin, 2021; Fructuoso et al., 2018; St-Onge et al., 2022).

Bibliometric Analysis

Particularly in recent years, bibliometric analysis has gained great popularity in research (Khan et al., 2021); it is stated that this popularity is based on its contribution to handling large volumes of scientific data and creating high research impact (Donthu et al., 2021). Given the contribution of a critical view of the past to the progress of the future, systematic reviews of journals with an academic background are seen as a common practice in academia (Rialp et al., 2019). Bibliometric analysis is used to make sense of and decipher large quantities of unstructured data, providing researchers a single general point of view, and can build solid foundations to stimulate progress in a field in unique and meaningful ways (Donthu et al., 2021). The bibliometric method involves the application of quantitative techniques such as citation analysis on bibliometric data such as publication and citation units (Broadus, 1987). Like the bibliometric method, systematic literature searches are also used to provide an overview of research. However, systematic literature reviews are conducted manually by researchers and therefore require a narrow study scope; they include fewer articles for review (Snyder, 2019), and rely on qualitative techniques that can be impaired by the interpretation bias from academics with different academic backgrounds (MacCoun, 1998). Thus, the bibliometric analysis method, which is based on quantitative techniques and can provide a summary of a particular field by handling large quantities of literature, is often preferred especially when the dataset is too large for manual review.

Problem Situation

While e-assessment practices remain a topic for many academic studies with their advantages and limitations, studies aiming to provide an overview of research on e-assessment and to create a general map of research trends are extremely limited. Many reseachers have utilized systematic review method to measure distribution of trend topics, and research effectiveness. For example, in his research to provide an overview based on the articles in three scientific journals on e-assessment, Stodberg (2012) stated that there were generally small-scale studies containing closed-ended questions such as multiple choice questions, and that more longitudinal studies were needed on e-assessment. Gikandi et al. (2011) conducted a systematic qualitative review of the research literature on online formative assessment in higher education, emphasizing validity, reliability, and dishonesty as key issues of assessment upon their research, underscoring the importance of formative and immediate feedback, engagement with critical learning processes, and promoting equitable education. The bibliometric method was used only by Sudakova (2022) , who conducted a bibliometric research on online formative assessment in higher education, analyzing 898 studies searched in the Scopus database, and presented citation analyses, the most influential journals, authors, trend topics, and co-creation networks. Yet, he limited his work to higher education and formative assessment. There is no bibliometric study in the literature that will reveal the map of studies that examine e-assessment in all aspects and educational levels within a general context. As bibliometric analysis provides broader insight through quantitative synthesis of research topics in a particular discipline via citation mapping (Zupic & Cater, 2015), there is a gap in the literature for such studies in which research on e-assessment is examined from a holistic context with this method.

PURPOSE OF THE STUDY

This study aims to reveal the trend of research on e-assessment in the field of educational sciences through scientific mapping and bibliometric analyses. Answers were sought for the following questions in the field of educational sciences in line with this purpose:

1. How is the numerical distribution of research on e-assessment by year, type of publication and country?
2. Which journals, authors, institutions and countries are most cited in the research on e-assessment?
3. What are the themes of research on e-assessment?
4. How is the change of trend topics in the research on e-assessment by year?
5. How is the cluster distribution formed after the text analysis of titles- keywords and abstracts in studies on e-assessment?

METHOD

Data Collection Process

Web of Science (WoS) database was used for the selection of the papers to be examined in the scope of this research. This database was chosen as it has a wider historical scope than Scopus (Balstad & Berg, 2020). The publication review using logical operators and keywords was shaped according to the PRISMA model (Page et al., 2020). Figure 1 provides a summary of how the publication search was shaped.

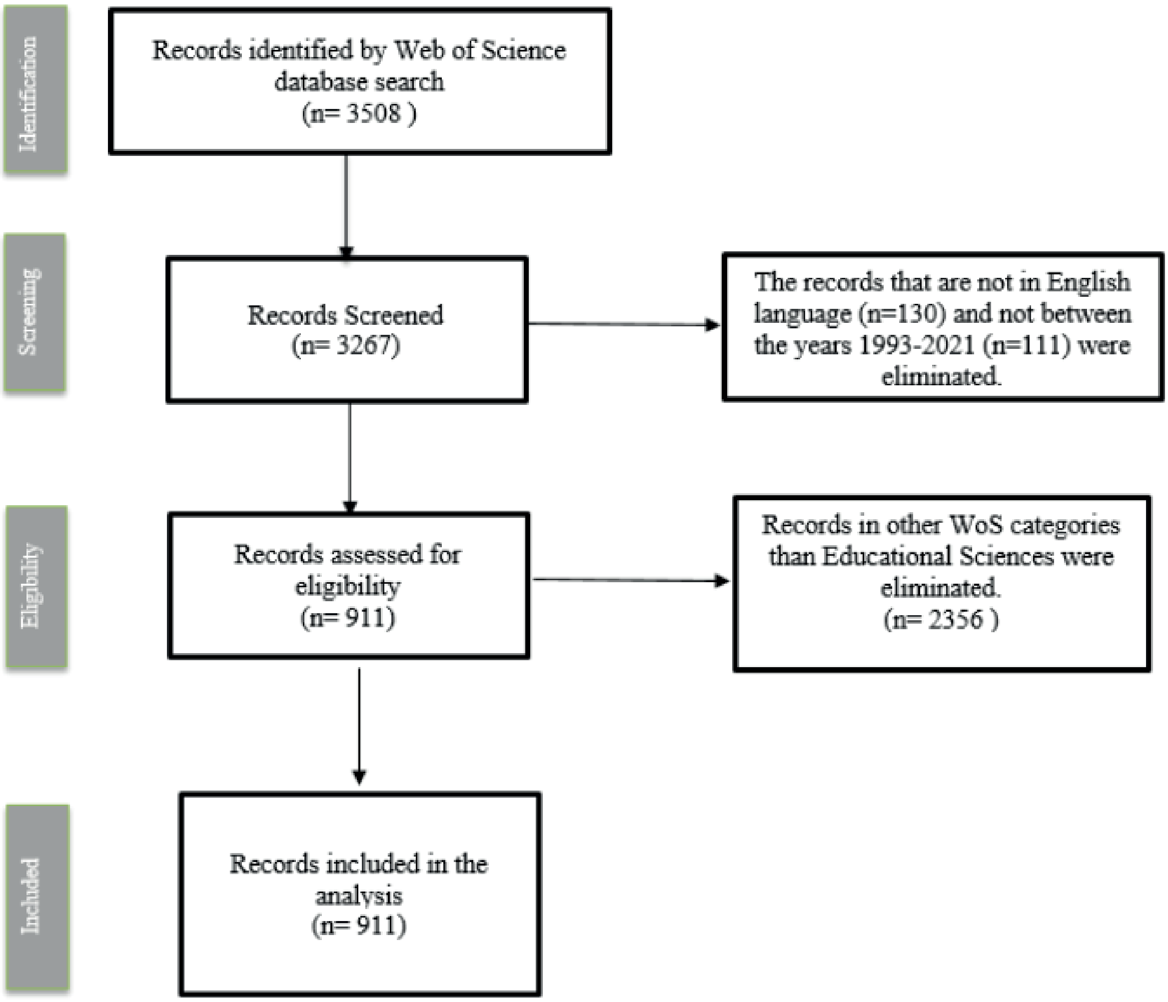


Figure 1. Selection of the publications included in the research by PRISMA method

A search was performed on WoS database on 26.05.2022. Studies in which the terms "online evaluation", "online assessment", "e-assessment" or "e-evaluation" were used in the title, keyword and abstract were searched using logical operators; 3508 records were found. After the records that are not in English language (n=130) and not between years 1993-2021 (n=111) were excluded, and the records in category of Educational Sciences were filtered, the remaining records (n=911) were included in the analysis.

Analysis of Data

VOSviewer, Biblioshiny, Smart Bibliometrics and Leximancer software were used for data analysis in the research. Distribution analyses of the examined publications were made on the information provided by the WoS database, and the worldwide scientific production map was produced by the Smart Bibliometrics software. Biblioshiny, Smart Bibliometrics and VOSviewer were collectively used in citation analysis, common word analysis and trend topic distribution analysis; Leximancer software was used for text analysis of abstracts-keywords and titles. VOSviewer is a free computer software for bibliometric mapping and visualization (Van Eck & Waltman, 2010). Smart Bibliometrics is a free or restricted access software that provides automatic visualization by uploading database files to designated drives (Pessin et al., 2022). Biblioshiny is software created in R, a programming language for statistical computing and graphics, and analyzing information in database files with dynamic graphic visualizations (Massimo & Cuccurullo, 2021). Leximancer is a text-mining program used for the analysis of qualitative data, providing visual display of information in the database in various forms such as concept maps and network clouds through statistics-based algorithms (Smith & Humphreys 2006). The described software were used for citation, distribution and text analyses in line with the questions of this research; the data were carefully reviewed before analysis, combining words with similar meanings and creating 'thesaurus files' of data such as institution-journal-country-author that are referred to in various ways for use in the analyses.

Limitations

This research is limited to e-assessment studies in English between the years 1993 and 2021, searched under the category of Educational Sciences in WoS database. E-assessment studies that are indexed in other databases and not in WoS are excluded from the scope, which constitutes one of the limitations of the research. Bibliometric analysis studies also have some limitations in the aspect that they examine social effects and take metadata into consideration rather than actual data of research (Mishra et al., 2021).

FINDINGS

911 studies covering the period 1993-2021 were analyzed under this research. The numerical distribution of the analyzed researches by year, publication type and countries, the most cited journals, authors, institutions and countries, the research themes of their studies, the change in trend topics and the cluster distribution resulting from text analysis will be presented in Findings section.

Distribution Analysis of Research on E-Assessment

The distribution of the number of publications included in the research by year is shown in Figure 2. There has been a significant increase in the number of studies on e-assessment since 2005, with the highest rank belonging to 2021 with 80 publications.

Figure 2. Distribution of the number of publications by year

Figure 3 presents the graphical representation of the distribution of studies by type of publication. As can be seen from Figure 3, research on e-assessment is mostly produced in article format with a rate of 52%, which is followed by conference proceedings with a rate of 41%. Book chapters ranked third with a rate of 4%, followed by early access publications, editorial materials and review papers that account for the remaining 3% altogether.

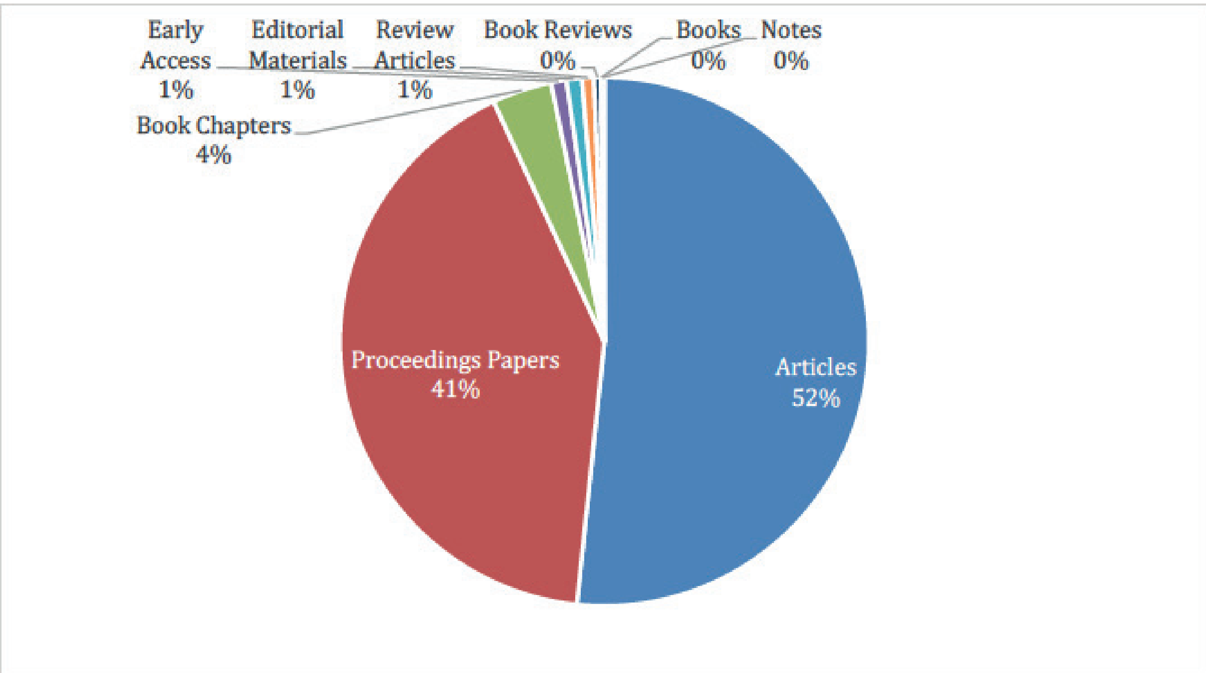


Figure 3. Distribution of studies by type of publication

The ranking of countries by publications produced in the field of e-assessment is shown in Figure 4. Figure 5 presents the worldwide scientific production map of studies on e-assessment. The most productive countries in the field are the USA (n=129), England (n=113), Australia (n=86) and Spain (n=86), as shown by Figure 4. Figure 5 reveals, on the other hand, that scientific production in the field of e-assessment is more prevalent across Europe, North America and Australia.

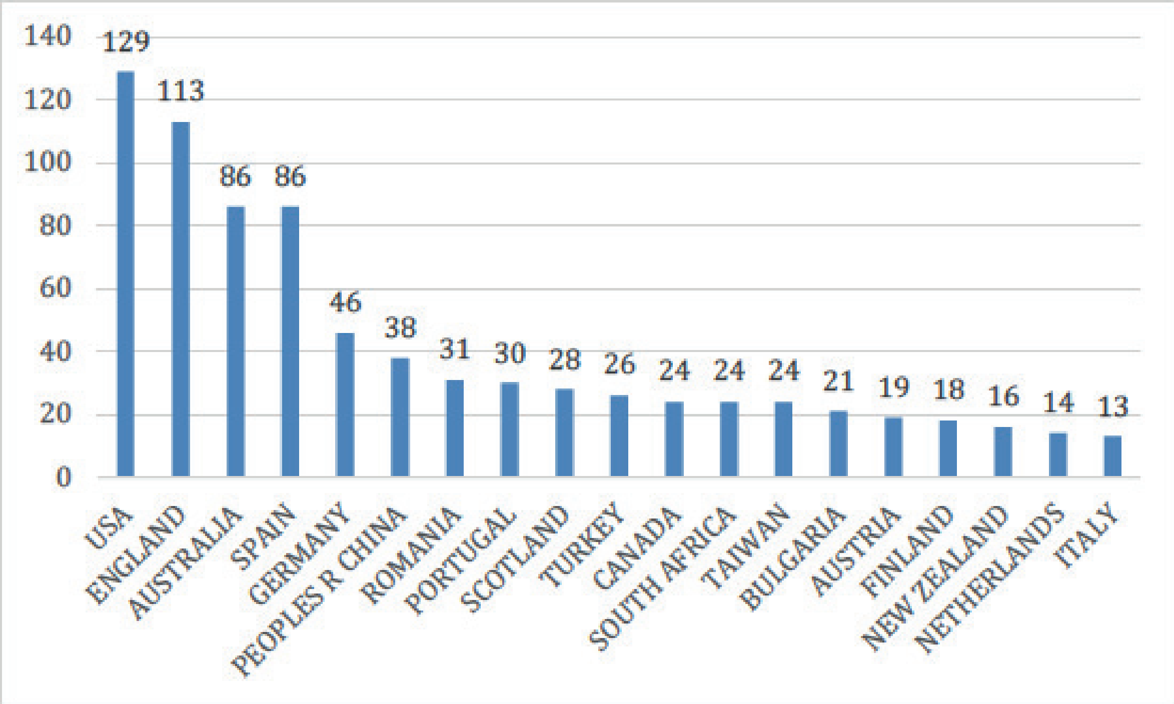


Figure 4. Ranking of countries by number of publications

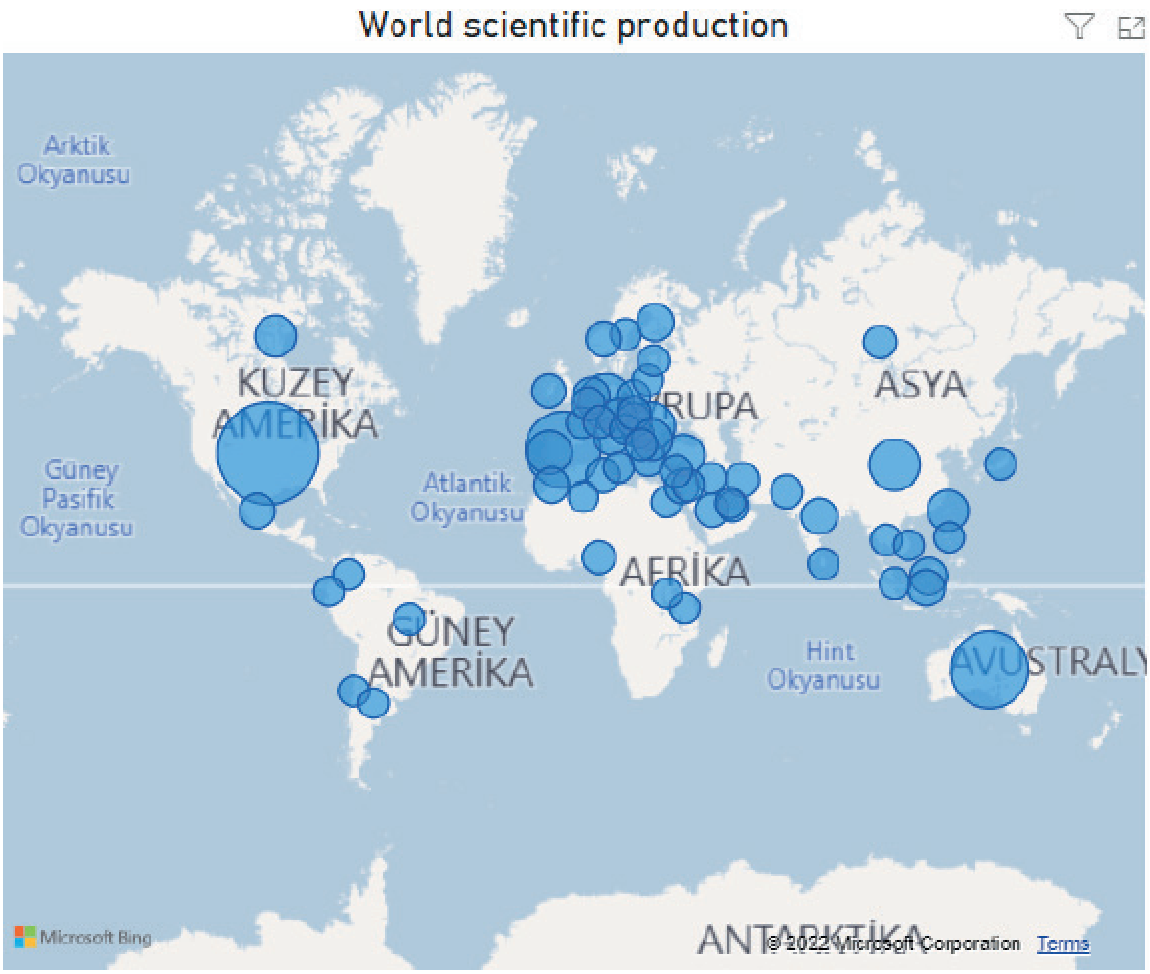


Figure 5. Scientific production map of e-assessment studies worldwide

Citation Analysis

Most Cited Journals and Most Productive Journals

The sources with the highest number of publications in terms of studies on e-assessment are shown in Figure 6. As seen from Figure 6, the International Journal of Emerging Technologies In Learning (n=31), Assessment & Evaluation In Higher Education (n=30) and British Journal of Educational Technology (n=28) are listed as the top sources with the highest number of publications in the field of e-assessment. It is concluded from Figure 6 that Edulearn conferences have an important position in terms of studies on e-assessment.

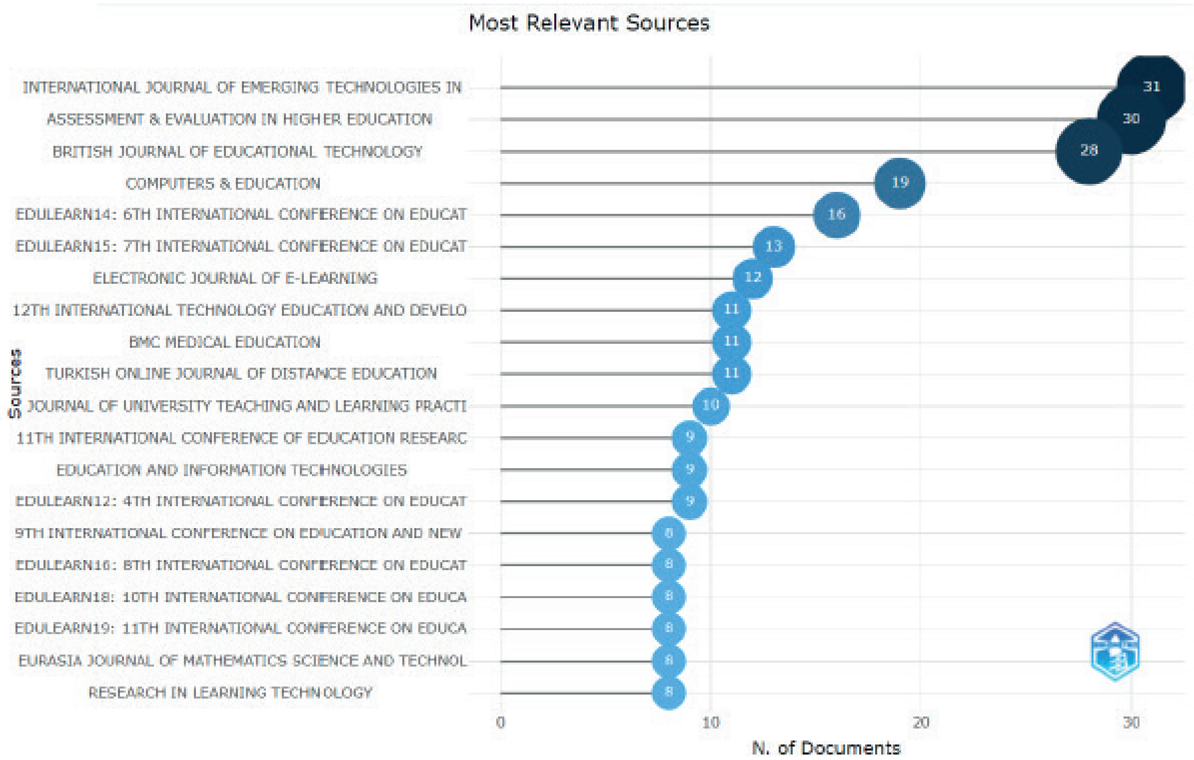


Figure 6. Sources with the highest number of publications in terms of research on e-assessment

The most cited journals in the field of e-assessment are listed in Figure 7 and Table 1. It is seen that Computers & Education (n=960), British Journal Of Educational Technology (n=740) and Assessment & Evaluation in Higher Education (n=554) are the most cited journals.

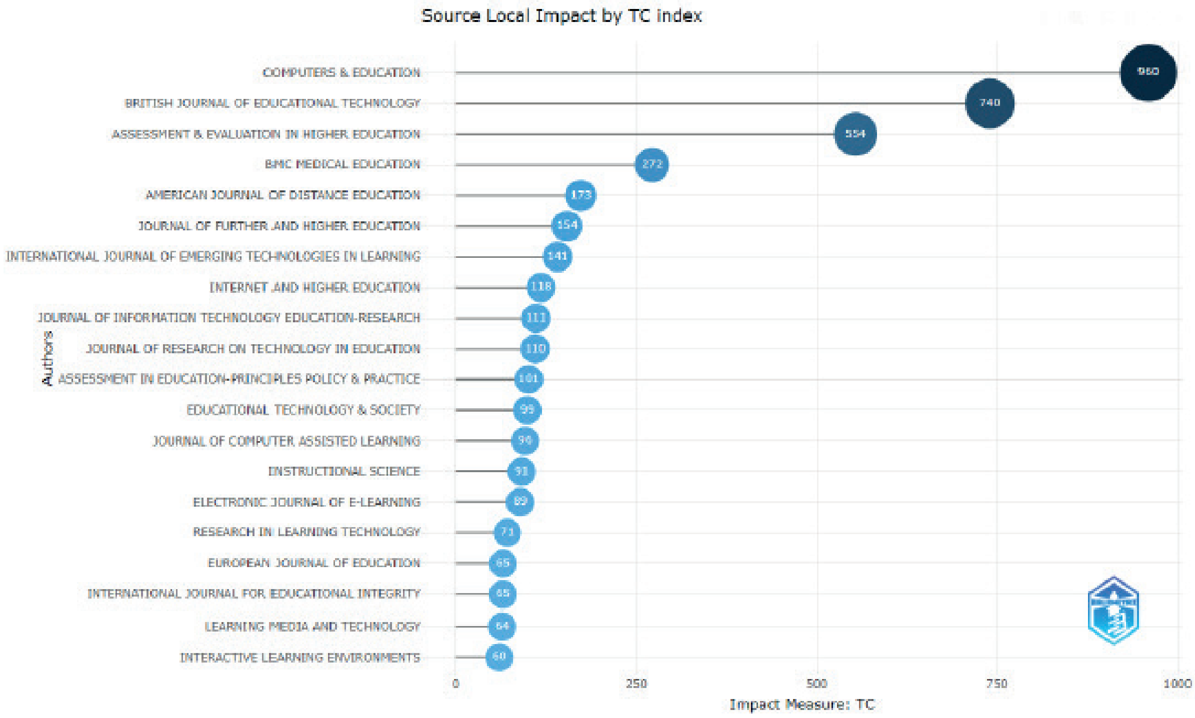


Figure 7. Most cited journals by research on e-assessment

Table 1. Most cited journals by research on e-assessment

Title of Journal	Number of Document	Citation Count	TLS
Computers & Education	19	960	59
British Journal Of Educational Technology	28	740	132
Assessment & Evaluation In Higher Education	30	554	134
Bmc Medical Education	11	272	3
American Journal Of Distance Education	3	173	16
Journal Of Further And Higher Education	2	154	21
International Journal Of Emerging Technologies In Learning	31	141	39
Internet And Higher Education	4	118	13
Journal Of Information Technology Education-Research	3	111	17
Journal Of Research On Technology In Education	1	110	7

TLS: Total Link Strength

In view of the Figure 7 and Table 1, the position of Computers & Education as the most cited journal despite ranking 4th in the list of highest number of publications can be considered as an indicator of the quality of the articles in this journal. British Journal of Educational Technology and Assessment & Evaluation in Higher Education both have the highest number of publications and the highest citation counts, which allows these journals to be considered as the leading sources in the field of e-assessment.

According to Garfield (1980), Bradford's Law claims that a substantial portion (1/3) of articles published on a particular subject or discipline is always composed of a small, core group of sources, while the other 1/3 is composed of a second group of more sources, and the remaining 1/3 comprises a large group that covers a lot more sources. Accordingly, it is suggested that there is a core group of sources in productivity ranking of the scientific journals publishing articles on a particular subject, and that the majority of articles are a part of that core group, arranged in order of decreasing productivity (Bradford, 1934). Figure 7 presents the core source distribution of publications in the field of e-assessment according to Bradford's Law.

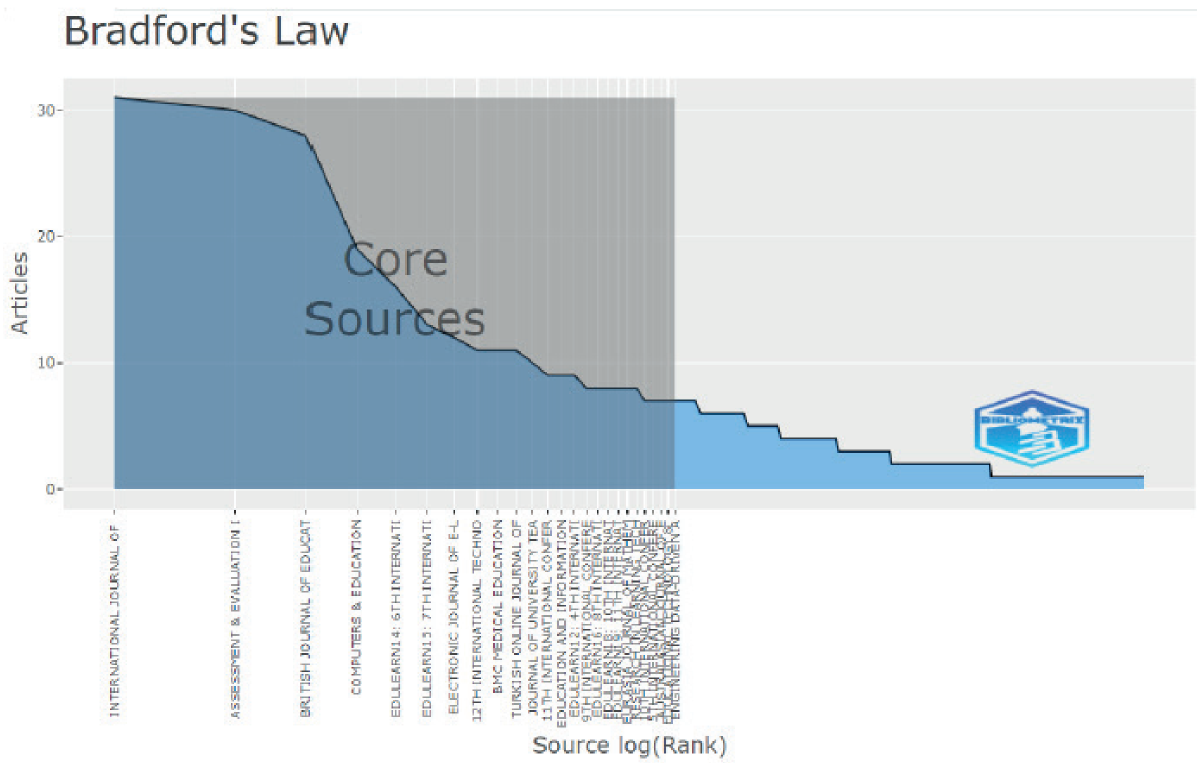


Figure 8. Core group of sources as per Bradford's Law

The findings given in Figure 7 are in parallel with Figure 6, which presents the ranking of the sources with the highest number of publications. It is understood that the International Journal of Emerging Technologies In Learning, Assessment & Evaluation In Higher Education, British Journal of Educational Technology and Computers & Education journals, which represent a significant portion of the core group of journals, are also listed as the journals with the highest number of publications.

Most Cited Authors and Collaboration of Authors

The authors with the highest citation count for research on e-assessment are listed in Figure 9. As shown by Figure 9, Martin Ebner Andreas Holzinger, David Nicol and Gavin Brown are among the top-cited authors.

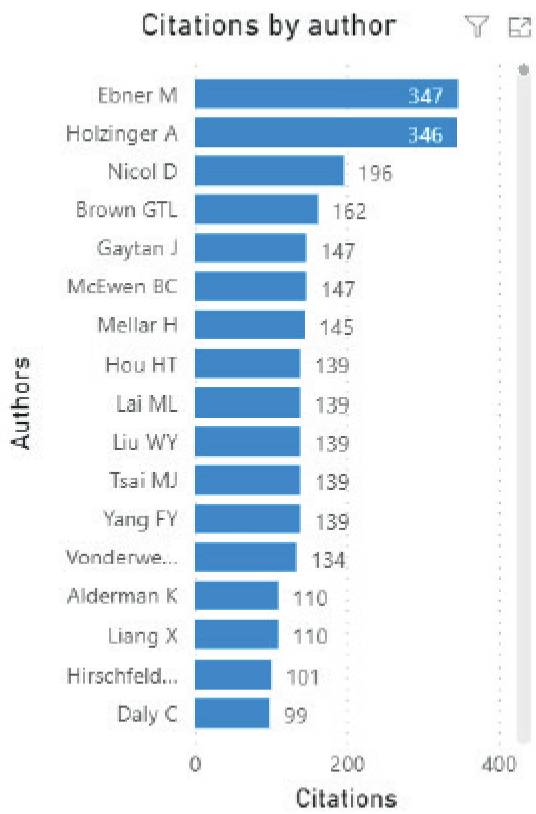


Figure 9. Most cited authors by research on e-assessment

The topics mostly addressed in publications by the most cited authors are seen to include the use of e-assessment in game-based learning, e-assessment design, students' perceptions of assessment, e-assessment strategies, formative assessment, and test reliability methods such as student authentication and authorship checking systems.

Figure 10 presents the distribution of corresponding authors in publications on e-assessment by country. A corresponding author is the person who submits the publication to the journal editor, manages all communicative processes, and has an e-mail address on the first page of the article as a contact person for other researchers (Mattsson et al., 2011). Accordingly, there are a total of 116 articles in which the corresponding author is based in the USA, with the USA ranking the top place. The UK ranks 2nd with 115 articles, Australia 3rd with 68 articles, and Spain 4th with 67 articles in the country ranking of the corresponding authors.

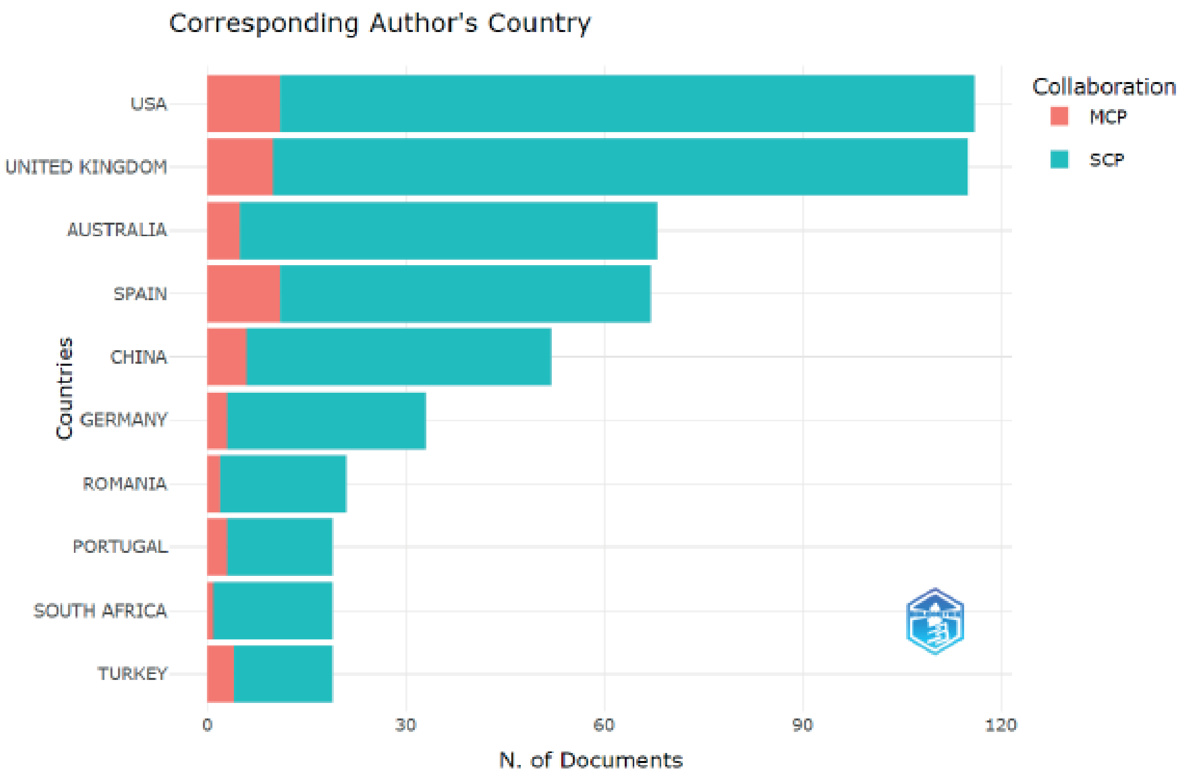


Figure 10. Distribution of corresponding authors by country. (Corresponding author's country. Intra-country (SCP) and inter-country (MCP) collaboration)

Figure 10 also shows the levels of intra-country (SCP) and inter-country (MCP) collaboration in different colors; the numerical equivalent of these representations is presented in Table 2. Table 2 shows the portion of intra-country (SCP) and inter-country (MCP) collaborations in the chart of country distribution of the corresponding authors (Figure 10).

Table 2. The intra-country (SCP) and inter-country (MCP) collaboration

Country	Articles	Freq	SCP	MCP	MCP_Ratio
USA	116	0,14518	105	11	0,0948
UNITED KINGDOM	115	0,14393	105	10	0,087
AUSTRALIA	68	0,08511	63	5	0,0735
SPAIN	67	0,08385	56	11	0,1642
CHINA	52	0,06508	46	6	0,1154
GERMANY	33	0,0413	30	3	0,0909
ROMANIA	21	0,02628	19	2	0,0952
PORTUGAL	19	0,02378	16	3	0,1579
SOUTH AFRICA	19	0,02378	18	1	0,0526
TURKIYE	19	0,02378	15	4	0,2105

According to Table 2, the rate of intra-country collaborations is higher than that of inter-country collaborations in many countries. The countries with the highest inter-country (MCP) collaborations are the USA, the UK and Spain. As for the MCP rate, Turkiye has the highest rate of inter-country collaboration, while Spain, Portugal and China are among the countries with a high rate of inter-country collaboration.

Most Cited Institutions

The list of most cited institutions in research on e-assessment is presented in Table 3. According to Table 3, Graz University of Technology, one of the five universities in Styria, Austria, and the oldest institute of science and technology research-training in Austria, is among the leading institutions in the field of e-assessment with 9 documents and 393 citations. It is followed by the University of Strathclyde in Scotland and the National Taiwan University of Science and Technology in Taiwan.

Table 3. Most Cited Institutions

Institution	Number of Document	Citation Count	TLS
Graz University of Technology	9	393	20
University of Strathclyde	6	232	40
National Taiwan University of Science and Technology	3	193	4
The University of Auckland	7	168	11
National Taiwan Normal University	3	156	2
North Carolina A&T State University	1	147	13
University of West Georgia	1	147	13
Cleveland State University	3	143	13
The University of Hong Kong	4	135	14
The Open University	17	124	77

TLS: Total Link Strength

It is seen that other top ranking institutions by productivity in the field of e-assessment are universities in New Zealand, Taiwan, USA, China and the UK. Also, it is understood that The Open University, an open education institution providing non-formal education at undergraduate level in the United Kingdom, has the highest number of publications in terms of research on e-assessment.

Most Cited Countries

The most cited countries in the field of e-assessment are listed in Figure 11 and the network map is shown in Table 12. The UK with 1443 citations and the USA with 1198 citations are the top ranking countries by a large margin in this field. They are followed by Australia (n: 621) and China (n:541).

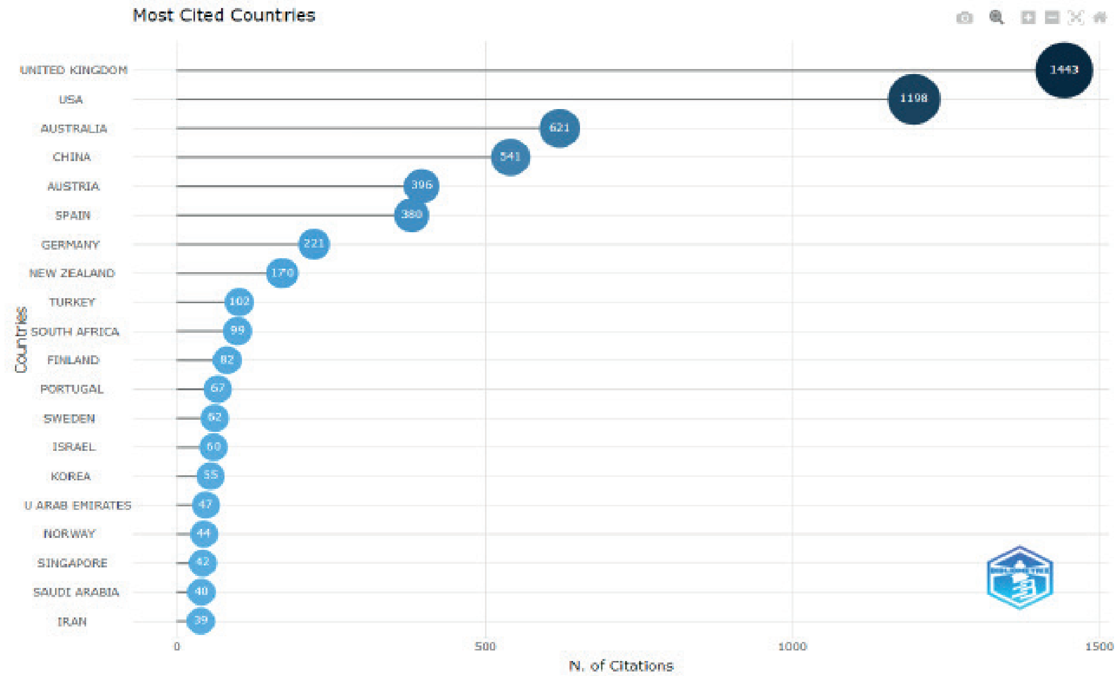


Figure 11. Most cited countries

The circles in the network map of the most cited countries in Figure 12 show the citation frequency, association and influence of that country according to their respective size. As can be understood from this figure, the most cited countries such as the UK (England), USA, Australia, and Spain are represented in a more central position with larger circles, which also confirms Figure 11. On the other hand, countries with weaker citation frequency and link strength are at the far ends of the map.

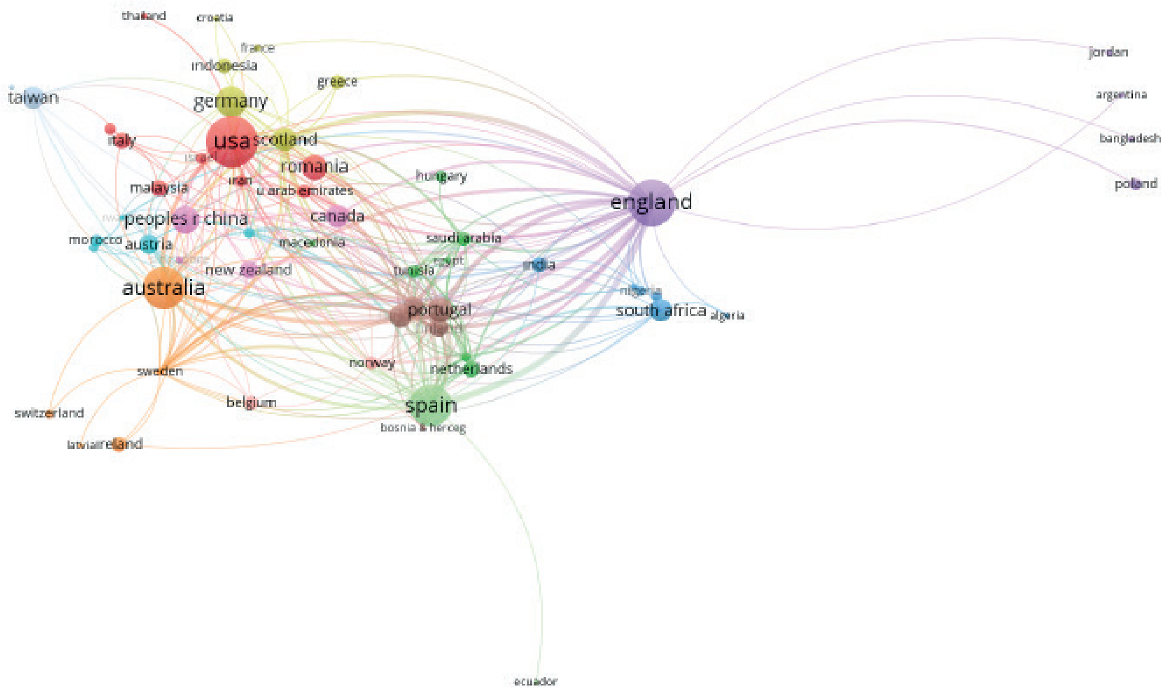


Figure 12. Network map of most cited countries

The 3-field plot in Figure 13 presents the keyword-source-country matching of the reviewed publications. Starting with the keyword and followed by the source, these three items are linked to the country of their publications via gray links. The size of the rectangles in each list indicates the number of publications associated with that item.

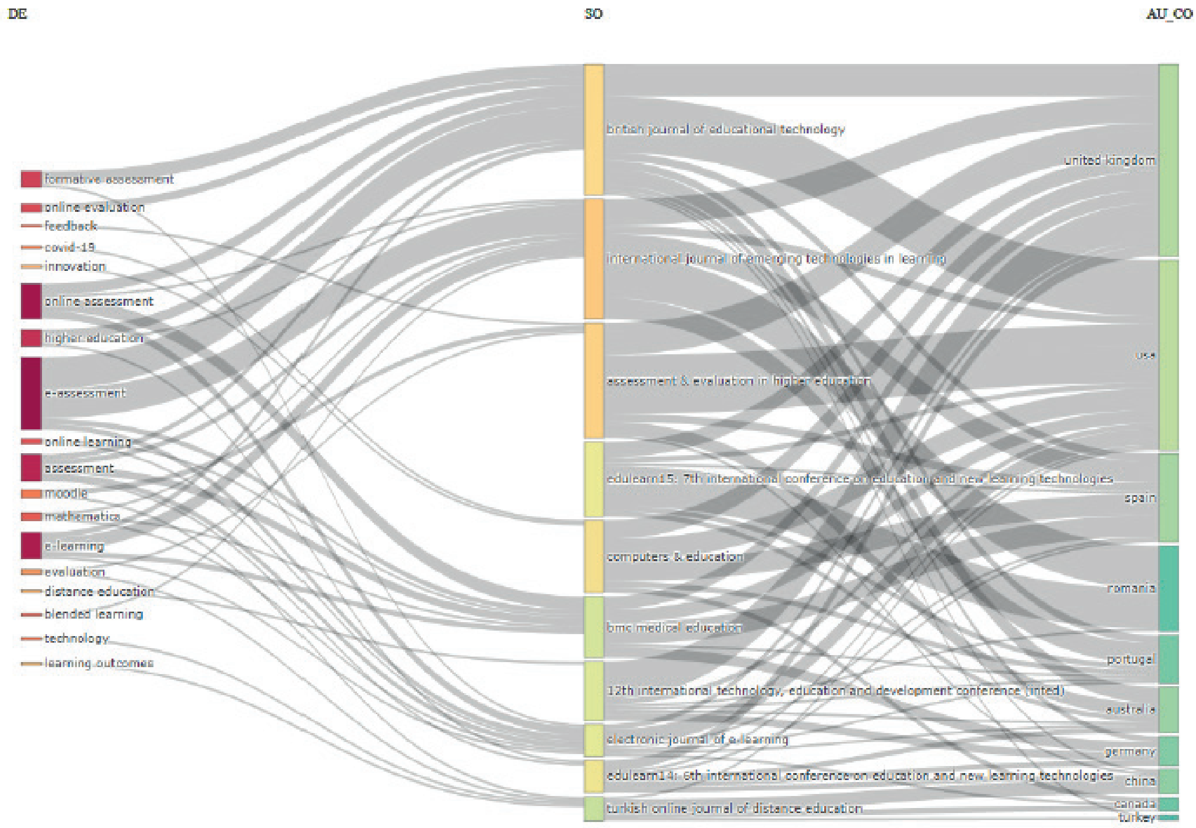


Figure 13. 3-field plot of keyword-source-country matching

When Figure 13 is examined, it is seen that the keywords "online evaluation, e-assessment, assessment, e-learning, higher education and formative assessment" are the most frequently repeated keywords. It is understood that the journals with the highest links for these keywords are British Journal Of Educational Technology, International Journal of Emerging Technologies In Learning and Assessment & Evaluation In Higher Education, and the publications in these journals are also mostly from the UK and the USA, as verified by the information in Figure 6. This supports the dominant position of the UK and the USA regarding publications in this field.

Common Word Analysis (Keyword)

Thematic clustering analysis based on keywords was conducted to explore the key concepts in the publications analyzed. The purpose of keyword analysis is to highlight the direction and main trends of research. Figure 14 provides a network visualization based on the co-occurrence of keywords identified by the authors. VOSviewer was used to visualize the co-occurrence of keywords. VOSviewer is a software that helps to create a bibliometric network and visualize its information. As shown in Figure 6, the larger the size of the circles, the stronger the frequency of occurrence of their keywords. The similar color of the circles indicates the cluster of keywords, and the lines between the circles indicate the link between the keywords (Xie et al., 2020). The minimum number of occurrences of keywords is set to 7. Out of 2116 keywords, 34 met the occurrence threshold of 7. As given in Figure 3, those keywords were divided into clusters based on their co-occurrence with other key words and their total link strength. There are 9 clusters formed.

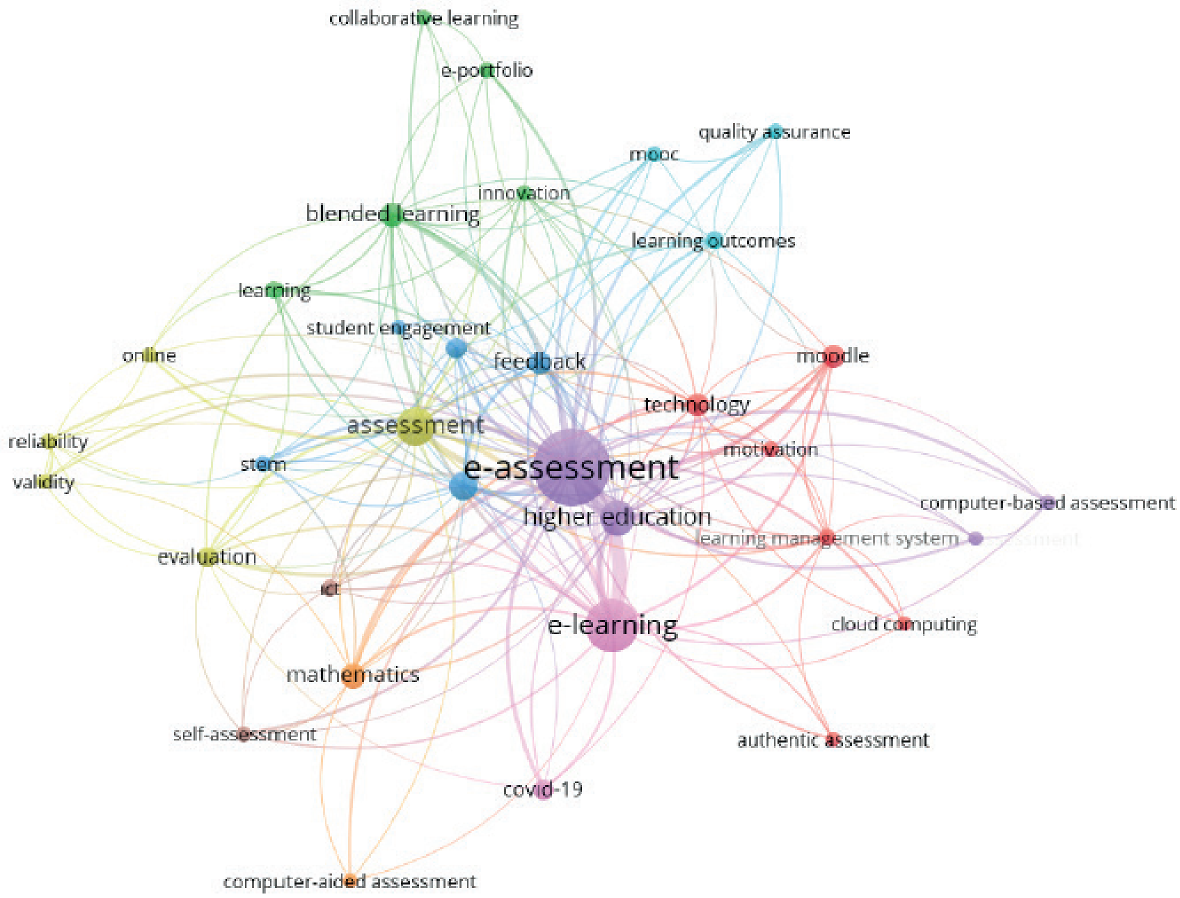


Figure 14. Keyword clustering generated in VOSviewer

Technology and Motivation: The red cluster consists of the words authentic assessment, cloud computing, learning management system, motivation, technology and moodle. Within this cluster, there is notable emphasis on learning management systems, which is one of the technologies used in e-assessment processes, with 3 different words. Moreover, it is seen that motivation and authentic assessment are frequently emphasized in the studies in this cluster.

Blended Learning and Collaboration: The green cluster consists of the words blended learning, collaborative learning, e-portfolio, innovation and learning. The concept of blended learning in this cluster is larger, which indicates that it is repeated more frequently compared to other concepts. The concepts of collaborative learning and e-portfolio are positioned in proximity of each other, which shows that these terms are often studied together.

Interaction and Innovative Approaches: The blue cluster covers the concepts of feedback, formative assessment, learning analytics, stem and student engagement. The concepts of feedback, formative assessment and student engagement, which point out the student interaction with the instructor or with the technical device in the e-assessment process, are gathered in the same cluster, which indicates that these topics related to interaction are frequently studied together. Innovative approaches such as stem and learning analytics have also been frequently associated with these concepts that point to interaction. The concepts of formative assessment and feedback are close to the center and larger than the other terms in the cluster, which indicates that these concepts are frequently studied in other clusters and their frequency of occurrence is high.

Validity and Reliability: The yellow cluster contains the terms assessment, online, validity and reliability. It is understood that the validity and reliability of online evaluation activities are questioned in this cluster. The central position and large structure of the term assessment in the cluster indicates that the term is both frequently repeated and frequently studied.

Higher Education Studies: The purple cluster covers the terms e-assessment, higher education, summative assessment and computer-based assessment. The most repeated word in this cluster is e-assessment, which is positioned at the center of the map, and followed by higher education. This indicates that studies on e-assessment have mostly been conducted at higher education level. It is understood that computer-based and summative assessments are also frequently addressed in e-assessment studies in higher education.

Quality: The turquoise cluster represents studies on learning outcomes, quality and moocs. It is understood from this cluster that the topic of quality is questioned particularly in moocs and learning outcomes.

Basic Disciplines: The terms mathematics, information technologies, computer-aided assessment and self-assessment are seen in the brown and orange clusters, which are two nested clusters. It can be deduced from this data that the two disciplines based on e-assessment studies are information technologies and mathematics, and that studies on self-assessment and computer-aided assessment are mostly related to these two fields.

Covid-19 Process: The pink cluster includes the terms e-learning and Covid-19. It can be understood that this cluster points to research on e-assessment processes in the studies on e-learning, which gained momentum during the Covid-19 pandemic.

Thematic Mapping

Figure 15 shows a thematic map divided into four topological regions based on density and centrality. This map was created by a semi-automatic algorithm with reference to the titles and keywords of all studies analyzed using Biblioshiny, and explains the research themes obtained from the conceptual structure of the documents included in the bibliometric analysis. The clusters in the graph indicate the subjects of the research, and the size of the clusters stands out in proportion to the number of keywords. Each quadrant in the figure represents a different theme. The right upper quadrant of the figure shows motor themes characterized by both high centrality and density. The left lower quadrant contains the subjects that have been used but showing a downtrend, indicated by low centrality and density. The themes placed in the right lower quadrant of the thematic map are known as core themes, while the left lower quadrant represents the themes that appear with low centrality and density.

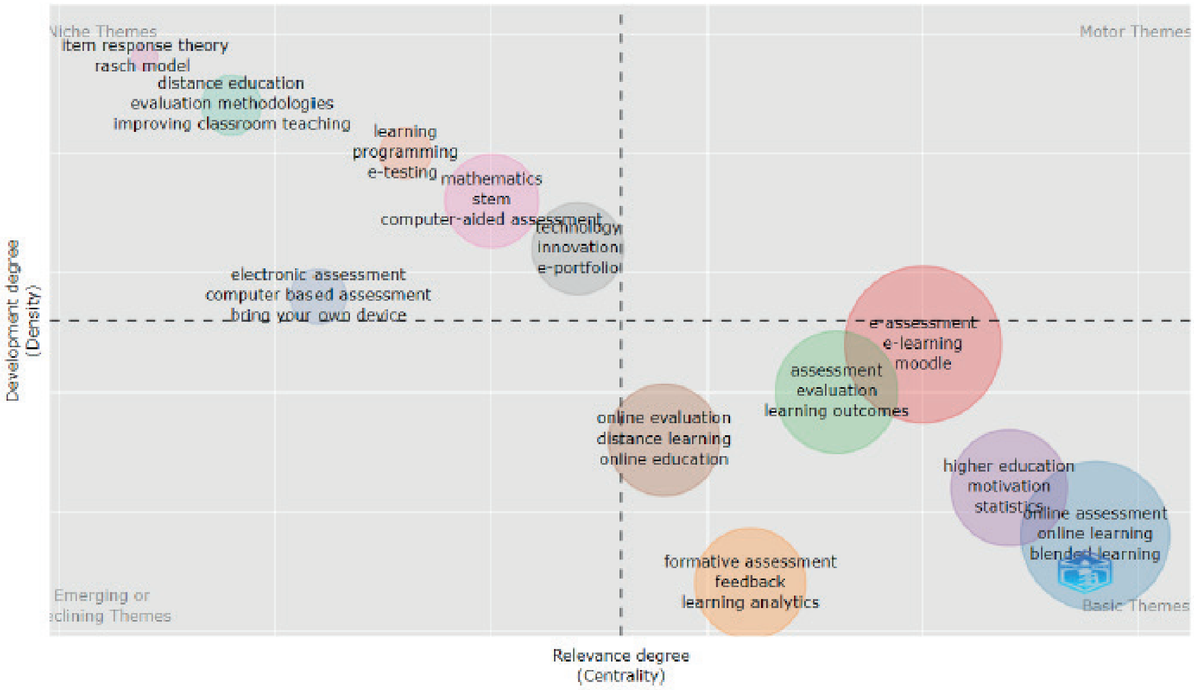


Figure 15. Thematic Map

The right upper quadrant is the area marked by high density and centrality, with e-assessment, e-learning and moodle clusters partially falling under this area. These topics need to be further developed given their importance for future research. The left upper quadrant shows underrepresented topics such as "item response theory", "stem" and "evaluation methodologies" with high density but low centrality, and with the potential to show rapid development. Whereas, the main themes with high centrality but low intensity in the right lower quadrant include topics such as formative assessment, higher education, online learning, and motivation. These are important for research as general topics, and are part of the topic of e-assessment.

Change in Trend Topics by Year

While some topics in the field of e-assessment have become trend topics over the years, others may end up becoming outdated. The changes in trend topics over the years are shown in Figure 16 for the period 1993-2010, and in Figure 17 for 2010- 2021.

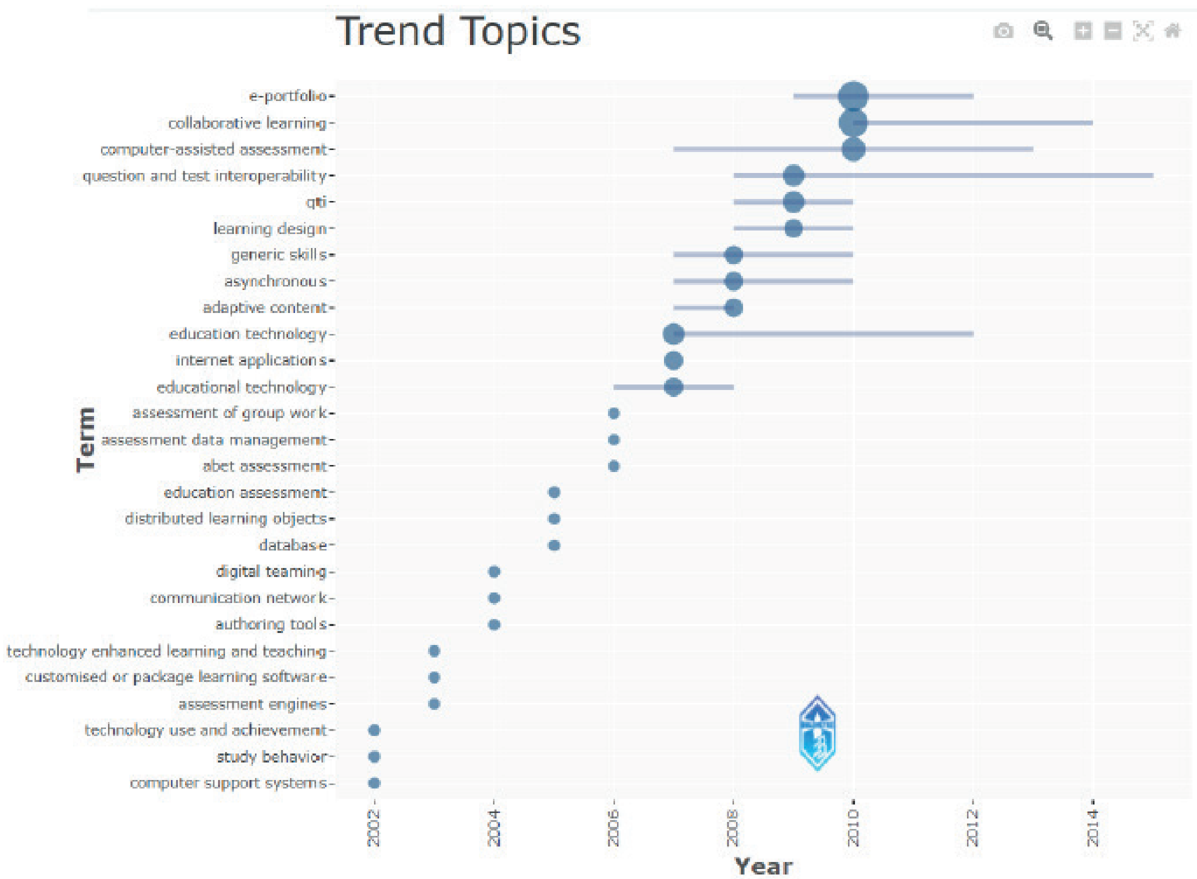


Figure 16. Change in Trend Topics by Year: 1993-2010

It is seen from Figure 16 that the studies on e-assessment in the period 1993-2010 were mostly concentrated on the year 2010, and that the topics of e-portfolio, collaborative learning and computer-aided assessment were the trend topics in the field of e-assessment. Also, Question and Test Interoperability (QTI), educational technologies, asynchronous technologies and adaptive content are among the topics studied frequently.

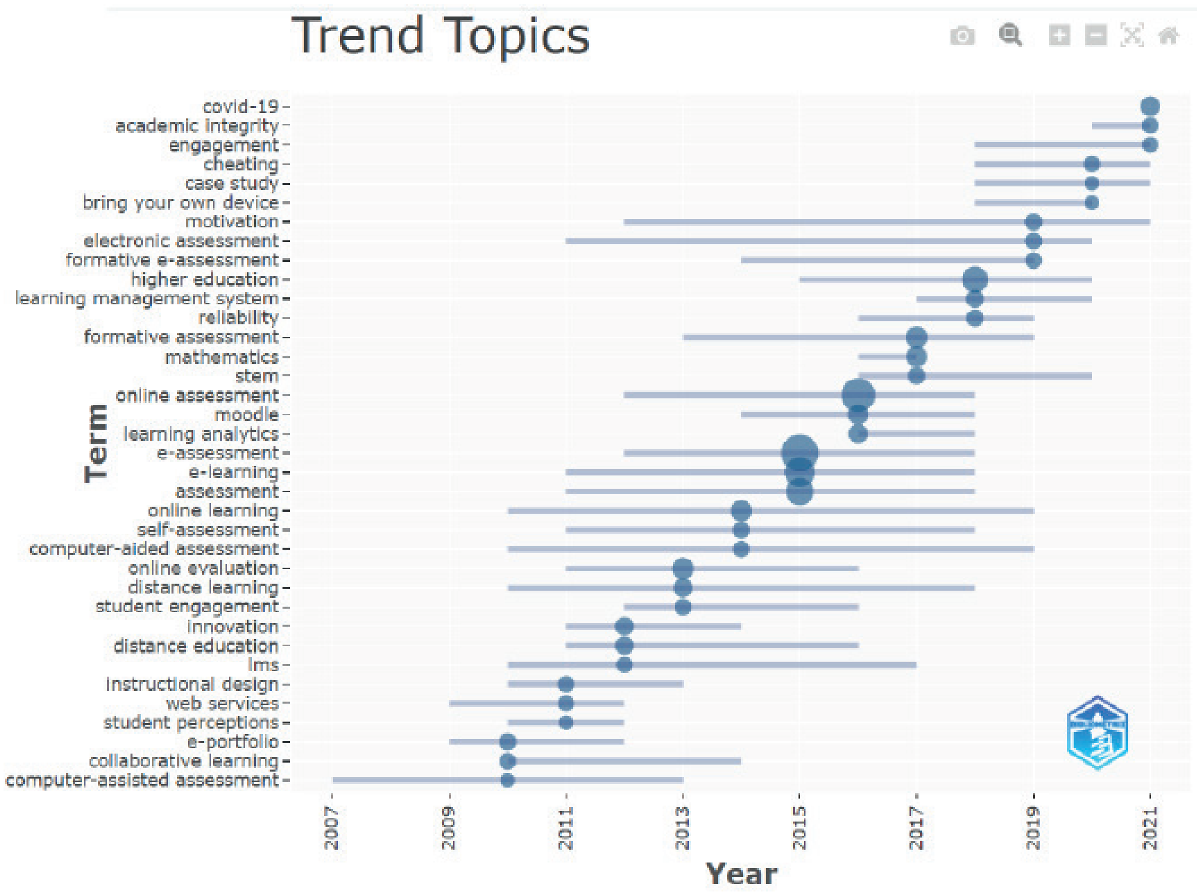


Figure 17. Change in Trend Topics by Year: 2010- 2021

Figure 17 shows that the studies on e-assessment in the period 2010-2021 were mostly concentrated on the period 2015-2018, in which e-assessment, e-learning, online learning, formative assessment, learning management systems, reliability, moodle and learning analytics were the trend topics in this period. A change is observed in the trend topics after the year 2019; it is noteworthy that Covid-19, academic integrity, engagement, cheating, case study, bring your own device and motivation appear as the trend topics in the field of e-evaluation. It is considered that the sudden transition to online education and e-assessment processes in many educational institutions during the Covid-19 pandemic has an impact on this change in trend topics.

Text Analysis of Abstract-Keywords and Titles

Figure 18 presents the thematic concept map created by text analysis via Leximancer software of the abstract-keywords and titles of the studies on e-assessment, which are examined in the scope of this research. Leximancer helps visualize the relationships between concepts based on the frequency of co-occurrence of the words in the analyzed text, enabling identification of thematic regions with colored circles of prominent concepts (Zawacki-Richter & Latchem, 2018). Figure 18 shows that the 8 themes obtained from the text analysis of the abstracts-keywords and titles of the analyzed studies are titled as Assessment, Student, Use, E-Assessment, Education, Feedback, Data, and Problem. These themes demonstrate that studies on e-assessment focus on many different elements related to students, such as performance, difference, group work, tasks, time and level, that feedback, data set and problems cover an important area in the studies on e-assessment, and that the systems, applications, platforms, tools, processes, etc. used in e-assessment mechanisms are of importance. Moreover, it is seen that higher education, technology education, learning outcomes, learning environment and learning support are frequently emphasized within the context of education in the studies on e-assessment, and that formative assessment, assessment methods and approaches are among the frequently studied topics.

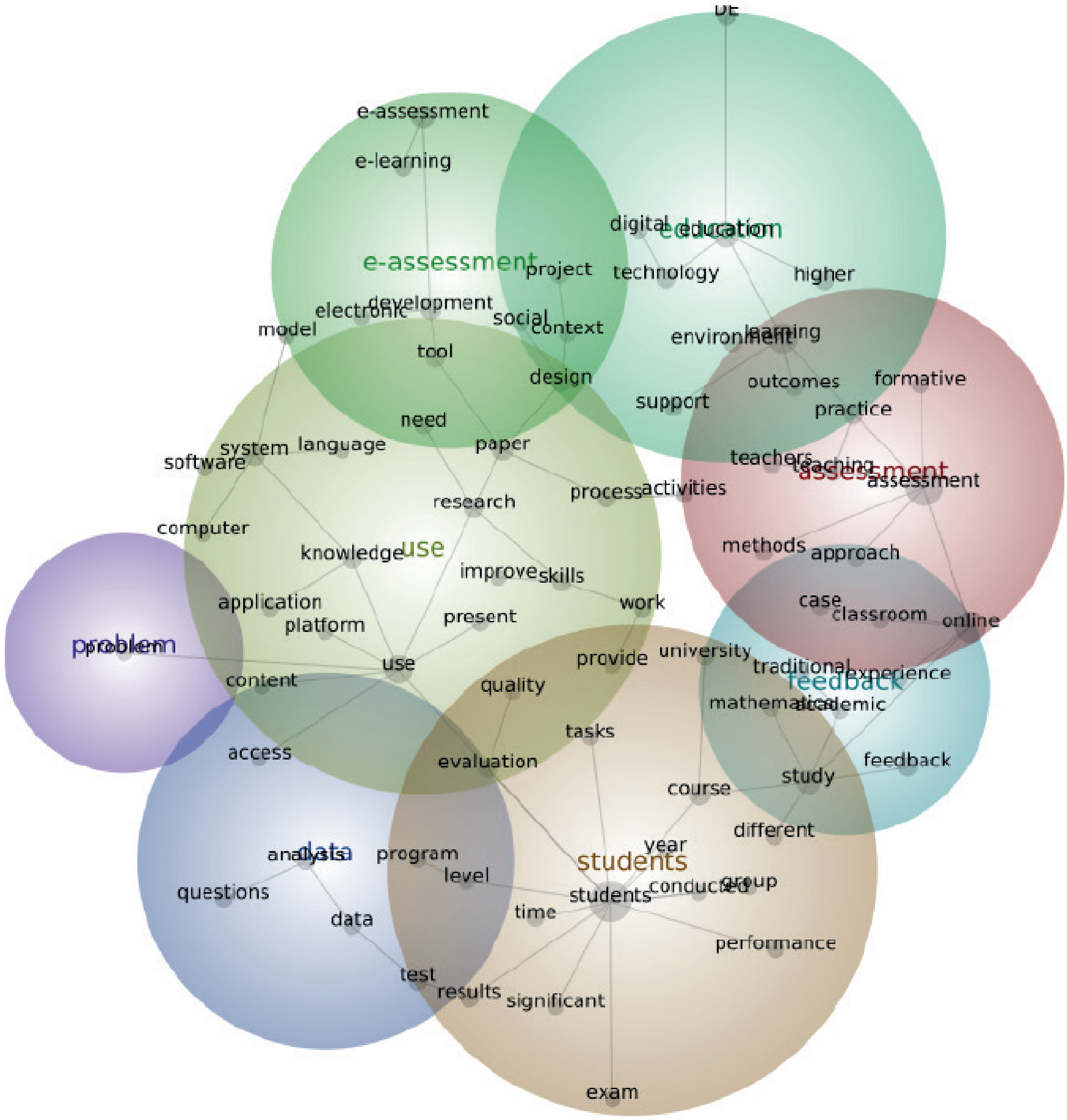


Figure 18. Thematic concept map providing text analysis of keywords, titles and abstracts

The themes presented in the thematic concept maps created by Leximancer are ranked by level of importance in Figure 19, and the concepts that are prominent in terms of count and relevance are presented in Figure 20.

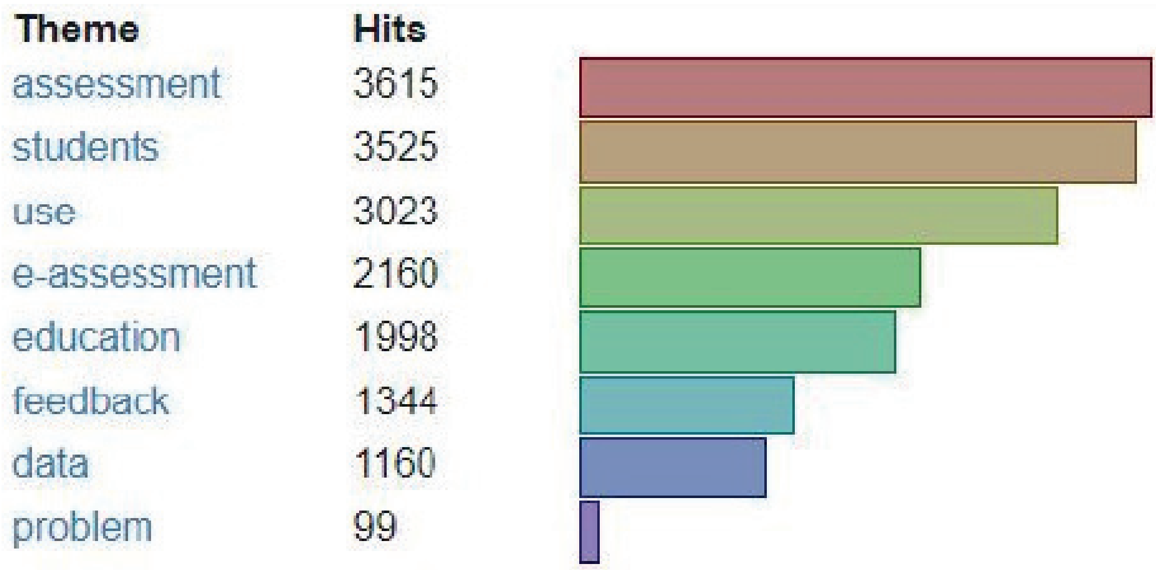
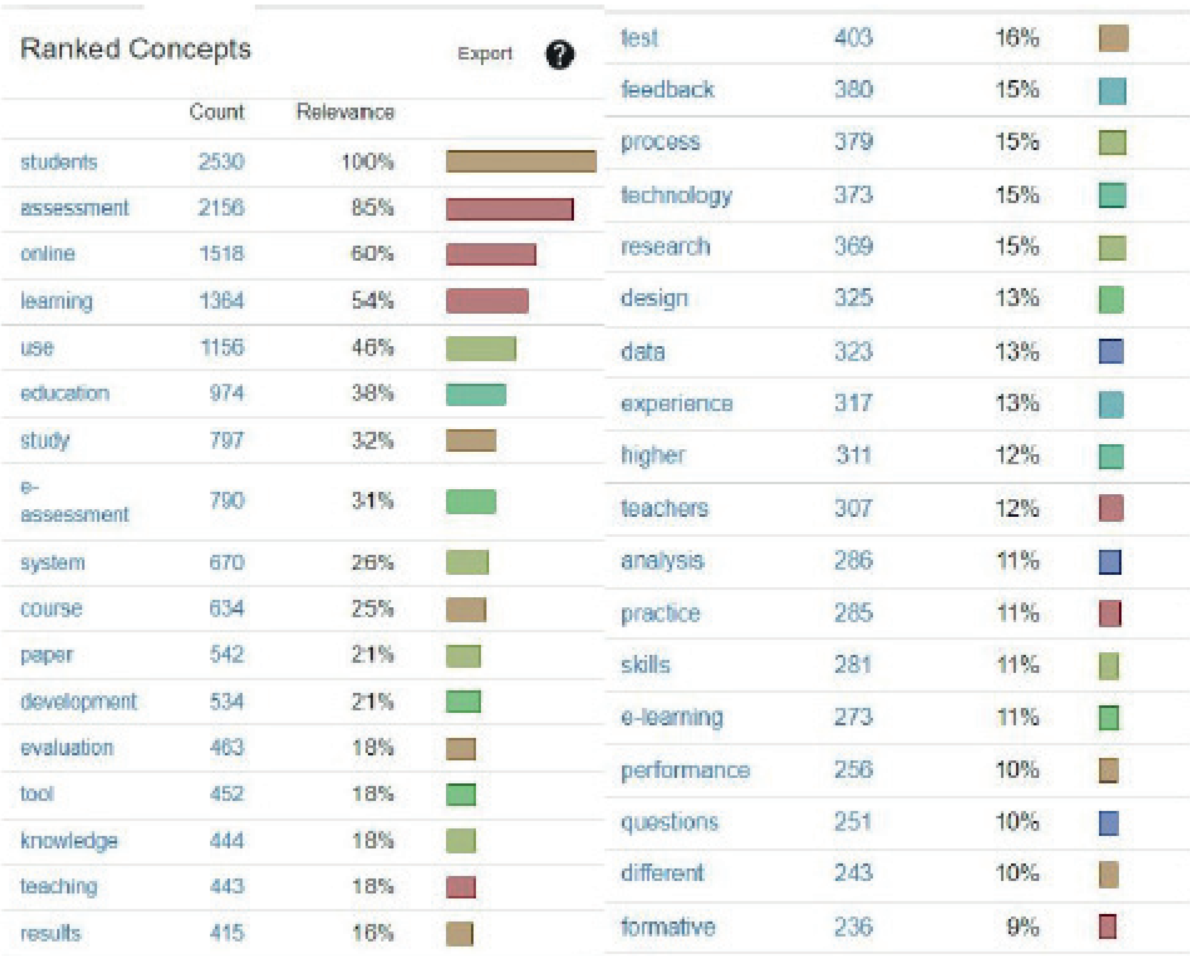


Figure 19. Levels of importance of the themes in the thematic concept map created by Leximancer



Ranked Concepts

Export

	Count	Relevance
students	2530	100%
assessment	2156	85%
online	1518	60%
learning	1364	54%
use	1156	46%
education	974	38%
study	797	32%
e-assessment	790	31%
system	670	26%
course	634	25%
paper	542	21%
development	534	21%
evaluation	463	18%
tool	452	18%
knowledge	444	18%
teaching	443	18%
results	415	16%
test	403	16%
feedback	380	15%
process	379	15%
technology	373	15%
research	369	15%
design	325	13%
data	323	13%
experience	317	13%
higher	311	12%
teachers	307	12%
analysis	286	11%
practice	285	11%
skills	281	11%
e-learning	273	11%
performance	256	10%
questions	251	10%
different	243	10%
formative	236	9%

Figure 20. Major concepts in the thematic concept map created by Leximancer

As can be seen from Figure 19 and Figure 20, the most dominant themes in the studies on e-assessment are Assessment, Student and Use, which leads to the inference that most of the studies focus on students and are concentrated on subjects related to use. An examination of the set of concepts in Figure 20 reveals that, apart from the concepts that stand out as themes, the system, courses, development, tools, teaching and feedback are frequently emphasized in the studies on e-assessment, and given importance in many studies.

DISCUSSION

The distribution of the publications included in the research by year, type of publication and country displayed an increase in studies on e-assessment starting from 2005, and it is seen that the highest number of studies belong to the year 2021. This finding is in parallel to the thesis advocated by studies (Crisp & Ward, 2008; Van der Pol et al., 2008; Wang, 2008) suggesting that effective use of e-assessment can provide meaningful educational experience for teachers and students; more and more studies have been produced on the use of e-assessment. It is understood that the studies produced are mostly published in the form of articles and proceedings. In their study analyzing the research on online formative assessment using the bibliometric method, Sudakova et al. (2022) reported that most of the publications were in article format, which was attributed to the fact that academic journals were indexed at a higher rate in databases.

The top most productive countries in terms of the research on e-assessment are seen to include the USA, England, Australia and Spain; the same ranking is observed in the countries of corresponding authors. The most cited countries are the UK, the USA, Australia and China. Besides these findings, Sudakova et al. (2022) also found that the USA and the UK are the two main centers for studies on e-assessment, and that the USA, the UK, Australia and Spain are also listed in the distribution of the countries of corresponding authors. The fact that studies published in languages other than English and indexed in other databases are not included in the analysis, as well as the fact that journals published in English are mostly indexed in international databases can be shown as the factors that affect this ranking (Tight, 2019).

The sources with the highest number of publications in the field of e-assessment are International Journal of Emerging Technologies In Learning, Assessment & Evaluation In Higher Education and British Journal Of Educational Technology, while the most cited journals are Computers & Education, British Journal Of Educational Technology and Assessment & Evaluation in Higher Education. It is understood that these journals, which represent the core group of journal according to Bradford's Law, are the most effective sources in this field. The top 3 most cited journals in the study conducted by Sudakova et al. (2022) overlap the top 3 most cited journals mentioned in this study, which confirms the leading position of these journals in the field of e-assessment.

The finding that the studies by the most cited authors focus on the use of e-assessment in game-based learning, e-assessment design, students' perceptions of assessment, e-assessment strategies, formative assessment and test reliability methods leads us to the conclusion that these topics are of interest in the field of e-assessment. Furthermore, it is observed that the rate of intra-country collaboration is higher than inter-country collaboration in many countries, and the countries with the highest rate of inter-country collaboration are the USA, the UK and Spain. In parallel with the findings of this study, Sudakova et al. (2022) also indicate that some countries have collaborated solely with the geographical regions in their proximity for studies on e-assessment, while some countries such as the USA and the UK have played a central role in collaboration. The top institutions in the field of e-assessment were found to be the Graz University of Technology in Austria, the University of Strathclyde in Scotland and the National Taiwan University of Science and Technology in Taiwan. Although Taiwan was not listed in the top ten most cited countries, it is worthy of note that two institutions in Taiwan were among the top ten in the list of most cited institutions. It is thought that this may be attributable to the difference in institution-country matching in the articles written via inter-country collaboration.

An examination of keyword clusters in the studies reveals the clusters of technology, motivation, blended learning, collaboration, interaction, innovative approaches, validity and reliability, higher education, quality, basic disciplines of information technologies and mathematics, and Covid-19 process. Cluster analysis of these keywords in publications is important to better understand the direction and research trends of studies on e-assessment. It is similarly reported in the study by Sudakova et al. (2022) that the term blended learning gained widespread popularity in studies on e-assessment between the years 2010 and 2020, and the term COVID was widely used in publications on e-assessment in 2020. The use of hints, guiding questions and feedbacks in e-assessment processes can have a positive effect on learner motivation (Nicol & Macfarlane, 2006). The validity and reliability of e-assessment processes is among the topics addressed and frequently emphasized in various studies. Gikandi et al. (2011) indicated that the validity of online formative assessment is related to (1) the reality of assessment activities, (2) effective formative feedback, (3) multidimensional perspectives, and (4) student support. The topics of cheating, authentication and authorship checking have been among the frequently addressed key topics in many different studies on e-assessment (Karim & Shukur, 2015; Kocdar et al., 2018; Okada et al., 2019; Peytcheva-Forsyth et al., 2018).

Different mapping techniques were also used in this research in order to better understand the topics of focus in the publications. Given the importance of e-learning and moodle for future research in thematic mapping, there are areas that need further development, that topics such as "item response theory", "stem" and "evaluation methodologies" are the areas of rapid development and yet are underrepresented, and that formative assessment, higher education and motivation are of importance for research as the general topics. Sources indicate that Moodle, the world's leading open source LMS, is used by various academic disciplines as well as in STEM education (Gamage et al., 2022) and the number of Moodle users increased from 78 million in 2015 (Singh, 2015) to over 333 million in 2022 (Moodle Project, 2022), which points to the importance of Moodle in line with the findings of this research. It is stated that learner motivation is one of the main aspects that need to be addressed for a successful learning process, and that evaluation and assessment of learner motivation has been the subject of many studies in the field of e-learning (Ghergulescu & Muntean, 2014). The use of different assessment methodologies by instructors providing online education is considered significant in terms of facilitating interactions and developing effective learning communities, particularly in online and mixed environments (Akyol et al., 2009). The themes obtained from the text analysis of the abstracts, keywords and titles of the studies reveal that the studies on e-assessment focus on the main topics of Student, Use, Education, Feedback, Data, and Problem, and that differences regarding students, feedback, data set, systems used and problems are frequently addressed in the studies. Gikandi et al. (2011) also stated that student progress should be tracked and evaluated so as to ensure the acquisition of meaningful information, and noted the importance of feedback and student engagement in online formative assessment.

When the change in trend topics over the years is examined, it is seen that the topics such as e-portfolio, collaborative learning and computer-aided assessment, which were the trend topics between 1993 and 2010, were then replaced by topics such as formative assessment, learning management systems, reliability and learning analytics between 2010 and 2021, and that topics such as Covid-19, academic integrity, engagement, cheating, case study, motivation have come to the fore in the field of e-assessment after 2019. The listing of formative assessment, assessment methods and approaches, and reliability among the frequently studied topics in all types of analysis points to the importance of these topics in studies on e-assessment. Studies that describe formative assessment as "assessment for learning" and (Akiri et al., 2021; Na et al., 2021) underscore the role of formative assessment in providing feedbacks to enable better learning of students (Cong et al., 2020) similarly emphasize the importance of this type of assessment.

CONCLUSION AND SUGGESTIONS

This study aims to reveal the trend of research on e-assessment in the field of educational sciences through bibliometric analysis. For this purpose, 911 publications between 1993-2021 from the WoS database were included in the research using PRISMA method, and their distribution and citation analyses, research themes, changes in trend topics and text analyses were examined. VOSviewer, Biblioshiny, Smart Bibliometrics and Leximancer were used for the analysis of data.

As revealed by the results of the research, the development of research on e-assessment has followed an upward trend in the literature over time; the USA, the UK and Australia have been the top ranking countries in terms of research on e-assessment, and majority of the studies in the literature have been published in the form of articles and conference papers. The British Journal of Educational Technology and Assessment & Evaluation in Higher Education, the journals with the highest publication and citation counts, have been among the most notable sources in the field of e-assessment. The topics of the most cited authors' publications particularly reveal the focus on the importance of the game-based approach, assessment design, student perceptions of assessment, assessment strategies, and test reliability in the field of e-assessment. It is observed that the rate of intra-country collaboration is higher than inter-country collaboration in many countries, and the countries with the highest rate of inter-country collaboration are the USA, the UK and Spain. On the basis of keyword analysis, we can conclude that technology, motivation, blended learning, collaboration, interaction, innovative approaches, validity and reliability, higher education studies, quality and the Covid-19 are frequently emphasized in the field of e-assessment. Furthermore, differences regarding students, feedback, data set, systems used and problems are among the most commonly addressed topics in e-assessment process. As for the change in trend topics, it is seen that the topics such as e-portfolio, collaborative learning and computer-aided assessment were then replaced by topics such as formative assessment, learning management systems, reliability and learning analytics, and that topics such as academic integrity, engagement, cheating, case study, and motivation have come to the fore in the literature after the Covid pandemic.

The results of this research, which aims to provide an understanding of the general trend of studies on e-assessment in the field of education, demonstrate how e-assessment practices have been developed and transformed in parallel with the development of technology, the pandemic, the development of e-learning practices and systemic differences in use, and present the current situation of the literature from a broad perspective. Further research to examine the developments in the field of e-assessment with supporting studies in different databases and languages can provide a better analysis of trends in this field, rapidly developing areas, areas with inadequate research coverage, and current trends, and help offer a more holistic view to the literature. Also, it is anticipated that articles that will reveal the scientific maps of the studies on the practice of formative and summative e-assessment at different levels will enrich the field. The systematic analysis of the literature within the context of validity-reliability, academic integrity and cheating, which are commonly addressed topics on e-assessment after the period of Covid pandemic, is considered important for providing a clearer picture of the developments in this field and identifying the gaps in the literature.

Authors' Note: Part of this article was presented as a proceedings paper at the IODL 2022 Conference.

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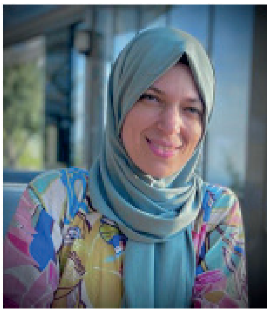

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IDENTIFYING VARIABLES THAT PREDICT STUDENTS' GEOGRAPHICAL INQUIRY SKILLS DURING THE COVID-19 PANDEMIC

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ABSTRACT

The purpose of this study was to observe the predictive power of the practices carried out in distance geography courses conducted during the Covid-19 pandemic in students' self-efficacy in geographical inquiry skills. Fourteen variables were determined for this purpose. In this context, questions covering the individual characteristics of the students, systems followed by the students (synchronous-asynchronous), students' interests in the course and their follow-ups, and their learning experiences were included. "The Self-Assessment Scale for Geographic Inquiry Process Skills" was used to determine the students' self-efficacy levels. The data were collected from 493 students attending 11th and 12th grades in eighteen high schools in the spring semester of the 2021-2022 academic year. The screening model was used in the research and the data were analyzed using multiple hierarchical regression methods. The results of the study showed that nine variables statistically predicted 89% of the total variance. In order of relative importance, grade, school type, and gender are the first and most important predictor variables. Students' asking questions, doing homework, and using supplementary materials come next. Based on this, it is recommended that teachers take on the responsibility of raising their students as individuals who are independent and learned to learn.

Keywords: Geography, distance learning, pandemic, inquiry, skill, self-efficacy.

INTRODUCTION

The Covid-19 pandemic is neither the first nor will it be the last of the pandemics that humankind has been facing since ancient times. Covid 19, which began in the first months of 2020, continues to have an impact on the lives of millions of people around the world, albeit in a weakening way. This pandemic, which has had significant impacts at different scales in different parts of the world, has affected the quality of life of human beings in many areas, especially in health and education. Since March 2020, when the pandemic started to be seen in our country, various measures have been taken at the secondary and higher education levels for face-to-face formal education to continue without interruption. However, since the measures taken did not provide the necessary environment for face-to-face education, distance education was swiftly and unpreparedly introduced. First, in secondary education, courses started to be conducted offline through the Education Information Network (EBA) and television broadcasting on this network, and soon afterwards online or in a hybrid model of both. Afterwards, education and training activities continued using both. This unplanned and instantaneous change was reflected in the studies in the literature, where teachers and administrators, as well as students and parents, faced adaptation problems. In this period, many educators and administrators have directed their entire educational background and skills to online learning platforms without proper planning and often without having the necessary methodological knowledge and skills (Palmentieri, 2022).

Teachers transferred their experiences in the face-to-face learning environment to online and offline platforms in a short period and contributed to the continuation of education and training activities without interruption. Teachers used tests, animations, daily assignments, additional resources, worksheets and questionnaires in online platforms to supplement live distance lectures. Students worked individually using these resources and asked questions about a subject when they had difficulty understanding it. They communicated with students through social networks so that they would not be distracted from the geography courses (Babacan & Ceviz, 2022; Firomumwe, 2022; Kilinc & Karademir, 2021). They assigned homework to the students from auxiliary sources and monitored whether the assignments were completed or not. In order not to disrupt the educational process, they continued to answer all kinds of questions about their field from all students, especially 12th-grade students preparing for the university entrance exams. The distance education and virtual classroom system enabled the diversification of geography teaching materials, and geography teachers did not have much difficulty in explaining new topics in live classes (Ince et al., 2021). Teachers stated that they carried out different activities from their face-to-face practices by using services such as Google Earth (Babacan & Ceviz, 2022). They also used video and pictures instead of fieldwork (Firomumwe, 2022). Teachers continued to use various traditional methods such as lectures, discussion, question-answer, and applied problem- and project-based learning models (Susanthi & Nursa'ban, 2022). During this period, students mostly preferred the study notes, and video and audio lectures that teachers had prepared by themselves, and textbooks (Hasan & Khan, 2020). Students were confined to watching the lessons broadcasted on EBA TV. In live classes, the quality of the class decreased due to the lack of interaction between the teacher and the students (Basaran et al., 2020), and students were negatively affected because they could not touch the materials (globes, maps, etc.) and could not access some resources (Babacan & Ceviz, 2022).

According to Bozkurt (2020), teachers taught in distance education with an experience similar to traditional, face-to-face education as much as possible. Therefore, the educational methods, tools and materials used in distance education were not very different from those used in a face-to-face course. The use of the EBA platform in Turkiye as an alternative to inaccessible online education has been included as a stabilizing factor for access to education and educational materials so that students are not disadvantaged in distance education due to their lack of readiness for this type of learning. EBA's strengths such as its rich content and its suitability for sharing questions made it easier for teachers to teach their classes (Turker & Dundar, 2020).

In addition, the Covid-19 theme as a subject has provided teachers with a basis for effective geography learning and teaching online in such an environment of turmoil, providing a unique context for current events and problem-based learning in geography education. In the geographic inquiry environment, where students are problem solvers, Covid 19 paved the way for students to reconsider the relationships between their daily lives and their education (Ushera & Dolan, 2021). The pandemic has provided opportunities for geography teachers to teach about global, economic, and socio-cultural events and phenomena in everyday life, especially the factors influencing the cause, emergence and spread of Covid 19, using digital resources. Unlike other courses, it has created real learning environments that ensured the active participation of students to develop many skills, especially geographical concepts. During the Covid 19 period, the students' current questions about what happened during this period and their desire to reach the answers to these questions offered teachers the opportunity to gain students a geographical perspective without wasting too much time. Therefore, the fact that geography itself is a natural part of Covid-19 has provided an environment for the use of many methods and resources on the internet in geography education. It is still unknown how the distance education environment, which is full of opportunities on the one hand and limitations on the other, was formed and how it turned into a learning opportunity.

Studies in the literature have raised important questions about the quality of distance education in terms of outcomes. During the pandemic period, most geography teachers focused on academic knowledge (Basaran et al., 2020), and social skills instead of geographical skills and pushed their responsibilities to gain geographical skills to the background. Due to the problems experienced by students, teachers returned to the textbook and reduced the variety of media they used in classes. Moreover, most teachers experienced difficulties in defining the role of Covid-19 in students' lives and linking it to geographical knowledge as an important field of study or subject matter for geography and geography education (Bagoly-Simo et al., 2020). The pandemic has crystallized the need for qualified geography teachers who teach students to look beyond maps, learn inquisitively and ask critical questions about complex issues in our rapidly changing world (Van der Scheea, 2020). In geography, a course that relies on the visualization of concepts such as movement, processes and systems, teachers have struggled to use the potential of online teaching. Teachers experienced many difficulties in selecting models and methods, mastering technology, communication and availability of infrastructure (Changa, 2020; Turker & Dundar, 2020), and explaining complex and abstract topics (Babacan & Ceviz, 2022). When problems such as students' lack of attendance and low motivation were added to these (Kilinc & Karademir, 2021; Ince et al., 2021; Susanthi & Nursa'ban, 2022), they continued to use the textbook as a reference source (Bagoly-Simo et al., 2020) and conducted most learning activities as online assignments (Susanthi & Nursa'ban, 2022).

During the pandemic, the majority of studies conducted in secondary and higher education to understand how distance geography education is carried out consist of opinions of teachers, opinions of students, experience sharing, and examples of activities. These include examples of activities (Hazen, 2020; Parra et al., 2022), model development, virtual fieldwork (Firomumwe, 2022; Li et al., 2022); evaluating the effectiveness of online learning (Abdi et al., 2021); the effects of Covid-19 on teaching and learning geography (Changa, 2020); the relationship of Covid-19 with students' life experiences (Ushera & Dolan, 2021); students' perspective (Hasan & Khan, 2020; Hastuti et al, 2021; Ince et al., 2021); the role of geography in understanding local and global issues (Van der Scheea, 2020); film as a pedagogical tool (Mullick & Haque, 2022); the current state of geography education in schools and its impact on geography learning and teaching (Bagoly-Simo et al, 2020; Schultz & DeMers, 2020; Susanthi & Nursa'ban, 2020; Day et al, 2021); effective course design (Santoso, 2021); educational experience gained in line with the European Commission's Digital Education Action Plan (2021-2027) (Palmentieri, 2022); students' attitudes towards distance learning (Saribas & Meydan 2020); opinions of teachers and prospective teachers (Babacan & Ceviz, 2022; Kilinc & Karademir, 2021; Ozkaral & Bozyigit, 2020; Turker & Dundar, 2020); the contribution of the pandemic period to students' geographical knowledge (Yigit Ozudogru & Sahin, 2022).

The pandemic period is known to offer students various opportunities to develop problem-solving, organization, listening and providing feedback, writing, time management, note-taking (Li et al., 2022) speaking and self-regulation skills (Hastuti et al., 2021). In this study, the effect of geography courses on students' geographical inquiry skills during the pandemic period was observed. The study was conducted to determine the variables predicting 11th and 12th-grade students' self-efficacy in geographical inquiry skills.

One of the four main sources of information that affect people's beliefs about their competencies is their past lives and experiences. Achievements are an effective way to have a strong sense of competence and to build a firm belief in one's own competence. The stronger the perceived self-efficacy, the higher the goals people set for themselves and the stronger their determination to meet them (Bandura, 2010).

PURPOSE OF THE STUDY

This study aimed to determine the effects of the methods of distance education used by secondary education students in geography classes and the frequency of their follow-ups, some of their demographic and learning-oriented characteristics, their perceptions of having learned and remembering geography classes, and their success in the course compared to the pre-pandemic period on their self-efficacy in geographical inquiry skills during the pandemic period.

The independent variables of the study are the variables defining the students and the school, the structure of the learning-teaching environment, students' self-regulatory characteristics, and students' experiences in the geography courses in the previous year. Students' self-efficacy in geographical inquiry skills is the dependent variable of the study.

In the study, four questions were created to determine whether some variables related to the geography course during the pandemic period predicted students' self-efficacy in geographical inquiry skills.

From this point of view, answers to the following questions were sought as the problem of the research:

1. Do 11th and 12th-grade secondary education students' gender, grade, school, school placement type, and participation in the project significantly predict their self-efficacy in geographical inquiry skills?
2. Do 11th and 12th-grade secondary education students' methods of joining geography classes (Live class or EBA TV) and the frequencies of joining the classes during the pandemic period significantly predict their self-efficacy in geographical inquiry skills?
3. Do 11th and 12th-grade secondary education students' doing their homework, using supplementary resources, and asking questions in the classes during the pandemic period significantly predict their self-efficacy in geographical inquiry skills?
4. Do 11th and 12th-grade secondary education students' learning, remembering, and succeeding in geography classes during the pandemic period significantly predict their self-efficacy in geographical inquiry skills?
5. It is important to understand the practices in distance education and to continue the experiences to improve the quality of education. The results of this study are expected to have an impact on improving the quality of distance geography education.

METHOD

In this study, the retrospective survey model, one of the quantitative methods in which participants are asked questions about the events they experienced in the past, was used (Buyukozturk et al., 2012; Karasar, 2020). The single survey model, which is one of the general survey models, was conducted retrospectively with a cross-sectional approach. In single surveys, it is important to determine the characteristics directly and in accordance with certain standards (Karasar, 2020).

The stratified purposive sampling method was preferred when determining the sample. In the stratification method, the sample is formed by dividing the groups drawn from the population into subgroups, each of which belongs to a stratum and also in such a way that none of the strata representing the population is excluded from the study (Buyukozturk et al., 2012). In this context, eighteen high schools were selected among schools of different quality in Ankara. In these high schools, students' participation in distance education during the pandemic period was effective in determining the branches.

Participants

The study group consisted of eighteen high schools and a total of 493 students. The schools were selected from Golbasi, Cankaya, Yenimahalle, Altindag, and Kecioren districts of Ankara province. These schools were also grouped according to whether they enrolled students with or without an entrance exam. Ten schools in the study group accepted students through the Address Based Population Registration System (ABPRS/ADNKS in Turkish) and eight schools accepted students through the high school entrance exam (HSEE/LGS in Turkish). Religious Vocational (aka Imam Hatip) and Vocational and Technical Anatolian, Anatolian (with and without placement exam), and Science and Social Sciences high schools were included in the study group. Two schools are located in Altindag, seven in Cankaya, six in Golbasi, one in Yenimahalle and two in Kecioren district. Seven of the schools are Anatolian high schools, four are religious vocational (imam hatip) high schools (two single-sex girls', one single-sex boys', and one coed), two are science high schools, two are social sciences high schools, and three are vocational and technical Anatolian high schools.

The data were collected from 11th and 12th-grade students who took elective or compulsory geography courses in the 2021-2022 academic year. The composition of the study group from 11th and 12th-grade students was because of the fact that they participated in geography courses through distance education for at least three semesters during the pandemic.

The study group consisted of 35.7% (n=176) male and 64.3% (n=317) female students, 73.4% (n=363) 11th-grade students and 26.4% (n=130) 12th-grade students. While 42.8% (n=211) of the students attended the schools without entrance exams, 57.2% (n=282) attended the schools that enroll students with an entrance exam. The number of students included in the study group varies according to the environmental characteristics and type of the school.

Data Collection and Analysis

The study was conducted in schools where school administration, parents and students were willing to participate. The data collection tools were administered by the researcher together with the school administrators who permitted the application after obtaining parent-student approval. The questionnaire form and scale were distributed to the students in printed form. The data collection took approximately one month in the spring semester of 2021-2022. SPSS 26 software was used for data analysis. For the purpose of the study, multiple linear hierarchical regression analysis was conducted to determine whether the 14 questions, determined as independent variables, were predictive variables of geographical inquiry skills and their predictive power. For this purpose, dummy variables were created by reducing the number of categories to two in each variable due to the categorical nature of the independent variables. The presence of a linear relationship between the predictor variables and self-efficacy, which is the dependent variable, and whether they show a multivariate normal distribution were analyzed. As a result of this examination, it was accepted that the normality and linearity assumptions of the data were met. The multicollinearity problem among the predictor variables was eliminated by removing some independent variables from the model.

The Scale

A fourteen-question questionnaire prepared by the researcher and the Geographical Inquiry Process Self-Assessment scale, which was developed by Yigit Ozudogru (2021) and includes five dimensions and 22 items, were used in the study. The scale used in the study was preferred because it was prepared for secondary school 9-12th-grade students and has high validity (KMO value 0.914 and chi-square (x^2=3459.765; df=231; sig=000) significant) and reliability (Cr α EFA value 0.926 and CFA value 0.950). While preparing the questionnaire, studies in the literature were examined and factors that may have an impact on students' geographical inquiry skills were identified. The questionnaire was finalized with the information obtained from the interviews with a teacher working at an Anatolian high school designated as a project school and an assistant principal at a vocational high school. The questionnaire included demographic information such as gender, grade, whether they participated in a TUBITAK project during the pandemic, and questions about the learning environment, learning style and learning status. First, in order to ensure cognitive or affective learning, students were expected to follow their lessons as in face-to-face education. To determine this, questions were prepared about whether the students attended the classes, and if so, the system they followed (synchronous-asynchronous) and how often they followed the classes. Even if a student participates in the class, quality learning may not take place. To understand the time he spent learning the course, it was aimed to determine how often he performed behaviors such as using materials, doing homework and asking questions. These behaviors were classified into three categories (never, occasionally, and always).

In addition to these questions, questions about their experiences related to learning were included. These questions were determined as the student's learning, remembering what he/she learned, i.e. retention and course success. The questionnaire was administered to an eleventh-grade student and the total response time was determined. After the questionnaire was reviewed by assessment and language experts, ethical and application approval was obtained.

FINDINGS

First, the students' geographical inquiry process skill scale total mean scores were calculated according to the schools and the results are given in Table 1.

Table 1. Distribution of Students by District, School, and School Type and Their Scale Mean Scores

District	School Name	School Type	N	%	Mean	SD
Altindag	Sabahattin Zaim Social Sciences High School	HSEE/LGS	31	6.3	83.16	2.382
	Ankara Girls' Anatolian Religious Vocational High School	HSEE/LGS	23	4.7	73.74	3.078
Cankaya	Hasan Ali Yucel Social Sciences High School	HSEE/LGS	91	18.5	85.89	1.578
	Cumhuriyet Science High School	HSEE/LGS	20	4.1	73.75	4.083
	Ankara Science High School	HSEE/LGS	30	6.1	80.80	2.180
	Bahcelievler Anatolian High School	ABPRS/ADNKS	23	4.7	87.57	2.838
	Ayhan Sumer Anatolian High School	HSEE/LGS	14	2.8	89.93	4.094
	Ayranci Vocational and Technical Anatolian High School	ABPRS/ADNKS	14	2.8	69.29	4.039
	Dr. Binnaz Ege- Dr. Ridvan Ege Anatolian High School	HSEE/LGS	18	3.7	79.89	3.634
Golbasi	Mehmet Akif Ersoy Boys' Anatolian Religious Vocational High School	ABPRS/ADNKS	16	3.2	78.50	4.283
	Zubeyde Hanim Vocational and Technical Anatolian High School	ABPRS/ADNKS	30	6.1	64.23	2.513
	Erdem Bayazit Anatolian High School	ABPRS/ADNKS	26	5.3	75.04	3.267
	Sehit Sebahattin Kocak Girls' Anatolian Religious Vocational High School	ABPRS/ADNKS	29	5.9	80.00	2.403
	Ahmet Alper Dincer Anatolian High School	ABPRS/ADNKS	41	8.3	80.49	2.646
	Sevgi Anatolian and Science High School	ABPRS/ADNKS	28	4.7	78.89	2.979
Yenimahalle	Tevfik Ileri Anatolian Religious Vocational High School	HSEE/LGS	27	5.5	81.30	3.029
Kecioren	Kâtip Celebi Anatolian High School	ABPRS/ADNKS	26	5.3	86.65	2.425
	Kanuni Vocational and Technical Anatolian High School	ABPRS/ADNKS	6	1.2	77.00	8.466

When the results of the scale total mean scores were analyzed according to the schools (Table 1), Ayhan Sumer Anatolian High School (with a mean score of 89.93) had the highest mean skill scores, followed by Bahcelievler Anatolian High School (with a mean score of 87.57). The schools with the lowest mean skill scores were Zubeyde Hanim (64.23) and Ayranci Vocational and Technical Anatolian High Schools (69.29). According to the school types, the students with the lowest mean total scale scores were in vocational high schools. These schools were followed by Cumhuriyet Science High School (with a total mean skill score of 73.75) and Ankara Girls' Anatolian Religious Vocational High School (with a total mean skill score of 73.74). These results show the significant impact of students' efforts on skills, rather than schools'.

The frequency analysis of the students' responses to the questionnaire items and the results of the scale total mean scores for each category of each variable are presented in Table 2.

Table 2. Descriptive Statistics of Student Responses According to Total Scale Score

Variable	Category	N	%	Total	Mean	SD
Gender	Female	317	64.3	493	79.77	.949
	Male	176	35.7		80.43	1.387
Grade	11	363	73.6	493	79.45	.891
	12	130	26.4		81.54	1.620
School Type	ABPRS/ADNKS	211	42.8	493	77.38	1.257
	HSEE/LGS	282	57.2		81.83	.983
TUBITAK	Yes	98	20.7		87.20	1.707
	No	344	72.6	493	77.96	.908
	Partly	32	6.8		80.15	2.098
How were the geography classes taught?	Eba TV	11	2.3	482	73.91	6.916
	Live class	381	79.0		79.92	.852
	Both	77	16.0		81.70	1.998
	None	13	2.7		77.70	7.196
How often did you follow the geography lessons broadcast on EBA TV?	Never	248	51.3	483	78.63	1.088
	Occasionally	194	40.2		80.12	1.169
	Always	41	8.5		87.43	3.074
How often did you follow live classes given by your geography teacher?	Never	41	8.5	485	77.33	3.216
	Occasionally	198	40.8		75.41	1.170
	Always	246	50.7		83.97	1.037
How often did you do the assignments given in EBA TV or live class?	Never	67	13.6	491	74.57	2.546
	Occasionally	204	41.5		78.43	1.090
	Always	167	34.0		84.46	1.328
	No assignments were given	53	10.8		78.40	2.202
How often did you use supplementary resources?	Never	98	20.0		73.41	1.973
	Occasionally	252	51.5	489	79.51	.979
	Always	139	28.4		85.34	1.436
How often did you ask your teacher questions?	Never	201	40.9		75.97	1.232
	Occasionally	250	50.8	492	81.52	1.014
	Always	41	8.3		90.94	2.831
My geography course success compared to the pre-pandemic period	Better	114	23.4		83.04	1.694
	Same	203	41.7	487	80.86	1.224
	Worse	170	34.9		76.93	1.230
I learned the topics covered in the geography course...	easily	187	38.2		85.68	1.192
	with difficulty	166	33.9	489	79.27	1.212
	I could not learn	136	27.8		73.28	1.514
Regarding what I learned in geography classes,...	I do not remember anything	177	35.9		74.78	1.354
	I remember a little	258	52.3	493	81.81	.965
	I remember	58	11.8		88.08	2.354

Table 2 shows that 79.0% of the students followed live classes and 16.0% of the students followed both live classes and lectures on EBA TV. 50.7% of these students followed all of the live classes. 51.3% of the students have never participated in the lectures given on EBA TV. 23.4% of the students stated that their geography course success was better than it was before the pandemic, 38.2% stated that they learned the subjects taught in the geography course easily and 35.9% stated that they did not remember what they had learned in the geography course.

The total mean scores of skill self-efficacy in Table 2 show that the mean skill scores of boys were slightly higher than girls, those of 12th graders were slightly higher than those of 11th graders, and those of participants in a project were slightly higher than those of non-participants. The difference in mean scores between 11th and 12th graders can be attributed to the fact that 12th graders took courses for two more semesters and that they were older.

However, those who followed the geography courses both on EBA TV and in live classes, who followed the classes without interruption, who did their homework regularly, who used supplementary resources, and who asked questions had higher mean skill scores than the others. Those who had lower achievement in geography courses compared to pre-pandemic levels, those who stated that they had learning difficulties during the distance education period, and those who did not remember what they had learned had lower mean skill scores compared to others.

How a student is placed in a school is also among the factors that increase self-efficacy related to student skills. Students who took the high school entrance exam (HSEE/LGS) and were placed in a school by passing this exam have higher average skill scores than others. It is quite normal for these students to have certain competencies more than others for various reasons. It can be said that both the students' prior competencies and the advantages of the school (quality of teachers and availability of technical infrastructure) have an impact on students' skill development.

Accordingly, the skills of students with developed self-regulation such as participating in projects, following the courses, asking questions about the topics in classes, and doing homework without any interruption are also high. In particular, the fact that the students with the highest mean scores in geographical inquiry self-efficacy were the students who stated that they constantly asked their teachers questions shows that asking questions is important for the development of inquiry skills.

The results of the stepwise multiple linear regression analysis to determine the significant predictors of students' geographical inquiry skills are given in Table 3.

Table 3. Multiple Linear Hierarchical Regression Analysis Results for the Total Scale Score

		Part. Cor.	t	p	B	ß	R	R^2	Adj. R^2	F	p
Model 1							.871	.759	.757	489.872	.000
	Gender	.041	2.786	.006	7.198	.071					
	School Type	.132	8.874	.000	2.571	.200					
	Grade	.053	3.563	.000	10.075	.063					
Model 2							.900	.810	.808	495.880	.000
	EBA TV	.050	3.381	.001	8.722	.074					
Model 3							.941	.886	.884	513.699	.000
	Assignment	.079	5.292	.000	16.361	.174					
	Resource	.093	6.216	.000	20.800	.227					
	Asking questions	.044	2.942	.003	8.101	.076					
Model 4							.948	.898	.896	450.257	.000
	Learning	.097	6.523	.000	19.214	.199					
	Success	.034	2.252	.025	6.596	.039					

Table 3 shows that there are nine important predictors of geographical inquiry skill.

In the regression analysis, the variables of gender, grade, participation in a project, and type of school placement were first added to the equation, explaining 75.7% of the variance in geographical inquiry (R^2 = .757; FReg = (4.445)= 489.872; p< .01). In the model, all variables contributed significantly to the variance. Therefore, all variables were included in the model in the first stage.

In the second stage, variables determining the frequency of following the courses via live classes and lectures broadcast on EBA TV were added under the title of course instruction and course follow-up method, which contributed 5.1% to the explained variance (R^2 =.808; FReg (2.445)= 495.880; p< .01). At this stage, the variables that showed multicollinearity such as course instruction and course follow-up method and the frequency of following live classes were excluded from the analysis. In the second stage, only the variable indicating the frequency of following the course via lectures broadcast on EBA TV was added to the first model.

In the third stage, the variables of doing homework, using supplementary resources and asking teachers questions were added for student self-control, which contributed 7.6% of the variance (R^2 =.884; FReg (3.539)= 513.699; p< .01). The third model, created with the new variables, is also statistically significant. At this stage, the new variables contributed significantly to the model along with all the variables included in the regression equation. Therefore, since no variable was removed from the model in the third stage, the number of variables increased to eight.

In the fourth stage, with a 1.2% contribution to the variance (R^2 =.916; FReg (1.538)= 450.257; p< .01), perception questions such as recall, learning and course success were included. The model at this stage is statistically significant but its contribution to the variance is low. The variables of recall and involvement in a TUBITAK project, which were statistically significant in the previous models, were removed because they did not contribute statistically significantly to this model. In the fourth and final stage, three variables were added and two variables were removed from the model.

Finally, after all variables were entered into the model in the form of a block, nine variables that had an effect on students' geographical inquiry skills and contributed significantly to the variance were identified. This model explains 89.6% of the variance. The variables that did not make a statistically significant contribution to the model were participating in a project and remembering the course. The variables excluded from the model due to multicollinearity are following the lessons live and always attending the live classes. The results of the test for the significance of the regression coefficients show that all variables included in the model are significant predictors of geographical inquiry skills. The signs of the regression coefficients indicate that the relationship between all variables and geographical inquiry skills is positive.

According to the standardized regression coefficient (ß), the relative order of importance of the predictor variables that contribute the most to this model on inquiry skills are; using supplementary resources, school type, having no problems in learning the course, doing homework completely, being able to ask questions and always watching the broadcasts on EBA TV without missing them, gender, being in the 12th grade, and the success in geography course during the pandemic.

When all the variables predicting the model are evaluated together, it is understood that the most important predictor is the determination of the student to participate in the class and fulfil his/her responsibilities. These students followed the live classes without any interruption, stayed in full communication with their teachers and followed the instructions they were given carefully. Another important contributing variable is school type. Accordingly, the geographical inquiry skills of students who were placed in a school through an exam are higher than those of students who were placed in a school through ABPRS/ADNKS. Students' use of supplementary sources is as effective as the type of school on skills. Students who follow their courses and continue to work with supplementary sources have improved their skills. Another important contributor to the model is the grade in which the student continues his/her education. 12th-grade students have higher skills than 11th-grade students. Based on its average and positive predictive power, it is possible to say that the effect of age is also observed indirectly. Here, the contribution of courses that students take in one more academic year should not be overlooked. Doing homework regularly also significantly predicted the skill. Following the lectures on EBA TV and communicating with the teacher, asking questions and getting feedback on their questions are among the other skill-building variables. This reveals that when synchronous courses and asynchronous courses are used together in distance education, they are as effective as in face-to-face learning. It is understood that both knowledge and skills are gained in asynchronous lessons where there is no interaction at all. These results put students who make an effort to learn ahead of others.

Whether the learning tools used by the students to follow the geography course were synchronous or asynchronous, remembering what they learned from the previous year and participating in a project, always following the live classes did not significantly predict self-efficacy in geographical inquiry skills. These variables are activities that are regularly carried out voluntarily by all students who have already taken responsibility for their learning. As can be understood when the significant predictors are examined, students who do not follow the course are not expected to do homework, use resources, ask questions, succeed in the course and learn.

DISCUSSIONS AND CONCLUSION

Although it is a global pandemic, the effects of Covid 19 were felt more at the local level, so measures were also taken at the local level. As health officials worked in laboratories to find a medical solution to the pandemic, economists looked for ways to manage its impact on national economies. Social policymakers have sought to identify and take measures to address the social and economic damage caused by Covid 19 to disadvantaged groups and the barriers to equal access to health and education. Geographers and geography educators have also taken on the task of helping to observe, understand and make sense of geographical events and phenomena stemming from Covid 19. Educators endeavored to understand what happens in the learning environment for a higher quality education (Sintema, 2020). This unexpected situation forced educators to adopt different learning theories that they had been largely unaware of (Schultz & DeMers, 2020).

Many studies have been carried out to identify the developments in education with Covid 19, to understand the applications in the learning environment, and to increase the quality of distance education. This study was conducted to determine the variables predicting students' self-efficacy in geographical inquiry skills in distance education. At the end of the study, it was found that nine of the fourteen variables significantly predicted students' self-efficacy in geographical inquiry skills.

First, gender, grade, and school placement type were found to be significant predictors in explaining students' self-efficacy in geographical inquiry skills. The self-efficacies of male students were higher and more significant than those of female students. The grade variable had a positive and significant predictive power in predicting students' perceptions of self-efficacy in geographical inquiry skills. 12th graders had a higher average score than 11th graders. The mean skill scores of students from all types of schools that enrol students through HSEE/LGS were higher than those of vocational high schools and Anatolian high schools that enrol students without an entrance exam, i.e., HSEE/LGS, and school type was a significant predictor. These results support the findings of Babacan and Ceviz (2022) that public school students with higher entrance exam scores are more likely to attend geography courses than those with lower entrance exam scores; Valentina (2002) that more mature students are most likely to achieve success through distance education; and Day (2015) that boys have higher test scores than girls (as cited in Day, et al., 2021).

Based on the results, it can be said that the differences observed between 11th and 12th grade students may be due to two reasons. The first one is the ages of the students, while the other is the setting learning objectives appropriate to the grades of the students with the Geography Course Curriculum (CDOP, 2018). In the CDOP, the recommended outcomes for the development of students' geographic inquiry skills continue to increase gradually from 9th grade to 12th grade (MEB, 2018). In addition, these outcomes, which are recommended for students to gain geographic inquiry skills, become increasingly complex towards 12th grade, focusing on themes that require cognitively higher level thinking. Therefore, the fact that 12th graders' self-efficacies in geographic inquiry are higher than that of 11th graders can be attributed to the fact that these students have taken two more semesters of geography courses in line with the CDOP.

The fact that the school type is a significant predictor depending on the placement score may be attributed to the fact that the students of Anatolian and Science high schools, which enrol students with high scores, have fewer deficits in their learning backgrounds and higher readiness levels. In addition, the high levels of teacher competencies and school infrastructure and equipment may also have an impact on these students. In the case of vocational high school students, the opposite situation may reduce their motivation and prevent them from having a better learning experience. Therefore, it can be said that these deficiencies and the cognitive difficulties experienced by students in the past learning periods were reflected in their self-efficacy.

Students' placement scores to enrol in a school have a relationship with the educational level and socioeconomic status of their families (MEB, 2019). High-poverty students' access to higher-quality education has become more difficult during the pandemic and they have not been fully provided with adequate conditions to overcome their academic underachievement. Many students attending vocational high schools in Turkiye are from low-income families. It is known that the pandemic period has increased the vulnerability of this lower-income group in education (Ozer et al., 2020). Girls in these families face a more disadvantageous situation than boys by having to take on responsibilities such as helping with domestic chores and taking on baby care (Ceran & Ergul, 2022). It is seen that the disadvantaged status of girls and students of schools that enrol without exams, such as vocational high schools, which continued before the pandemic, increased their vulnerability in skill development with the pandemic. In the literature, there are findings that the geographical characteristics of the place where students live have a significant impact on learning deficits and that children from families living in rural areas are more disadvantaged than those living in cities (Baz, 2021). In this study, since all students resided in the metropolitan districts of Ankara, the capital of Turkiye, a problem related to internet access was not identified as a variable to be used to interpret the results of the study. However, although students attending open-enrollment schools such as vocational high schools do not have problems with internet access, crowded families and the presence of more than one school-age child in the family hinder adequate access to technological devices such as computers and televisions. As a result, it becomes possible for more than one student in a house to participate in a class at the same time. It can be said that this situation reflects negatively on the development of students' self-efficacies in geographic inquiry process skills whose families have low educational and socio-economic levels.

Families' close monitoring of the distance education process, their motivation and support for attending classes and doing homework directly affect students' participation in distance education processes and their learning levels (Ozer et al., 2020). Students in schools with entrance exams generally come from families with high levels of education and socio-economic status. The fact that the follow-up and support of the families of successful students who enrolled in a school with the placement exam score continued during the pandemic caused their self-efficacies in geographic inquiry skills to increase compared to other students.

Second, it was found that students' self-regulatory behaviors such as asking questions, doing homework, and making use of supplementary resources both increased their mean self-efficacy scores and were significant predictors following the personal variables. In particular, the fact that the students who insisted on asking the teachers questions had the highest mean scores of self-efficacy in geographical inquiry skills compared to other variables shows that the role of questions in the development of inquiry skills is important.

The mean scores of the students who asked questions support the theoretical knowledge and conceptual framework suggesting that a good inquiry should start with questions. Basar et al. (2019)'s finding that there is a direct correlation between attitudes towards distance education and caring, attention, course efficiency and success; Reimers and Schleicher (2020)'s finding that time spent on learning is a reliable predictor of learning opportunity; Yates et al. (2021)'s findings that the time allocated to school and school assignments affects students' sense of learning, students who spend less time studying at home than others have a lower sense of learning than students who spend more time studying; Babacan and Ceviz (2022)'s findings that students who participate in class learn more because they ask more questions and want to answer them more than others; Sintema (2020)'s findings that the time students spend in communication with their teachers and their ability to consult them when they encounter difficulties in learning/comprehension are effective on the level of academic performance; Day et al. (2021)'s finding that teachers' accessibility, quick feedback and clear instructions lead to progress in students; and Orhan et al. (2021)'s findings and opinions that learning perceptions make significant differences according to participation in classes and that the learning rates of students who do not participate in classes decrease are in line with the results of this study.

As the above research results show, class participation and the structure of the learning environment is a factor that increases the learning rate and encourages students to ask and answer questions. The atmosphere created for easy access to the teacher in the learning environment improved the geographic inquiry skill self-efficacies of the students who attended the class, asked questions and received answers to the questions they asked, and were supported with various methods when necessary to reach the answer.

According to the CDOP (2018), it is not enough to talk about a single type of assessment and evaluation method and to make cognitive measurements only. To this end, students are asked to develop their skills through various types of homework assignments as well as in-school activities. When students are given homework assignments that involve thinking, understanding, questioning, research and problem solving, these assignments improve their skills, help them structure information in their minds and increase the retention of learning. Research suggests that the reason why Korean and Japanese children are more successful than others in exams such as PISA, PIRLS and TIMMS is because they do homework (Gunes, 2014). During the Covid 19 period, teachers, students and parents agreed that homework has an important role for students' development (Altan & Karalar, 2022, Basaran & Vural, 2022; Pekcan & Toraman, 2022). The conditions experienced during the pandemic directed teachers and students to homework, and students who fulfilled their responsibilities by doing their homework received positive results. Homework assignments given for various purposes such as preparation, reinforcement, drawing attention and repetition within the scope of the geography course increased students' self-efficacy in geographic inquiry skills. Doing homework by using various resources and asking questions to the teacher when necessary, students taking responsibility for their own learning, and the correct design of the learning environment by the teacher as open to communication supported skill development in distance education.

Third, it was found that regularly following the classes from asynchronous sources such as EBA TV increased the students' mean scores of self-efficacy in geographical inquiry skill and predicted them significantly.

Turk et al. (2021) reported that asynchronous method is more effective than synchronous method and Ince et al. (2021) mentioned that EBA TV contributes less to distance education practice. In the emergence of this result, which overlaps with both studies, the effects of the content of the course carried out synchronously via the EBA platform, the materials used, and the design of the learning and teaching environment can be mentioned. It can be said that the way of conducting live classes in the distance education period and the purpose of using EBA TV are effective on the results. EBA has different learning tools for all ages and levels, including lecture videos, interactive materials, interactive games, tests, lecture notes and other resources. On the EBA platform, teachers can communicate with students, assign homework, provide feedback and encourage student engagement through online discussion forums. It allows students to manage their time effectively and acquire knowledge and skills in accordance with their own learning pace and style. However, EBA has some limitations in that the classes are one-way, there is no opportunity to ask questions to the teachers, and students cannot satisfy their curiosity at that moment. Therefore, students prefer interactive lessons because they can communicate more easily with the teacher and ask questions (Aydin, 2020). However, students tried to overcome their deficits on the EBA platform because they had problems with attendance, active participation and focusing in live classes during the distance education period (Ceran & Ergul, 2022). EBA was used by students as a supplementary platform to overcome difficulties they encountered in synchronous lessons or to learn topics they had difficulty understanding. The time students spend on a particular course tool to learn the course is an indicator of their effort and diligence towards the course. Therefore, the determined and eager behavior of the students who followed EBA TV in attending the class made them stand out in skill acquisition compared to the students who followed the live classes compulsorily and reluctantly. The results of this study show that students' active participation in live classes and supporting their learning with EBA provided positive development. The results of this study show that students' active participation in live classes and supporting their learning with EBA provided positive development. Therefore, in order to close the gap in students, it is expected that using both methods together instead of using only synchronous or asynchronous methods in course follow-up will be a solution for more permanent learning and skill development. For this, the EBA platform should be enriched by adding skill-based applications and materials.

Fourth, having no difficulty in learning the geography course and indirectly the success in the course was reflected in the student's geographical inquiry skill self-efficacy mean score and predicted the model significantly. As a result, having been able to learn geography classes supports students' skill development. The pandemic period has provided many opportunities for geography teachers to conduct their classes more actively and ensure permanent learning. In addition, what happened during the pandemic period provided up-to-date content for geography courses. Geography teachers used many materials related to the subject, especially digital maps and globes, in their classes (Macit & Coban, 2021). The use of these materials in the classes facilitated students' learning of the lesson and contributed to skill development. In a study conducted by Santoso (2021) using the inquiry method during the distance education period, he found that students were more successful than face-to-face education. (Ozcan & Gucum, 2022) concluded in a similar study that students' achievement in science courses increased. According to Ceran & Ergul (2022), during the pandemic period, teachers' use of traditional and student-centered methods together is an important process for students to gain skills. Therefore, it is possible to say that skill development took place in the courses conducted by teachers using methods, approaches and materials appropriate to the characteristics of students during the pandemic period. According to these results, the responsibility of teachers to prepare learning environments appropriate to the level of students and the necessity of conducting classes with different approaches and using materials appropriate to the content of the course in distance education have become evident. It was concluded that students' skill development would increase if teachers move away from monotonous lectures, plan inquisitive classes and conduct these classes with the active participation of students and by utilizing tools such as maps, globes, Google Earth and GIS.

Students' participation in classes, listening actively, repeating through homework assignments, and trying to overcome their deficits by following asynchronous broadcasts, in other words, taking their responsibilities on their own and staying in communication with their teachers positively affected the development of their self-efficacies in geographic inquiry skills. Therefore, in distance education, students need to have the skills to control, manage and plan their own learning compared to face-to-face education (Ally, 2004). In distance education, just as in face-to-face classroom education, students' characteristics and willingness affect skill self-efficacy. From this point of view, it is possible to say that skill development is directly affected by a student's sense of responsibility, interest in the course, attitude and motivation. The results showed that students who actively participated in classes and were able to fulfill their responsibilities had higher levels of skill self-efficacy. Depending on a student's effort and success in learning a lesson, his/her skill development also increased. In distance education, self-regulated learning skills increased success (Duzgun & Unal, 2022) and supported the development of students' skills and abilities (Samortin et al., 2022) and inquiry skills (Teke, 2020), as well as geographic inquiry skill self-efficacy. It was concluded that students' self-efficacies in geographic inquiry skills develop in distance education if the learning environment in face-to-face education is created and students have the opportunity to fulfill their responsibilities.

Based on the results of the study, it is recommended that;

- the responsibility for learning be given to students (Demir et al., 2022),
- environments, materials and perspectives that support a culture of inquiry-based learning be created,
- students be encouraged to ask questions,
- materials be designed in a multidimensional form on the EBA platform so that they will be live and can be used in distance education,
- assignments that are accessible and suitable for individual work be given,
- synchronous and asynchronous methods be used together.

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EDUCATIONAL DESIGN AND EVALUATION MODELS OF THE LEARNING EFFECTIVENESS IN E-LEARNING PROCESS: A SYSTEMATIC REVIEW

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ABSTRACT

Educational Design and Evaluation Models are important factors in e-learning as they provide guidance information for proper strategy organization pursuing both specific learning outcomes and ensuring the main elements of e-learning, such as self-regulation and collaborative learning. The examined educational models of ADDIE, Bloom, and Kirkpatrick are widely known and recognized as models for design and measuring the effectiveness of learning in order to achieve the best possible learning outcomes based on the needs of a specific target group in a specific educational context whether traditional or digital. Specifically, the ADDIE Model is a widely known learning design model used by many educational designers and training programmers to develop education and training programs. The Bloom Taxonomy is a method of building learning goals that follows the process of cognition. The Kirkpatrick Model is a method of evaluating the effectiveness of e-learning and educational programs in general, both in terms of training and business performance of learners. The purpose of this paper was both the investigation of the academic performance, the self-regulated learning and the collaborative learning in relation to the models of ADDIE, Kirkpatrick and Bloom in distance online environments and their effectiveness to the learning process. Meta-analysis was applied for research methodology. After a systematic literature review, we found that only 37 articles were appropriate for meta-analysis. Especially, 23 articles were on the ADDIE model, 9 articles were on the Kirkpatrick model and 5 articles were on the Bloom model. According to the results of this study, we found that all models apply to online process and meet different learning requirements. Regarding the cognitive performance of the trainees, all models supported the effectiveness of distance education. Moreover, the self-regulated learning and the collaborative learning, as factors inextricably linked to the effectiveness of the distance education, were examined in a small number studies in the above models. Finally, all three examined models reinforced students' positive attitudes and perceptions, even while transferring the acquired knowledge to the workplace.

Keywords: ADDIE model, Bloom taxonomy, Kirkpatrick model, instructional design, e-learning, distance education.

INTRODUCTION

In constantly evolving modern globalized society, e-learning is an internationally recognized alternative method of education that aims to enrich learning qualitatively with respect for the learning particularities of the "other" (Keengwe et al., 2014). Not only that but also, the demand for e-learning has been growing rapidly with factors directly related to its many effects (Amiti, 2020; Azevedo & Jacobson, 2008; Trivella, 2017; Troussas et al., 2022), such as learning effectiveness, its use for professional development and its cost efficiency and measurable return on investment in education (Castro & Tumibay (2019). There is the growing demand for e-courses but does not keep pace with proper pedagogical planning and the necessary skills required as a prerequisite for such learning environments (Khalil & Elkhider, 2016; Puzziferro & Shelton, 2008). Due to the multifaceted and complex characteristics of e-learning, such as self-learning, all participants' interaction, educational resources and distance learning (Aparicio et al., 2016), there is a need for the application of different models not only as guidelines of the design thinking process pursuing specific learning outcomes (Papazisis, 2020) but also as a "guardian" of e-learning features, enhancing the work of educators, instructional designers, and training developers (Castro & Tumibay, 2019; Hess & Greer, 2016).

Given that the research on educational models in the context of distance education is limited (Abernathy, 2019), there is a wide research scope. The present study refers to the investigation of the academic performance, the self-regulation and the collaborative learning in relation to the educational models of ADDIE, Kirkpatrick and Bloom in distance online environments, factors which play an important role in e-learning and are directly related to the transfer of knowledge in the work environment. Taking into account the fact that the continuous interaction of three main elements in theories and models of learning, teaching methods and learning technologies contribute to the improvement of the learning process (Barari et al., 2020) offering adaptability and personalization (Lameras & Arnab, 2022), the selection of the subject under review was constructed.

Although the specific models are well-known and recognized models inextricably linked to the effectiveness of the learning process (Hubalovsky et al., 2018; Reio et al, 2017; Trust & Pektas, 2018), a limited number of such systematic reviews or meta-analyses can be found in the relevant literature (Abdull Mutalib et al., 2022; Castro & Tumibay, 2019; Crompton et al., 2018). Some of these studies are about one of the specific models and the effectiveness of e-learning compared to traditional training (Castro & Tumibay, 2019; Santos et al., 2016; Zafar et al., 2014) focusing, mainly, on the academic performance and the lack of interaction (Abdull Mutalib et al., 2022). Although most researches emphasize the importance of pedagogical design (Barari et al., 2020; Samia et al., 2019), few of them acknowledge the existence of well-designed e-courses today (Castro & Tumibay, 2019; Crompton et al., 2018). Also, Crompton et al., 2018 claim that trainees are forced to work at lower levels of knowledge even though advanced technological systems and applications are highly designed. E-learning is approached as an alternative effective way of training (Santos et al., 2016), but without appropriate pedagogical planning (Adnan & Ritzhaupt, 2017; Khalil & Elkhider, 2016).

To the best of our knowledge no systematic reviews of distance education have been done by meta-analytic methods related to at least one of the three specific models and the particular variables with all their components. The purpose of this research is, initially, to investigate the effectiveness of the aforementioned models in distance education (Hanafi et al., 2020) and then, their contribution to the cultivation of mental and emotional functions (Hess & Greer, 2016). The ultimate goal is to highlight good suggestions for improving the specific teaching and learning systems, i.e. synchronous and asynchronous online environments, through the investigation of these educational design and evaluation models (Chang & Chen, 2014; Yu et al., 2021).

THE APPLICATION OF E-LEARNING IN EDUCATIONAL MODELS

The design of the educational process that will be implemented during the creation of an e-learning must follow the most appropriate educational strategies for specified learners in a certain learning environment focusing on the achievement of educational pre-planned results (Hess & Greer, 2016; Papazisis, 2020; Hatziroufa, 2019). Regardless of the type of e-learning (synchronous or asynchronous), the pedagogical strategies inextricably linked to the needs of the target group must derive from learning theories and models that provide general principles for the learning facilitation (Gelameris, 2015; Gros & Garcia-

Penalvo, 2016). Therefore, an important guide of the pedagogical design process in e-learning is the use of an educational model that provides guiding information for proper strategy organization pursuing both specific learning outcomes and ensuring the main elements of e-learning which include self-learning, an interactive process of all participants, educational resources and distance learning (Aparicio et al., 2016; Zampelis, 2020).

However, in recent years, systematic strategy for e-learning is almost absent and several studies (Abernathy, 2019; Barari et al., 2020; Khalil & Elkhider, 2016) highlight the low performance of most e-learning applications in motivating learners to learn, which later reflects in their work environment. According to Ballera et al. (2014), Battle (2019) and Song et al. (2004), a reliable indicator of learning quality and an essential component of online learning to ensure the important elements of distance learning is educational planning. Barari et al. (2020) point out the interaction of three basic elements in theories of learning, teaching methods and learning technologies, for the acquisition of essential knowledge while Ballera and Elssaedi (2013), Song et al. (2004) and Zampelis (2020) focus on the use of an educational model as a fundamental feature of the design thinking process in e-learning. In addition, according to Sharif & Cho (2015) there is no fixed model to be followed, but different models to meet different teaching and learning requirements in an evolving field. A similar approach is also adopted by Kennedy et al. (2014) and Paull et al. (2016). However, several researchers have found that the demand for online courses does not go hand in hand with appropriate pedagogical planning (Adnan & Ritzhaupt, 2017; Song, et al., 2004). This imbalance of statements is expanding when taking into account both the rapid growth of e-learning (Amiti, 2020) and the abundance of many technological means and tools (Spatiotis et al., 2020).

In the last two decades, according to literature review (Fernandes et al., 2020; Soto, 2013), there are various educational models, such as ADDIE, ASSURE, Dick & Carey, Gagne for e-learning, many of which are based on the ADDIE. In addition, the frequent use, mainly, of the ADDIE model and less of the Kirkpatrick model is considered as a basis for the application of expanding models, such as PeRSIVA and IDEA (Chrysafiadi & Virvou, 2013; Mullins, 2014). Even less the Bloom model is considered as a basis for an extended model (Gil-Jaurena & Kucina Softic, 2016). Nevertheless, there is a limited number of surveys which explore the ADDIE model (Hess & Greer, 2016; Trust & Pektas, 2018) and even less which examine the applications of Kirkpatrick and Bloom model in the context of distance learning (Hubalovsky et al., 2018; Lin & Cantoni, 2018). Moreover, even less are the studies which refer to the relation of factors - which are, also, the key features of e-learning - such as the self-regulation, the collaborative learning and learners' attitudes in distance online environments.

In the learning process, the emphasis is placed on the student's abilities and educational strategies for undertaking learning tasks. In particular, the attention is focused on their cognitive or behavioral performance with comparatively less attention to emotional issues, such as self-regulated learning, collaboration, motivations and factors which affect the motivation of learners (Ozdileka & Robeck, 2009). This fact happens, even though learners' characteristics, such as abilities or skills, motivation, and personality play an important role in e-learning and they are directly related to the transfer of knowledge in the work environment (Santiari, 2015). Learning is a process which is active, based on prior knowledge and which occurs in a validated social environment and requires motivation and cognitive, meta-cognitive, behavioral and emotional involvement of the student focusing on the object of learning (Gowda & Suma, 2017). The motivations of the learners include, mainly, the achievement of personal and professional development, with the main components being the learning needs and the self-realization (Greene et al., 2014). Santiari (2015) identifies knowledge and skills as two of the three fields that contribute to "behavior change". The third element is attitude. In particular, educators are responsible for developing and improving e-learning courses and educational resources that can foster positive student behavior and, therefore, better learning outcomes. In this manner, students' attitudes and perceptions about e-learning are inextricably linked to their needs and characteristics (Eiriemiokhale & Idiedo, 2020). These must be taken into account in order to fully evaluate the effectiveness of an online course (Svirko & Mellanby, 2009). All the above are mentioned in greater detail below.

SELF-REGULATED LEARNING

As mentioned above, although the e-learning facilitates participants' learning, its effectiveness is directly related to self-learning (Evans at al., 2014; Rabak & Cleveland-Innes, 2006). More specifically, the degree of effectiveness of e-learning is directly related to the degree of self-improvement that each learner seeks (Pange, 2014; Wang, 2011). Previous studies have shown the difficulties in regulating learning in digital environments (Azevedo et al., 2008). The large volume of information in combination with the various learning processes in digital environments makes it imperative to adopt self-regulatory processes (Greene et al., 2014). The challenge of the self-regulation, also, arises during online interactions and collaborative processes in virtual learning teams (Donelan & Kear, 2018). Empirical studies investigating, in general, online learning in relation to the development of skills in training programs do not almost appear in the studies we examine (DeRouin et al., 2005), although more positive learning outcomes are achieved when they are based on skills than cognitive material (Hatziroufa, 2019). In addition, well-designed courses, suitable instructors and stable technology with understanding the learning preferences have a direct effect on the involvement of learners in e-learning (Hatziroufa, 2019). Consequently, the self-regulated learning is a complex process (Pange, 2014) consisting of four components: a) *cognitive regulation*, b) *regulation of behavior*, c) *regulation of motivations and emotions* and d) *regulation of social conditions* (Greene et al., 2014). The Figure 1 below exhibits them more graphically.

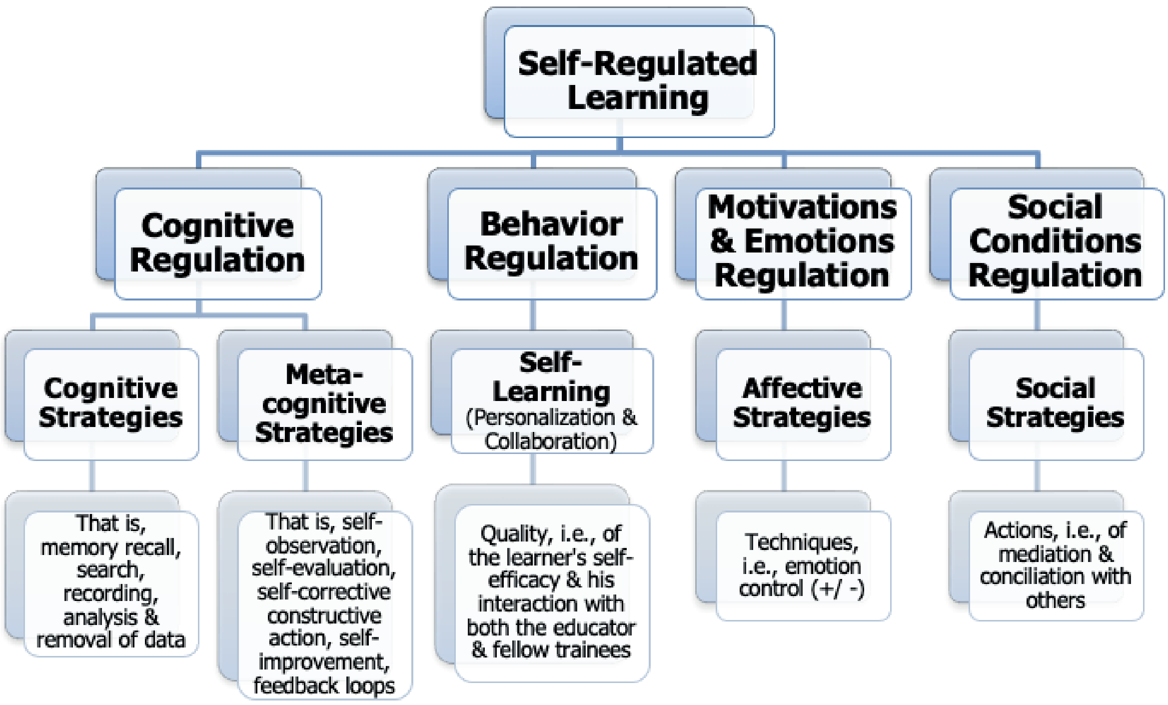

Figure 1. The main components of the self-regulated learning

COLLABORATIVE LEARNING

One of the most important characteristics of e-learning includes an interactive process of all participants, (Aparicio et al., 2016) and alternative methodologies, such as collaborative learning, are adopted in the implementation of e-learning (Gelameris, 2015), as previously mentioned. The context of the collaborative learning includes learners working in teams on a task or a project under certain conditions in which certain criteria are met, including that each individual as a team member should be held individually responsible for full content of the project (Johnson & Johnson, 2011). Therefore, in the collaborative learning, learners work in groups to pursue a common goal. The following five elements: a) *positive interdependence*, b) *individual accountability*, c) *promotional interaction*, d) *use of appropriate collaborative skills* and e) *group development of common goals* (Mabrouk, 2007) which are a prerequisite for collaborative learning, contribute to increase the motivation of learners for active participation in their learning process (Gambrari et al., 2015). The Figure 2 below exhibits them more graphically. According to Zemelman et al. (2005) the phrase good practices includes a number of aspects which make the teaching personalized, collaborative, and challenging by enabling an active, experiential, authentic, and democratic approach.

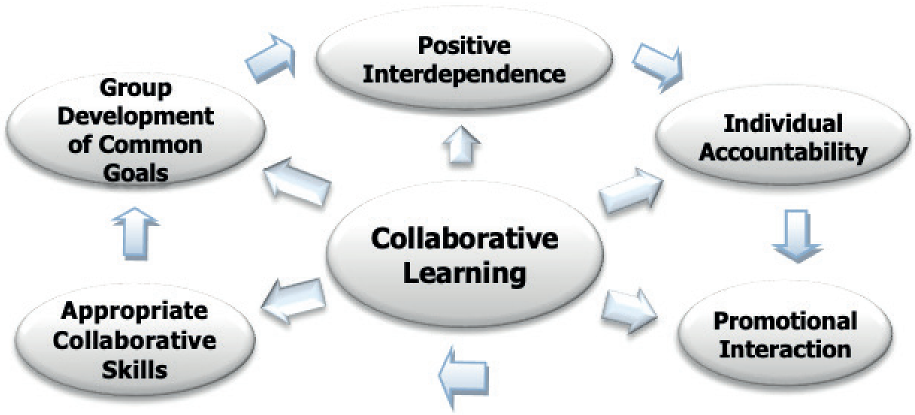

Figure 2. The main components of the collaborative learning

LEARNERS' PERCEPTIONS AND ATTITUDES

Perceptions and attitudes are important as e-learning is considered successful when a positive attitude is achieved and fully successful when a positive workplace attitude is also acquired (Santiari 2015). Specifically, educators have the "mission" to design and improve an e-learning course or educational resources in order to foster positive student behaviors and consequently, better learning outcomes. Therefore, students 'attitudes and perceptions are inextricably linked to students' needs and characteristics (Eiriemiokhale & Idiedo, 2020). A positive attitude of a learner in the e-learning means adaptation to the new form of education while a negative attitude means non-adaptation to the new system due to the learner's lack of the necessary characteristics. Moreover, Kisanga and Ireson (2016) take a broader approach to the process of attitude as a "behavioral mood". In particular, it is taken as a positive or negative evaluative judgment of an object or a process based on emotional, cognitive and behavioral experience. In other words, the attitude depends on the way the student feels (*emotional assessment*), the knowledge of the object or the situation being judged (*cognitive assessment*) and finally, on the way he has acted towards something similar in the past (*behavioral assessment*). According to Santiari (2015), attitude is one of the fields that compose the type of "behavior change". The other two elements are knowledge and skills. These must be taken into account in order to fully evaluate the effectiveness of an online course (Svirko & Mellanby, 2009).

THE CONSIDERED EDUCATIONAL MODELS

The ADDIE, Bloom, Kirkpatrick models are widely known and recognized as models for design and assessing the effectiveness of learning. These models emphasize the educational design and the evaluation of the learning process for learners and educators order to examine and achieve the best possible learning outcomes based on the needs of a specific target group in a specific educational context whether traditional or digital (Hubalovsky et al., 2018; Reio et al, 2017; Trust & Pektas, 2018). Specifically, the ADDIE Model is an educational or instructional design model (Lau et al., 2017). The Bloom model (Bloom Taxonomy) is called as a cognitive domain design, namely, a method of design and building learning goals that follows the *process of knowledge* or other words, the *process of cognition* (Farhat, 2021). Finally, the Kirkpatrick Model is a method of planning and evaluating the effectiveness of learning and educational programs in general both in terms of educational training and the business performance of learners (Khare & Kumar, 2015).

Even though these models are applied for different purposes, they aim at the best possible learning design and evaluation of the learning experiences, courses and educational content. Therefore, the phases of analysis, application & evaluation are found in all three models having a different way of their implementation, but serving the needs and learning goals of a specific target group. Moreover, the analysis phase of the ADDIE model can be aligned with the four levels of the Kirkpatrick model. The Kirkpatrick evaluation model is used to evaluate the effectiveness of a training program in terms of meeting the needs of both learners and the organization (Reio et al, 2017), as previously mentioned. Therefore, individual needs are linked to the response and the motivation. The needs of the target group for training are related to learning. Work performance needs in the case of employee training programs are related to the behavior and while the business needs are related to the results. Thus, all three models focus on the effectiveness of learning.

Approaching in more detail their educational characteristics concerning teaching and learning, several similarities and differences can be distinguished. They could be categorized based on certain criteria, some of which were defined according to the guidelines, as presented in Diamantopoulou (2017) as follows: a) *Basic elements of the educational models by Branch and Merrill (2011)*, b) *Basic theoretical and philosophical characteristics*, c) *Their structure and function* and d) *Time data and constraints*. All the aforementioned characteristics are presented in greater detail below while the Figure 3 below exhibits them more graphically.

All three examined models are accompanied by the basic elements of the educational models, which are identified by Branch and Merrill (2011). These are (a) *clearly defined steps*; (b) *clearly defined objectives based on the needs of the trainees*; (c) *evaluation* related to the desired learning outcomes (measurable, reliable, and valid); (d) c*ommon stages* (analysis, implementation, and evaluation) with considerable divergences in how they are implemented; (e) *team effort of educational designers,* keeping the fundamental data empirically; and (f) *development of real-life behaviors* as a guarantee for connecting the learning and business needs.

According to their basic theoretical and philosophical characteristics, the specific models are widely known and recognized as models for designing and evaluating the learning experiences, courses and educational content (Trust & Pektas, 2018) and they are based on pedagogical scenarios. In particular, the ADDIE model and the Kirkpatrick model are based on the general systems theory/ analysis which ensures that the analysis of tasks will follow a logical and smooth process (Diamantopoulou, 2017). In contrast, the Bloom model is based on a Learning Theory. Also, the underlying theory for the ADDIE model is the Theory of Behaviorism while for the Bloom model is the theory of Constructivism. Regarding the type of knowledge, the ADDIE model approaches the procedural knowledge while the other two models adopt the procedural & metacognitive knowledge.

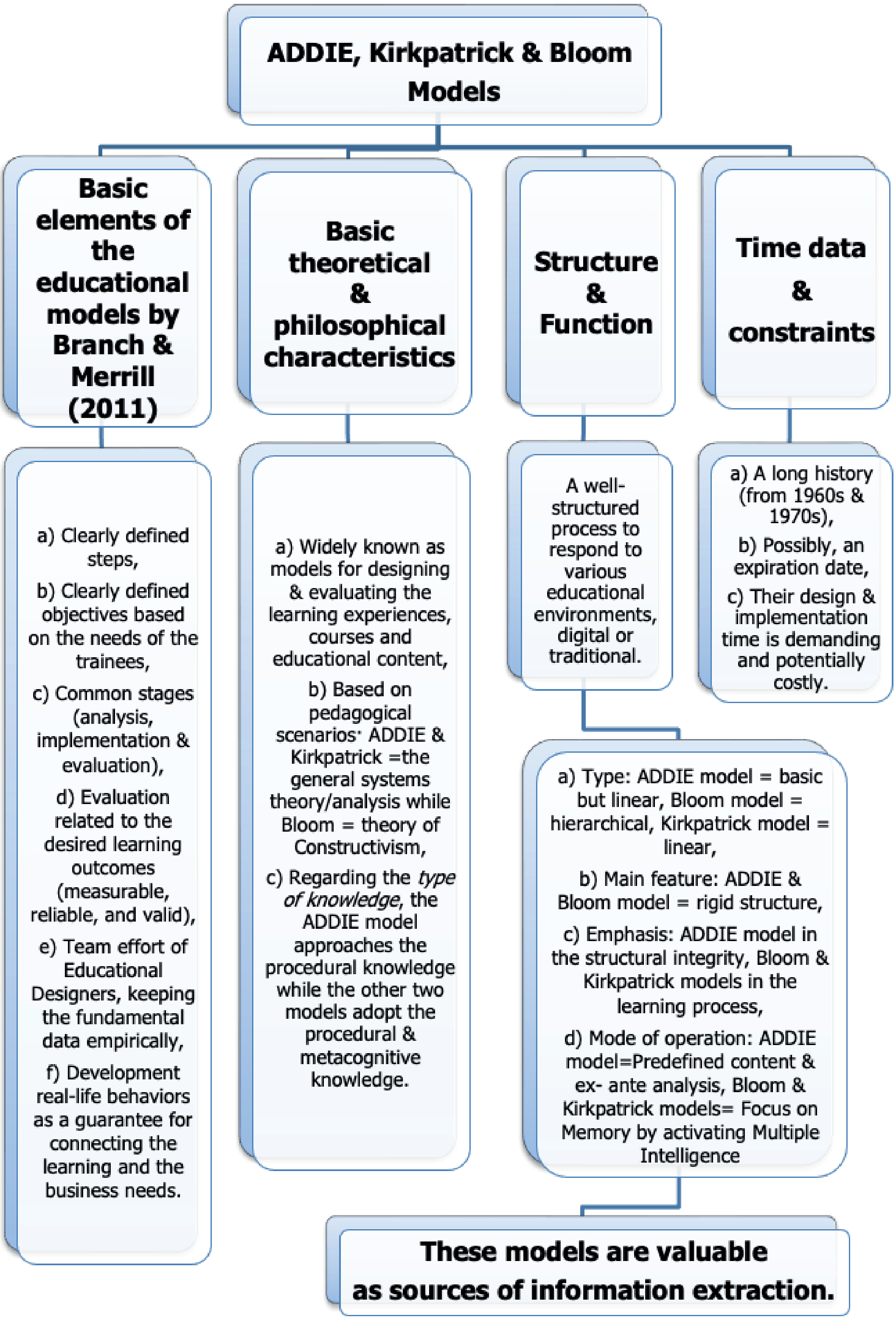

Figure 3. The main characteristics of the educational models

In terms of their structure and the way they work, it is observed that they ensure a well-structured process to respond to various educational environments, whether digital or traditional (Turker, 2016). Also, the ADDIE model and the Bloom model are characterized by their almost rigid structure, potentially limiting the creativity of educators and programmers. In particular, the ADDIE model has a strict linear structure with wide phases, but with the dominance of each simplest stage being considered a prerequisite for the conquest of the next stage. It is a limitation if the design team follows a rigid workflow (Lahti et al., 2014). This means that the movement from one stage to another is flexible, but the movement is strictly circular. Therefore, it does not work well without predefined content and without complete prior analysis. However, its structural integrity, its flexibility and its simplicity make it one of the most popular of all design models, most of which are spin-offs or its variations, inspiring even those trying to create a different model (Jusas et al., 2021; Mullins, 2014). For this reason, even the most experienced designers define it as a model for Instructional Systems Design (ISD).

Similarly, Bloom identified six cognitive levels, which are hierarchically classified from the simplest level to the most complex and from the specific to the abstract, with the dominance of each simplest stage being considered a prerequisite for the conquest of the next stage (Lopez-Zambrano et al., 2022). It creates restrictions especially for educators who do not consider that learners must follow strict steps in order to achieve effectiveness in their learning. In contrast to the structural integrity that the ADDIE model imposes, the other two models - Bloom and Kirkpatrick - prioritize the learning process of all participants. In particular, Bloom's Taxonomy through a specific cognitive process aims to develop critical thinking and transferable skills in learners (Ballera & Elssaedi, 2013). Both of the last two models mentioned above focus on the importance of memory by activating multiple intelligence and maintaining the involvement of the learners. Therefore, for the process of selecting one of the two models as the most appropriate to serve a specific learning situation, it is required to take into account the type and the needs of the trainees and the type of subject to be taught.

ADDIE, Kirkpatrick, and Bloom are three well-known educational models that have been associated with learning effectiveness (Hubalovsky et al., 2018; Reio et al, 2017; Trust & Pektas, 2018), as mentioned above. Nevertheless, there have not been sufficient systematic reviews of distance education conducted using meta-analytic methods in relation to the specific models and factors (Abdull Mutalib et al., 2022; Castro & Tumibay, 2019; Crompton et al., 2018). Some of them are about one of the specific models and the effectiveness of e-learning in general compared to traditional training (Castro & Tumibay, 2019; Santos et al., 2016; Zafar et al., 2014). To the best of our knowledge no systematic reviews of distance education have been done by meta-analytic methods related to the three specific models and the particular variables with their components. Therefore, it is important to focus on the investigation of the important factors of distance education, such as the academic performance, the self-regulated learning, the collaborative learning and learners' attitudes in relation to the examined models in distance online environments and their effectiveness to the learning process.

PURPOSE OF THE STUDY

Based on the bibliographic review (Abdull Mutalib et al., 2022; Castro & Tumibay, 2019; Crompton et al., 2018), there have not been enough systematic reviews of distance education done by meta-analytic methods related to the ADDIE, Kirkpatrick or Bloom models and the important factors of distance education, such as the academic performance, the self-regulated learning, the collaborative learning and learners' attitudes. Some of these systematic reviews and meta-analyses are about one of the specific models and the effectiveness of e-learning in general compared to traditional training by focusing on cognitive achievement (Castro & Tumibay, 2019; Santos et al., 2016; Zafar et al., 2014). To the best of our knowledge no systematic reviews of distance education have been done by meta-analytic methods related to the three specific models or only to one of them and the particular variables with their components. Therefore, it is important to focus on the investigation of the particular factors of distance education in relation to the specific educational models (Hubalovsky et al., 2018; Paull et al., 2016).

More specifically, the purpose of the research is, initially, to investigate the effectiveness of the ADDIE, Kirkpatrick and Bloom models in distance education and especially, in synchronous and asynchronous electronic environments (Crompton et al., 2018; Hanafi et al., 2020; Hess & Greer, 2016). Then, the purpose of the research is to investigate the contribution of the aforementioned educational models to the cultivation of mental and emotional functions, such as cognitive performance, self-regulated learning and collaborative learning. Considering the fact that there is a lack of such researches in the literature review (Abdull Mutalib et al., 2022), the ultimate goal of the present study is as best as possible to highlight quality suggestions for improving the specific way of education, i.e. synchronous and asynchronous distance education through the investigation of the considered educational design and evaluation models of the learning process (Chang & Chen, 2014).

In order to achieve this purpose, the following two research questions were formulated as well as four other sub-questions of second research question. Namely:

1. How effective are the application of the educational models ADDIE, Kirkpatrick and Bloom in online distance learning as presented in the different researches in online distance learning?
2. Additionally, we would investigate whether these educational models to synchronous and asynchronous e-learning:
    a) promote the cognitive performance,
    b) cultivate the development of self-regulated learning,
    c) develop collaborative learning,
    d) enhance learners' perceptions and attitudes.

METHODOLOGY

Research Process

For the need of this study, a literature review was carried out on relevant studies of the last time period (2010-2022) and the process of meta-analysis of the most appropriate studies is considered. Researchers usually look for the most recent studies so that the references are up-to-date. However, a limited number of relevant studies were initially identified for the specific models of distance education. As a result, the time period has been extended to 2010. Then, a process of systematic review was followed to extract appropriate information for our study. A meta-analysis was applied and conclusions of the meta-analysis were implemented, followed by highlighting the ways ofapplication and good practices of the above models for e-learning. Meta-analysis is "a mathematical process that statistically combines the results of studies selected after a systematic review of the literature" (Galanis, 2009). Therefore, meta-analysis is a process inextricably linked to systematic review and in combination, safe conclusions can be drawn.

Data Collection Technique

Selective bibliography from international research journals was searched. Specifically, using systematic review, databases were used, such as ERIC, Science Direct-Elsevier, Springer Link, SCOPUS and Greek research journals. The specific databases were chosen as they are among the largest bibliographic databases that cover scientific bibliography from almost every discipline and especially, from the field of education to which the subject of this research belongs. Moreover, data were extracted using the web quest process in order to be used to strengthen the bibliographic framework of the work and not to use them as basic data of the meta-analysis process. The collected scientific articles had as main subject the Distance Education and Technology in Education and more specifically, we collected those articles which refer to educational models in synchronous and asynchronous digital learning environments. Appropriate keywords such as "ADDIE model", "Kirkpatrick model", "Bloom taxonomy", "educational design", "e-learning", "online learning", "distance learning", "meta-analysis" and various combinations of these words were used to search for the above information material.

Reliability and Validity

In order to ensure the quality of the surveys, appropriate instructions were taken into account regarding the evaluation of the online sources searched and extracted from the specified databases, as presented in a relevant source of the University of Cyprus (Research initiatives, n.d) and the educational material (Cohen & Manion, 1994; Creswell, 2016). Then, for the extraction of the aggregate result, the process of meta-analysis was applied (Galanis, 2009), during which a combined conclusion was calculated, guided by the results of the individual appropriate empirical articles. Specifically, the basic stages of the methodological research were followed, as mentioned by Pellas et al. (2018), part of which was the process of defining the certain inclusion and exclusion criteria (Pellas et al., 2016). In addition, the PRISMA recommendation (Moher et al., 2009) was applied for the systematic reviews and meta-analyses as it is considered as one of the most appropriate protocols to highlight the advantages and disadvantages of any research review (Liberati et al., 2009). The aim of the whole process was to carry out a centralized result with the utmost precision, reliability and validity.

Detailed Planning of the Research Process

The meta-analysis process was based on the following classified transitional procedures proposed by Kitchenham (2007, as cited in Pellas et al., 2019). As shown in the Figure 4, the literature review carried out the stages as follows:

Stage 1: *Design of the bibliographic review*: a) Selection of appropriate journals and databases, b) definition of criteria for inclusion and exclusion of articles and c) definition categories for analysis.

Stage 2: *Conducting the literature review*: a) Study selection, (b) Data extraction (content analysis methods were applied), (c) Data synthesis and (d) Data coding.

Stage 3: *Evaluation report*: Analysis of results and discussion of findings, trends and conclusions following the principles of the PRISMA (Preferred Reported Items for Systematic Reviews and Meta-Analyzes) statement (Moher et al., 2009).

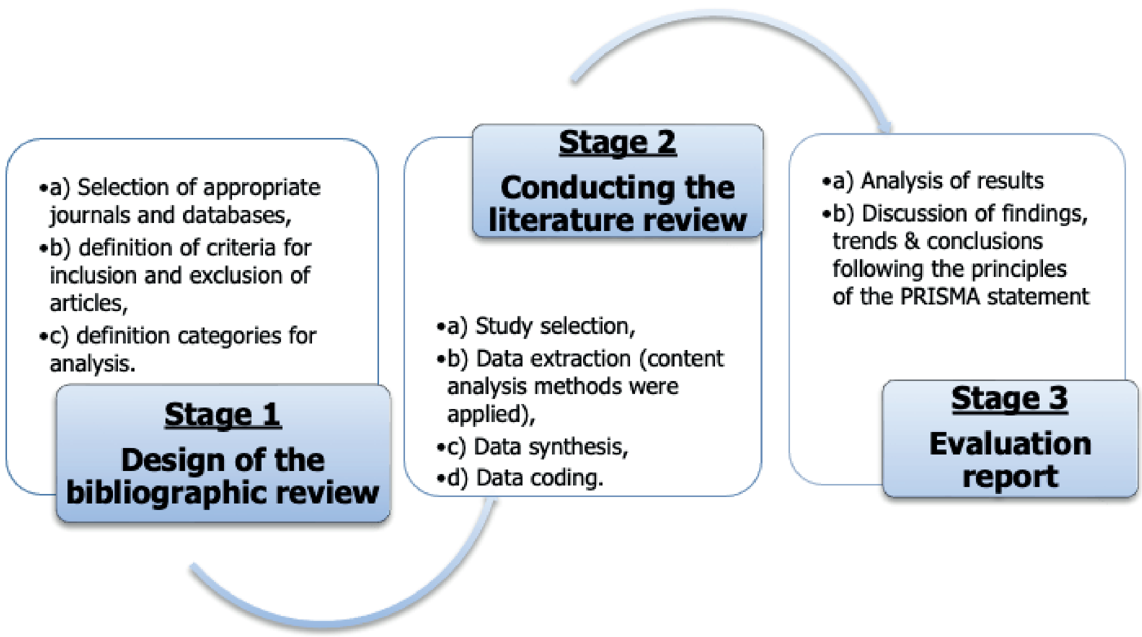

Figure 4. The design stages of the research process

In the step [Stage 1st (b)], the criteria for inclusion and exclusion of appropriate research (Pellas et al., 2016) were determined based on the research questions of the present research, the time frame of the literature review and type of research as follows:

Inclusion criteria: General criteria: (a) Studies published during the period 2010 to 2022 ·(b) Conceptual articles or studies that they provided evidence of educational potential based on a research method ·(c) Articles whose summary and the complete document was prepared in English or Greek. Specific criteria: (a) Studies which have an experimental application stating the advantages, the disadvantages, the educational benefits and the effectiveness of the models - ADDIE, Bloom, Kirkpatrick - in the online distance education·(b) Studies describing the application of the specific teaching models ·(c) Studies describing the application of the specific models to be explored in online training courses for trainees in their professional career (nurses, company employees, librarians, etc.).

Exclusion criteria: (a) Studies which were either before 2010 or after 2022 ·(b) Studies which were not written in English or Greek·(c) Studies which are not recognized as "articles" in selected journals (e.g. books, book reviews / chapters, editorial information, etc.) ·(d) All articles which did not present evaluation data or did not follow a well-structured research process ·(e) Studies which did not provide sufficient data to calculate the magnitude of the results or did not have clear summaries or aggregated findings from their qualitative data · (f) Studies which mentioned one of the terms "ADDIE model", "Kirkpatrick model", "Bloom taxonomy" in online learning and related to either blended learning, mobile learning or virtual reality learning, or in a multimedia classroom but they were not examined in a distance environment, in which the subject of the present research is mentioned ·(g) Also, studies have not been included which, although based on the above-mentioned models as to their theoretical framework, their research methodology subsequently concerned an expanding educational model.

The Figure 5 illustrates these criteria for inclusion and exclusion of appropriate research more graphically.

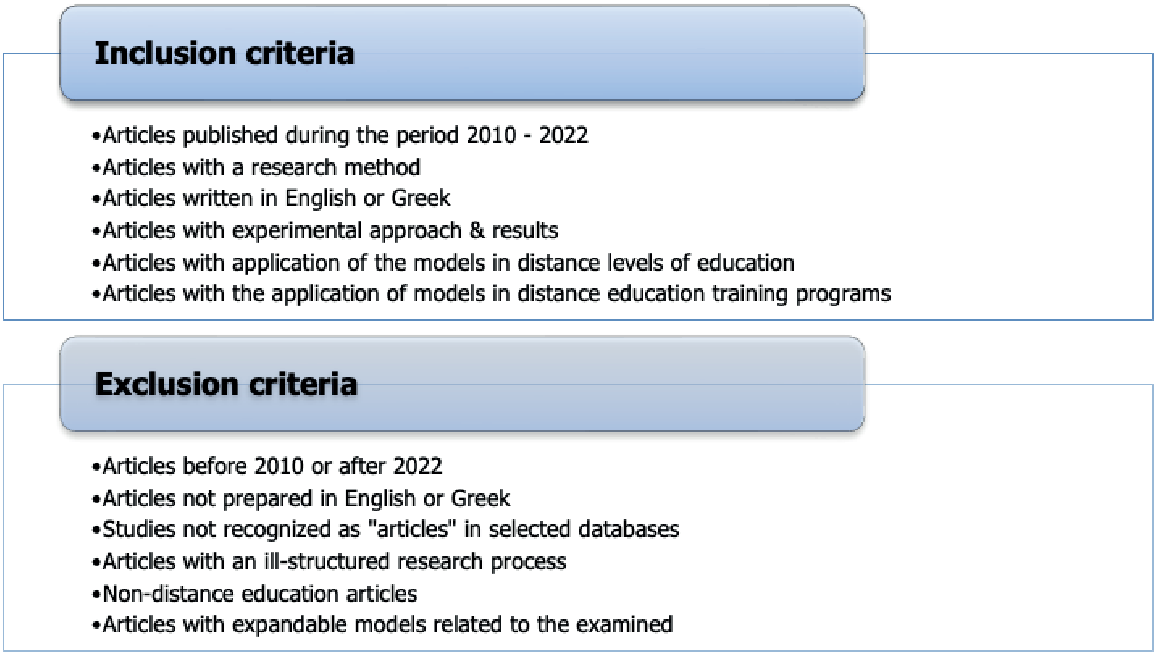

Figure 5. Criteria for inclusion and exclusion of articles

For the analysis of the results, thematic analysis of the collected data was used. Specifically, detection of repetitive patterns of meaning (topics) based on the aforementioned literature review and rendering of interpretive codes, conceptual definitions in the various data sections were applied (Tsiolis, 2017). Then, the presentation of the results was done using *Microsoft Office Professional Plus 2019, Excel Version 2206.*

Conduct and Analysis of the Relevant Literature Review through a Flow Chart

The Figure 6 below depicts a flow chart regarding the process of selecting the appropriate articles followed using instructions from Liberati et al. (2009), the analysis of which is presented as follows:

Identification: In order to find and identify suitable articles for subsequent inclusion in critical editing, a search was made in certain databases during the period of three consecutive months, January, February and March 2022. The search for appropriate articles was defined based on the topic of this research and their scope was defined based on the framework "The Models of ADDIE, Bloom, Kirkpatrick in online distance learning".

Screening: During the bibliographic review process, 103 articles were extracted and after removing 12 duplicates, 91 articles were checked by reading their titles and their abstracts based on criteria which had already been defined.

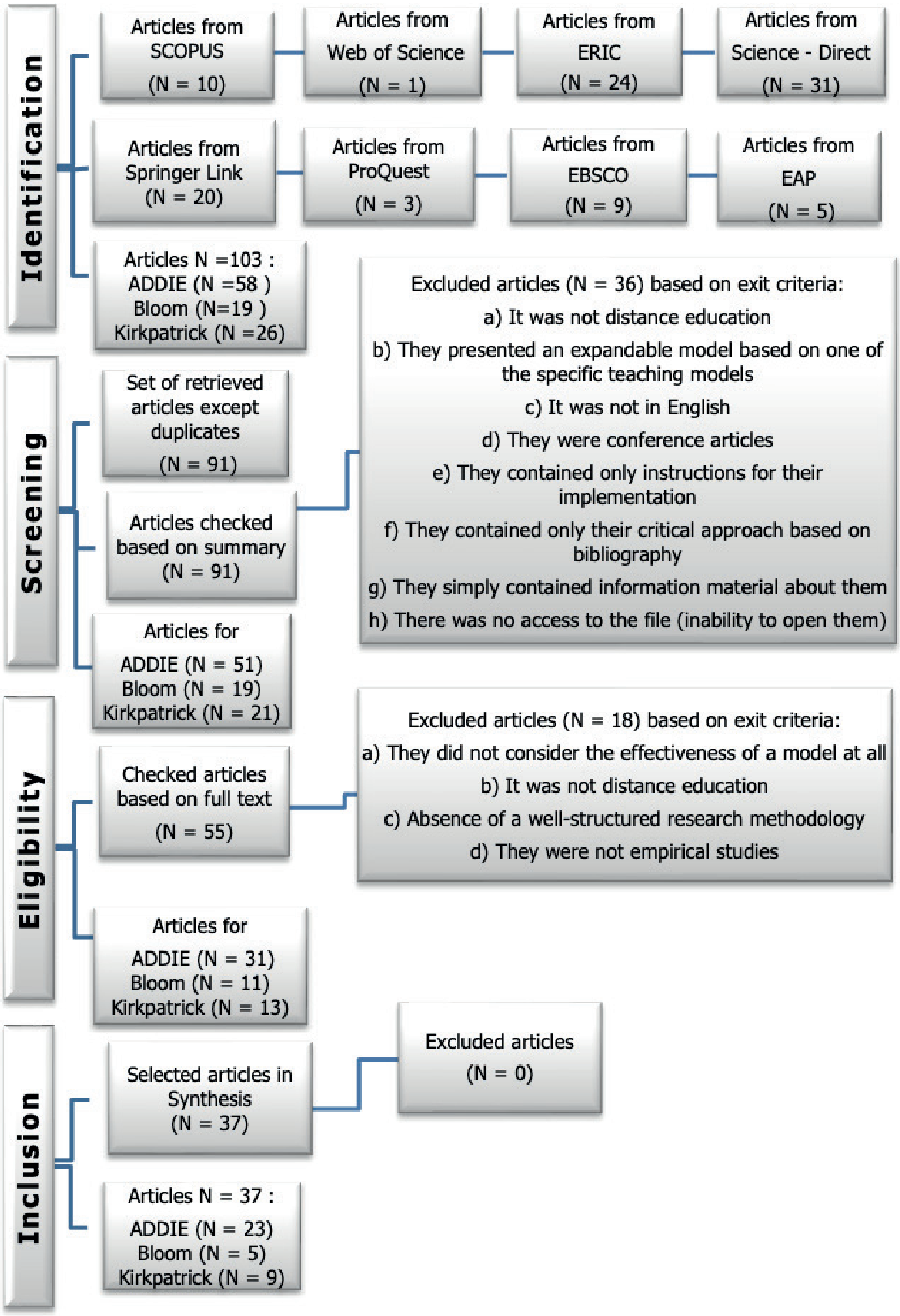

Figure 6. The flowchart for the article selection process

During the screening process, 36 articles were rejected, while in the next phase, 55 articles were selected to be thoroughly reviewed. During the screening process, of the 36 rejected articles, 9 articles were not distance education, 7 articles were conference papers while 5 articles presented an expanding model based on one of the specific models. 6 articles contained instructions for the correct application of the specific models or in general, for the educational design, 4 articles contained a critical approach of the models based on the literature and 5 articles contained simply information material about them and 1 article could not be opened.

Eligibility: During the selection phase, full text analysis is required. For this reason, the 55 articles were thoroughly studied following specific eligibility criteria or otherwise, entry criteria. The eligibility criteria were as shown in Figure 6.

At this stage "*Eligibility*", 18 articles underwent the exclusion procedure as ineligible while 37 articles were deemed appropriate for data extraction. In particular, of the 18 rejected articles, 7 articles did not examine the effectiveness of the specific models at all, although during the methodological process, they emphasized the development of the specific models. The 6 articles were not distance education, although they referred to virtual reality environments, multimedia classrooms and mobile learning or TV programs without being specified in the summary in order to be rejected in previous stage of checking their suitability (*screening phase*). 5 articles were not empirical studies, of which 2 articles were comparative studies of ADDIE and Agile or SAM models based on relevant literature.

Inclusion: For this stage, as mentioned above, 37 articles were deemed appropriate, which were classified separately based on the examined models, ADDIE, Bloom, Kirkpatrick. Thus, 23 articles referring to the ADDIE model, 5 articles referring to the Bloom model and 9 articles referring to the Kirkpatrick model were found.

FINDINGS

All the above articles were processed to extract results and conclusions based on parameters, as defined in the detailed design of the research process. Regarding Stage 2 (a), after a manual search in the selected databases, 37 suitable journal articles were selected applying the defined inclusion and exclusion criteria. Stage 2 (b) and 2 (c) were performed by carefully reading the appropriate articles and the data coding process was performed according to the categories defined in Stage 1 (c). The results were presented according to the research questions.

The control variables results for each relevant article separately and per model are illustrated with symbols in Tables 1, 2 and 3. Specifically, the control variables were cognitive performance, self-regulated learning, collaborative learning and perceptions/attitudes. The self-regulated learning as a complex variable was approached with all four of its components a) cognitive regulation, b) regulation of behavior, c) regulation of motivations and emotions and d) regulation of social conditions.

Table 1. Results of control variables for the ADDIE model

Authors	Cognitive performance	Self-regulated learning				Collaborative learning	Perceptions & Attitudes
		Cognitive regulation	Regulation of behavior	Regulation of motivations & emotions	Regulation of social conditions		
Cheng (2011)	↑*	–**	↑	–	–	–	–
Mavroudi & Hadzilacos (2013)	↑	–	↑	–	–	↑	↑
REINBOLD. (2013)	↑	–	↑	–	–	–	↑
Robinson & Dearmon (2013)	↑	–	↑	–	–	–	↑
Soto (2013)	↑	–	–	↑	–	↑	↑
Hsu et al. (2014)	↑	–	–	–	–	–	↑
Santiari (2015)	↑	–	↑	↑	–	–	↑
Durak & Ataizi (2016)	↑	–	–	–	–	–	–
Hess & Greer (2016)	↑	–	↑	–	–	–	–
Nordin et al. (2016)	–	↑	↑	↑	–	–	↑
Turker (2016)	↑	–	–	–	–	–	–
Ismail et al. (2018)	↑	–	↑	–	–	–	↑
Patel et al. (2018)	↑	–	–	–	–	–	–
Trust & Pektas (2018)	–	–	↑	–	–	↑	↑
Abernathy (2019)	↑	–	–	–	–	–	–
Hatziroufa (2019)	–	↑	↑	–	–	–	↑
Gournakis (2020)	↑	–	↑	–	–	–	–
Zampelis (2020)	↑	↑	↑	↑	↑	↑	↑
Hanafi et al. (2020)	↑	–	↑	–	–	–	↑
KOC (2020)	↑	–	–	–	–	↑	–
Manitsara (2020)	↑	–	–	↑	–	–	–
Salas-Rueda et al. (2020)	↑	–	↑	–	–	–	–
Almelhi (2021)	↑	↑	↑	↑	↑	↑	–

Note. *↑ = *percentage increase,* **– = *the article does not examine the control variable*

The Table 1 depicts the control variables results for each relevant article separately for the ADDIE model. The selected articles that examined the above variables point out a positive impact of the application of ADDIE model. More specifically, there are 19 articles out of the 23 selected articles examined its effectiveness in improving learning, i.e. the variable of cognitive performance. 16 articles out of the 23 selected articles related to the ADDIE model examined the self-regulatory factor, mainly some of its parameters, i.e. the involvement and motivation of the student. Moreover, 3 of them did not present the results in sufficient detail. In terms of the variable collaborative learning, 6 articles on the ADDIE model were included. Finally, 12 articles on the ADDIE model examined and pointed out the positive perspectives and attitudes.

Table 2. Results of control variables for the Kirkpatrick model

Authors	Cognitive performance	Self-regulated learning				Collaborative learning	Perceptions & Attitudes
		Cognitive regulation	Regulation of behavior	Regulation of motivations & emotions	Regulation of social conditions		
Edwards & Black (2012)	↑*	–**	–	–	–	–	↑
Lavender et al. (2013)	↑	–	–	–	–	–	–
Aluko & Shonubi (2014)	–	–	↑	–	–	–	↑
Chang & Chen (2014)	↑	↑	↑	↑	↑	↑	↑
Lahti et al. (2014)	↑	↑	–	↑	–	–	↑
Lin & Cantoni (2017)	↑	–	–	–	–	↑	↑
Goh et al. (2018)	–	–	↑	↑	–	–	–
Moreira et al. (2019)	↑	–	–	↑	–	–	–
Fernandes et al. (2020)	↑	–	↑	↑	–	↑	↑

*Note. *↑= percentage increase, **– = the article does not examine the control variable*

The Table 2 illustrates the control variables results for each relevant article separately for the Kirkpatrick model. From the 9 articles, 7 articles were examined its effectiveness in improving learning, i.e. the variable of cognitive performance. The self-regulatory factor was examined in relation to, mainly with some of its parameters, the involvement and motivation of the student. From the 9 articles concerning the Kirkpatrick model, 6 articles related to the specific control variable were included. In terms of collaborative learning, 3 articles on the Kirkpatrick model were included. Finally, 5 articles on the Kirkpatrick model pointed out the positive perspectives and attitudes. The selected articles that examined the above variables point out a positive impact of the application of Kirkpatrick model.

Table 3. Results of control variables for the Bloom model

Authors	Cognitive Performance	Self-regulated learning				Collaborative learning	Perceptions & Attitudes
		Cognitive regulation	Regulation of behavior	Regulation of motivations & emotions	Regulation of social conditions		
Domun & Bahadur (2014)	↑*	↑	↑	↑	↑	↑	–***
Blau et al. (2017)	↑	↑	↓**	↓	↓	–	↑
Lau at al. (2017)	↑	–	↑	–	–	↑	–
Kumpas-Lenk, et al. (2018)	↑	–	↑	↑	–	–	↑
Barari et al. (2020)	↑	–	–	–	–	↑	↑

Note. ** ↑ = *percentage increase,* ** ↓ = *percentage decrease,* ***– = *the article does not examine the control variable*

The Table 3 shows the control variables results for each relevant article separately for the Bloom model. All articles refer exploratory to the improvement of learning examining the variable of cognitive performance. The self-regulatory factor was examined in relation to, mainly with some of its parameters, the involvement and motivation of the student. From the 5 articles concerning the Bloom model, 4 articles related to the specific control variable were included. In terms of collaborative learning, 3 articles on the Bloom model were included. Finally, 3 articles on the Bloom model pointed out the positive perspectives and attitudes. Almost all the selected articles that examined the above variables highlight a positive effect of applying the Bloom model. However, one of the selected articles pointed out a percentage reduction in parameters of the self-regulation variable.

The Tables 4 and 5 present the overall results regarding the aforementioned variables per model and per category (positive effects and limitations in synchronous and asynchronous online learning environments).

Table 4. Positive effects from the application of the models on the distance e-learning

Positive effects for the ADDIE model	Number of studies	Percentage
Better learning performance and / or learning benefit	19	83%
Development of self-regulatory factors	16	70%
Student interaction / socialization / collaboration	6	26%
Positive perceptions and attitudes of students	12	52%
Positive effects for the Kirkpatrick model	**Number of studies**	**Percentage**
Better learning performance and / or learning benefit	7	78%
Development of self-regulatory factors	6	67%
Student interaction / socialization / collaboration	3	33%
Positive perceptions and attitudes of students	5	56%
Positive effects for the Bloom model	**Number of studies**	**Percentage**
Better learning performance and / or learning benefit	5	100%
Development of self-regulatory factors	4	80%
Student interaction / socialization / collaboration	3	60%
Positive perceptions and attitudes of students	3	60%

According to Table 4, there are 19 articles out of the 23 selected articles related to the ADDIE model examined its effectiveness in improving learning (83%). Moreover, 5 of them did not present the results in sufficient detail. All articles related to the Bloom model refer exploratory to the improvement of learning by percentage (100%) while from the 9 articles concerning the Kirkpatrick model, 7 articles (78%) were included. The self-regulatory factor was examined in relation to, mainly with some of its parameters, the involvement and motivation of the student. 16 articles out of the 23 selected articles related to the ADDIE model examined the self-regulatory factor (70%). Moreover, 3 of them did not present the results in sufficient detail. From the 5 articles concerning the Bloom model, 4 articles refer to the self-regulatory factor (80%) while from the 9 articles concerning the Kirkpatrick model, 6 articles related to the specific control variable were included (67%). In terms of collaborative learning, 6 articles on the ADDIE model (26%), 3 articles on the Kirkpatrick model (33%) and 3 on the Bloom model (60%) were included. Finally, according to positive perspectives and attitudes, 12 articles on the ADDIE model (52%), 5 articles on the Kirkpatrick model (56%) and 3 on the Bloom model (60%) were included.

Table 5. Limitations in the application of the models in the distance e-learning

Limitations for the ADDIE model	Number of studies	Percentage
Key factors which contribute to the reduction of the motivation and the involvement of the student are the lack of the interaction with others & the lack of the quality of the educational material.	6	26%
The Educators must develop additional learning material exclusively for the needs of the distance learning.	5	22 %
The Educators, also, shoulder the burden of the planning e-courses, often in the absence of adequate training and skills.	5	22%
The lack of skills, the motivation and the support are factors which contribute to a lack of the commitment to the MOOC.	4	17%
Limitations for the Kirkpatrick model	**Number of studies**	**Percentage**
Further evaluation of the design, the multimedia, the technological learning tools is required in the distance e-learning	4	44%
Inability to transfer the acquired knowledge to the work environment due to educational policies or lack of resources	2	22%
The simulation of learning situations through virtual labs cannot replace face to face laboratory data.	2	22%
Limitations for the Bloom model	**Number of studies**	**Percentage**
Learning results, which correspond to the 3 lowest levels of Bloom, can negatively affect the non-involvement of the learners in the learning process resulting in dropout.	2	40%
The lack of the quality educational material implies the lack of the motivation.	2	40%
The stress factor acts as an obstacle in distance e-learning.	2	40%

The Table 5 shows the limitations in the context of the application of the examined models. For the ADDIE model, the limitations are a) the factors that contribute to the reduction of motivation and involvement of the student (namely, the lack of interaction with others & the lack of quality of educational material) (26%), b) the additional learning material that educators need to develop exclusively for distance learning needs (22%), c) the additional burden of designing the e-courses that the educators carry, often in the absence of adequate training and skills (22%) and finally, d) the factors that contribute to the lack of commitment to MOOCs (namely, the lack of skills, motivation and support) (17%). Regarding the Kirkpatrick model, the limitations are a) the need for further evaluation of design, multimedia, technological learning tools in the distance e-learning (44%), b) the impossibility of transferring the acquired knowledge to the work environment due to educational policies or lack of resources (22%) and c) the impossibility of replacing living laboratory conditions with virtual simulation laboratories (22%). For the Bloom model, the limitations are

a) the learning outcomes, which correspond to the three lowest levels of the Bloom taxonomy, can negatively affect the involvement of the learner in the learning process resulting in dropout (40%), b) the lack of quality of educational material implies a lack of motivation (40%) and c) the stress factor acts as an obstacle to distance e-learning (40%).

DISCUSSIONS AND CONCLUSIONS

The Effectiveness from the Application of the Examined Models in Distance Learning

According to our finding, the effectiveness of the educational models ADDIE, Kirkpatrick and Bloom in online distance learning appears in all learning environments. All models apply to online process but meet different learning requirements.

More specifically, the ADDIE model has a flexible structure which allows it to be applied in all learning environments (Almelhi, 2021; Turker, 2016). The educational planning process of the online learning with the ADDIE model is most often used for the design of massive online courses (MOOCs) and is considered effective although there is always a negligible percentage of students who drop out of massive online courses with abandonment factors, as indicated in the relevant literature (Nordin et al., 2016; Trust & Pektas, 2018; Zampelis, 2020), not related to the ADDIE model (e.g. difficulty due to lack of previous experience with MOOCs programs, time commitment and perceptions for the trainer). However, the lack of skills, the motivation and the support are factors that contribute to the lack of commitment in a MOOC (Nordin et al., 2016). Also, the ADDIE model is preferred for the development of virtual reality commands (Soto, 2013) and is considered suitable for the design and implementation of mobile learning by enhancing students' positive attitudes and perceptions regarding the adoption and the use of technology for educational purposes (Hanafi et al., 2020). The success of e-learning is considered complete when a positive workplace attitude has been achieved. The training planning through the ADDIE model enables creating a positive attitude for the learners, even while transferring the acquired knowledge to their workplace (Santiari, 2015) Therefore, the ADDIE model may offer educational designers and educators a flexible and systematic strategy for the development of a flexible and interactive multiform e-learning (Patel et al., 2018). Finally, many scientists (Ali & Esia-Donkoh, 2021; Soto 2013) emphasize the adaptation of existing model, such as the ADDIE model for virtual reality environments, as many of them achieve both constructive analysis of students' learning behaviors and provide corresponding targeted feedback for learners' improvement based on their needs (Yu et al., 2021). As well as, this model encourages the organization and creation of innovative, useful and creative spaces for online training context, thus contributing to the improvement of learners' academic performance, motivation and involvement (Salas-Rueda et al., 2020).

The findings of the present meta-analysis indicate that the Kirkpatrick model is mainly used to measure the effectiveness of training programs in relation to the first two levels, i.e. *reaction* and *learning* (Lavender et al., 2013) and less for the third level, which is behavior / transfer (Lahti et al., 2014; Moreira et al., 2019). Also, the fourth level, which is defined as *results*, is rarer (Chang & Chen, 2014; Goh et al., 2018; Lin & Cantoni, 2018). Also, the specific model is applied in massive online courses (MOOCs), which are offered in asynchronous online environments. Since the Kirkpatrick model is a popular framework for evaluating e-learning by assessing the knowledge transfer in the workplace (Galloway, 2005), it was expected to be used in employee training programs in the wider corporate environment and not, mainly, in relation to medical and nursing training programs, as the results of the present search highlight. Possibly, this is justifiable, since according to Galloway (2005), the Kirkpatrick model cannot keep up with the modern competitive entrepreneurship that requires cost efficiency and measurable return on investment in education, creating a way to determine the cost to benefit ratio of knowledge. That is why Galloway (2005) and Kennedy et al. (2014) propose a combination of the Kirkpatrick model with another model, such as the ROI models, which will include a method for assessing intellectual property in terms of expertise and employee skill levels, effectively helping an employer determine the value of an employee or a group of employees. After all, workplace evaluation requires more complex approaches and therefore additional support and infrastructure (Kennedy et al., 2014; Paull et al., 2016).

The Bloom model is mostly used as a basis for measuring the effectiveness of e-resources - mainly e-textbooks, collaborative learning activities on student cognitive quality and assessment exercises - for online learning specifying the context or not of distance education (Hubalovsky et al., 2018). Those who emphasized the context of the distance education were very few choosing the asynchronous online learning approach and the use of the Revised Bloom Taxonomy (Lahti et al., 2014). The lack of researches on the Bloom model but also, on the other two models, in general, can be equated with the finding that the demand for online courses is not harmonized with appropriate pedagogical design (Abernathy, 2019; Barari et al., 2020; Khalil & Elkhider, 2016; Song et al., 2004). Finally, during the application of the Bloom model, it was observed that factors such as personality characteristics (extroversion-introversion and emotional stability-neuroticism), the style and type of learning, the growing acquaintance among the participants and the learner's work rate influence the effectiveness of e-learning (Blau et al., 2017; Weiser et al., 2018). The Bloom model is proposed in combination of adaptive algorithm and software taking into account the above factors, while the research field of this is a challenge for cooperative learning in distance education and mobile learning (Domun & Bahadur, 2014; Hubalovsky et al., 2018). Finally, the design of learning outcomes is directly related to student perceptions, motivation, involvement and achievement of learning outcomes (Kumpas-Lenk et al., 2018).

The Importance of the Examined Models to E-Learning regarding the Learning Performance of Learners

The impact of application of the above models to synchronous and asynchronous e-learning shows that all three models are valuable as sources of information extraction by providing good learning benefits (Hsu et al., 2014; Patel et al., 2018; Reio et al., 2017). As indicated in the relevant researches, when designing the learning process, the attention is given to the learner's abilities and to educational strategies for undertaking learning tasks, focusing on cognitive performance with comparatively less attention to emotional issues (Hatziroufa, 2019; Hsu et al., 2014; Ismail et al., 2018; Robinson & Dearmon, 2013) and factors directly related to the learning effectiveness, such as self-regulation and collaborative learning (Almelhi, 2021; Barari et al., 2020; Koc, 2020; Lavender et al., 2013; Weiser et al., 2018). In addition to the above, we found that all three examined models reinforced students' positive attitudes and perceptions regarding the adoption of strategies for the acquisition and the application of knowledge (Fernandes et al., 2020; Hanafi et al., 2020; Moreira et al., 2019) even though these often face limitations (Kumpas-Lenk et al., 2018; Nordin et al., 2016). All the above are mentioned in more detail below.

Regarding the cognitive performance of the trainees, all models supported the effectiveness of online distance education. In the ADDIE model, this is achieved as the e-course focuses on the learner's learning needs - not teaching - and recognizes the student's involvement with the learning object while achieving superior learning outcomes (Alturkistani et al., 2018; Robinson & Dearmon, 2013; Turker, 2016). Nevertheless, several researches (Durak & Ataizi, 2016; Gournakis, 2020) required the return of the Educational Designers to any previous stage for improvement interventions and a more enjoyable approach to learning objectives through the attractiveness of design. As Abernathy (2019) and Reinbold (2013) pointed out, these interventions are not directly related to the effectiveness of the model itself but mainly, to the mistakes of educational designers in the analysis and design phases. During the interventions, the main form of teaching through short multimedia presentation and, in fact, with an adaptation to the local culture in combination with different interactive exercises was suitable for the acquisition of all levels of knowledge while meeting the different needs of the learners (Hadullo, 2021; Manitsara, 2020; Mavroudi & Hadzilacos, 2013). As for the Kirkpatrick model, there is an improvement in the learning process in the context of both academic and professional performance of the trainees, despite the fact that transfer of knowledge in the workplace faces limitations in the application of learning due to political beliefs or leadership strategies or the lack of resources (Edwards & Black, 2012; Lin & Cantoni, 2018). However, Aluko and Shonubi (2014) and Chang and Chen (2014) point out that for the acquisition and transfer of knowledge, the learners' characteristics, such as abilities or skills, motivation and personality, also, play an important role in distance education. Also, educational design specialists do not devote more time to activities which are decoded in a positive behavior change and corresponding results that reflect the levels 3 and 4 of the Kirkpatrick model (Goh et al., 2018; Moreira et al., 2019). According to the findings of the meta-analysis, only learning outcomes designed at higher levels of cognitive demand enhance the learning process, as more complex ways of thinking are required (Kumpas-Lenk et al., 2018). Unfortunately, specialist educators are devoted to designing learning outcomes that reflect the lower levels of Bloom's taxonomy while ignoring the needs of the wider competitive contemporary reality that demands more complex ways of thinking (Barari et al., 2020). That is why this model suggests the use of multiple combinations of learning activities based on virtual discussion forums (Lau et al., 2017), external e-tools (Domun & Bahadur, 2014), interaction using of animated films, gamification simulation software, virtual augmented reality technology (Ballera et al., 2014; Barari et al., 2020) and adaptive e-learning exercises (Hubalovsky et al., 2018) as part of the teaching activity, meeting the different needs of learners in a more efficient way (Ischimura et al., 2020). Moreover, Blau et al. (2017) highlight that for the acquisition of knowledge, the style of synchronous e-learning (one-way or two-way) and the learners' traits play an important role in distance education.

Considering the fact that self-regulated learning is a complex process (Pange, 2014) consisting of four components (Greene et al., 2014), this factor was examined, mainly, regarding the regulation of motivation and involvement while in relation to the regulation of cognitive skills, the metacognitive skills were not tested at all, as neither did the regulation of social conditions. Although the motivations of the learners include personal and professional training, with key components the needs of learning & self-realization, e-learning based on the ADDIE model enhance the motivation of learners through an accessible, enjoyable and innovative online environment (Almelhi, 2021; Hanafi et al., 2020; Hatziroufa, 2019) encouraging active learning (Almelhi, 2021; Trust & Pektas, 2018). Athough all of the above are achieved by emphasizing the analysis and design phase, the results of Gournakis (2020) and Mavroudi and Hadzilacos (2013) indicated that improvement interventions were also needed. Then, the maintenance of learners' attention was strengthened and their motivation increased (Durak & Ataizi, 2016; Hanafi et al., 2020; Reinbold, 2013; Salas-Rueda et al., 2020). Subsequently, the learners demonstrated better involvement in learning even compared to students taught in a traditional way of education (Dogra & Dutt, 2016). As Abernathy (2019) pointed out, during the analysis phase, no attention is paid to the dimension "Need" closely related to motivation to learn, namely, "why" "every" student must learn the material. According to the Kirkpatrick model, although it is emphasized that the self-directed learning increases the efficiency of time management (Alturkistani et al., 2018; Goh et al., 2018; Lavender et al., 2013), a combined learning strategy is suggested as a perfect method (Chang & Chen, 2014). That is why the self-learning is achieved through interaction with others (Lin & Cantoni, 2017; Fernandes et al., 2020) and the learner is activated to engage in the learning process with his personality traits playing an important role in it (Aluko & Shonubi, 2014; Chang & Chen, 2014; Gowda & Suma, 2017). After all, self-regulated learners have higher motivation and greater control over their learning behaviors and therefore, create better learning outcomes both individually and in groups (Wang, 2011). Finally, for the model Bloom, the learning lower-level results may be one of the reasons why students do not feel committed to their studies and can explain the steady and slightly increasing dropout rates (Kumpas-Lenk et al., 2018). Sometimes, the level of e-learning (mixed learning, one-way or two-way video conferencing, asynchronous learning, etc.) can enhance the cognitive aspect of learners and jeopardize their emotional and social aspects (Blau et al. 2017; Weiser et al., 2018).

The following control variable, namely, the collaborative learning, was examined in very few studies per examined model with a small deviation of numerical data. In particularly, according to the relevant literature, the ADDIE model creates a common mutual process of learning pursuit for all participants (Almelhi, 2021; Hsu et al., 2014; Huang et al., 2010). With the specific redesign of the e-courses, higher levels of learning, autonomy and cooperation of learners are achieved through the well-chosen multimedia (Hatziroufa, 2019; Ismail et al. 2018; Trust & Pektas, 2018) and the process of immersive in virtual worlds thereby enabling learners to participate in their learning as "active agents of change" (Soto, 2013). This interaction can often increase learners' motivation and reduce the number of students who drop out of e-courses before they have been completed (Durak & Ataizi, 2016). Moreover, the frequent evaluation strengthened the researchers' work gaining an insight into the overall learners' involvement with the lesson and the concepts and assignments that either facilitate or fail to facilitate the desired levels of interaction (Battle, 2019; Hess & Greer, 2016; Hsu et al., 2014). In addition to the ADDIE model (Huang et al., 2010; Wang, 2011), in the other two examined models, namely in Bloom (Barari et al., 2020) and Kirkpatrick (Chang & Chen, 2014; Lin & Cantoni, 2018), a combined learning strategy (self-directed and collaborative) is suggested as a perfect method as it leads to the acquisition of skills and knowledge simultaneously (Fernandes et al., 2020). Also, interaction can often increase student motivation and reduce the number of students who drop out e-course before it is completed (Alturkistani et al., 2018). Moreover, these models suggest the use of the social media tools (such as Facebook and Twitter) as educational resources to develop students' social participation in the learning process (Domun & Bahadur, 2014; Lau et al., 2017). After all, the connection of e-learning courses with external online tools facilitates the high level of knowledge within Bloom taxonomy (Lahti et al., 2014).

In addition to the above, we found that all three examined models reinforced students' positive attitudes and perceptions. In particular, the implementation of the ADDIE model could enhance the positive attitudes and perceptions of students regarding the acquisition of more learning experiences and the adoption and use of technology for educational purposes (Hanafi et al., 2020; Nordin et al., 2016). However, these attitudes and perceptions often face limitations either from factors directly related to the process of e-learning (Kumpas-Lenk et al., 2018; Nordin et al., 2016) or the process of the transfer of knowledge to the work environment (Edwards & Black, 2012; Galloway, 2005). The change of attitude which has an impact on the workplace is also underlined in the Kirkpatrick model (Chang & Chen, 2014; Fernandes et al., 2020; Lin & Cantoni, 2018; Moreira et al., 2019), but researchers argue that the learner's characteristics, such as skills or abilities, motivation and personality, also play an important role in e-learning (Aluko & Shonubi, 2014). The application of the Bloom model emphasizes the fact that achieving learning outcomes designed at higher levels of cognitive demand learners not only achieve a higher level of knowledge with a more complex way of thinking but increase their satisfaction, motivation and involvement (Kumpas-Lenk et al., 2018; Lahti et al., 2014). In combination with the interaction required by the higher levels of the Bloom taxonomy, learners acquire a positive attitude and a new perception (Barari et al., 2020).

In conclusion, our findings are consistent with the view of Sharif and Cho (2015) and Paull et al. (2016) who argue that there is no fixed model to follow, but different models to meet different teaching and learning requirements in an evolving field. Of course, in some cases learning models could be used interactively or extensively, such as the Kirkpatrick model (Galloway, 2005; Kennedy et al., 2014). Possibly, this is justifiable, since according to Galloway (2005), the Kirkpatrick model cannot keep up with the modern competitive entrepreneurship that requires cost-effectiveness and measurable return on investment in education by creating a way to determine the cost-benefit ratio of education. Similarly, although the ADDIE model is a good illustration of the basic steps in the educational process of designing and developing e-learning courses, it lacks basic elements which correspond to the specifics of e-learning projects (Kuciapski, 2010). Moreover, the percentage of appropriate articles referred to the ADDIE model is relatively not negligible compared to the other two models, the use of which are attenuated or almost non-existent, mainly the Bloom model in online distance environments. Therefore, in recent decades, these models have been strongly criticized (Adnan & Ritzhaupt, 2017; Draper-Rodi et al, 2018; Santally, et al., 2012).

Although the processes of self-regulation and collaborative learning are factors directly related to the effectiveness of e-learning (De la Fuente et al., 2015; Evans et al., 2014; Gambrari et al., 2015; Gowda & Suma, 2017; Johnson & Johnson, 2011; Ozdileka & Robeck, 2009; Rabak & Cleveland-Innes., 2006; Wang & Hong, 2018), they were examined in very few studies per examined model with a small deviation of numerical data, as opposed to the cognitive performance (Almelhi, 2021; Barari et al., 2020; Koc, 2020; Lavender et al., 2013; Weiser et al., 2018), a finding confirmed by wider literature (Abdull Mutalib et al., 2022; De Rouin et al., 2005; Santos et al., 2016; Zafar et al., 2014). Taking into account the view of de la Fuente et al. (2015) and Greene et al. (2014) that self-regulation is an important and complex variable in the fields of education, work and research and that, if there is a deficit in any of its components, the trainee's learning capacity is disrupted or impaired, then the inclusion of all its elements in the specific variable is considered necessary. However, this factor was examined, mainly, regarding two of four components. So, this control variable should be considered for e-learning as well as the use of the social media tools and multimedia presentations as educational resources to develop students' social participation in the learning process (Sypsas & Pange, 2014). In addition to the above, we found that all three examined models reinforced students' positive attitudes and perceptions regarding the adoption of strategies for the acquisition and the application of knowledge (Fernandes et al., 2020; Hanafi et al., 2020; Moreira et al., 2019) as a key for the complete success of e-learning (Eiriemiokhale & Idiedo, 2020) even though these often face limitations either from factors directly related to the process of e-learning (Kumpas-Lenk et al., 2018; Nordin et al., 2016) or the process of the transfer of knowledge to the work environment (Edwards & Black, 2012; Galloway, 2005) or the learner's personality traits (Gowda & Suma, 2017).

The aforementioned findings and limitations are mostly inextricably linked with the mistakes of educational designers (Adnan & Ritzhaupt, 2017; Kumpas-Lenk et al., 2018), a finding confirmed by wider literature review (Abdull Mutalib et al., 2022; Castro & Tumibay, 2019; Crompton et al., 2018). That is, educators–designers use strategies that focus more on cognitive performances and the design of the learning outcomes reflect the lower levels of knowledge while ignoring the emotional and cooperative factors, the basic principle of effective and efficient educational intervention (Smith & Ragan, 2005). Not only that, but also, Crompton et al. (2018) claim that trainees are forced to work at lower levels of knowledge even though advanced technological systems and applications are highly designed. Moreover, the strategies are designed whilst ignoring the achievement of the goals in the shortest possible time, as well as the transfer of knowledge to the wider competitive reality (Van Rooij, 2010). After all, the Educators shoulder the burden of the planning e-courses, often in the absence of adequate training and skills (Koc, 2020; Sharif & Cho, 2015). Hence, although according our findings, the application of the ADDIE, Kirkpatrick and Bloom models in distance education is considered effective, these educational models are not alone a guarantee that education will succeed. The educators–designers can make a well-designed lesson succeed or fail (Reinbold, 2013).

All the above may be related to the wider problem of the imbalance between the demand for e-courses and appropriate pedagogical planning (Abernathy, 2019; Barari et al., 2020; Khalil & Elkhider, 2016; Song et al., 2004).

Suggestions for Researchers and Practitioners

The present study investigated the effectiveness of the ADDIE, Bloom and Kirkpatrick models in distance e-learning environments and their contribution to the cultivation of factors such as the academic performance, the self-regulation and the collaborative learning.

Given that the research on the specific models in the framework of the distance education is limited, there is a wide scope of their research, namely, either by verifying the aforementioned surveys in a larger sample, as highlighted in most surveys or by expanding to other thematic areas, such as Educational Programs in the Humanities. Also, the effectiveness of these models could be done separately for the factor of self-regulation, or for the stress factor and other personality traits of students (extroversion & introversion) or in relation to the level of e-learning (mixed learning, one-way or two-way teleconferencing, asynchronous e-learning) or in relation to the principle of effective and efficient educational intervention, in other words, the achievement of goals in the shortest possible time or in relation to limiting factors in the transfer of knowledge to the work environment. Finally, it could be researched the adaptation of the existing models, such as the ADDIE model for virtual reality environments or mobile learning.

The guidelines listed above are only small incentives to a wide field of research, which is already challenging due to multiple variables and hidden threats.

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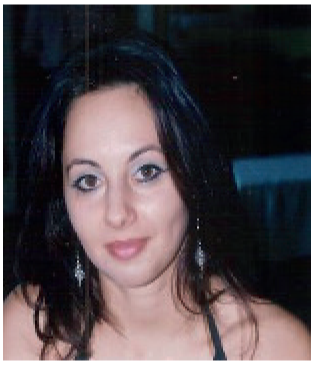

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SELF-DIRECTED LEARNING AND MOOC INTEGRATION INTO HIGHER EDUCATION EFL CLASSROOMS

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ABSTRACT

This research includes the first cycle of an application based on the integration of a MOOC given in the field of "writing" into the formal education curriculum to reinforce classroom teaching and support the learning process to improve English writing skills. It was carried out in the spring semester of the 2021-2022 academic year with 14 students studying in an English preparatory program at a Turkish state university. In this study, qualitative research method was adopted and the action research design was applied. The implementation was carried out within the scope of the Reading/Writing course in the program in question. As data collection tools, a semi-structured interview form, Self-directed Learning Scale, and students' course completion scores in their chosen MOOCs were utilized. In addition, the articles written by the students at the end of the term within the scope of classroom evaluation were also used to support the research data. The first data obtained in this direction show that the majority of the participants could not go beyond the course selection and registration stage. Although the students mostly did not have problems in accessing technology and showed self-directed learner characteristics, they did not follow or complete these courses due to lack of motivation, technological problems, heavy course loads and health problems.

Keywords: MOOC, foreign language learning, writing skill, preparatory program, university students.

INTRODUCTION

The educational deficiencies caused by the prolonged lockdown during the Covid-19 pandemic were tried to be compensated with open and distance teaching-learning methods such as online courses and telecourses (Ferri et al., 2020; Hazaea et al., 2021, Tsai, 2019), supported by social media (Erarslan, 2021; Muftah, 2022), discussion forums (Bailey et al., 2021), and MOOCs (Amalia et al., 2021; Tlili et al., 2022). Despite the transition to face-to-face education with the removal of educational restrictions due to the pandemic, hybrid models that adopt blended teaching have begun to be preferred instead of moving away from online learning in many developed countries (Cobo-Rendon et al., 2022). In such practices, the classes are carried out by using face-to-face teaching in the classroom together with information and communication technologies and/ or online environments. Open educational resources are frequently used to increase learning opportunities in blended teaching. In this respect, massive open online courses (MOOCs) are preferred because they are an open course model that promises free and open access to quality content without prerequisites to anyone with internet access and suitable devices. The interest in these courses, which are mostly based on individual work, has increased even more during and after the pandemic period (Tlili et al., 2022). While MOOCs can often be followed as a stand-alone course, they can also be used to support different teaching models and approaches. As a matter of fact, the present research includes the first cycle of an application based on the integration of a MOOC given in the field of "writing" into the formal education curriculum to reinforce classroom teaching and support the learning process to improve English writing skills. The investigation of any compensative instructional implementation is thought to suggest a constructive course of action for future probable emergency cases.

Literature Review

Massive open online courses (MOOCs), which were introduced as a modality of distance education without charge at the outset in 2008, became popular in 2012, thus enabling learners worldwide to join courses asynchronously in accordance with their individual learning pace (Siemens, 2013). MOOCs were soon hailed due to the merits they claimed to provide particularly for learners falling behind in mainstream education. MOOCs were regarded to be a breakthrough in the early 2010s on the grounds that they made a reduction in the effect of economic and geographic inequality, by allowing people with low-income and in remote areas to get access to the best learning content (Vodolazskaya, 2020). It is discernible from the current literature that MOOCs have been preferred as a supportive and compensative teaching/learning modality besides synchronous online education in various higher education disciplines since the outbreak of the pandemic (Bhattacharya et al., 2020; Impey & Formanek, 2021; Salas-Rueda et al., 2022; Singh & Sharma, 2021; Tlili et al., 2022).

Studies report several major reasons for learners to take a MOOC, such as advancement in their jobs, employment opportunities, personal challenge, and curiosity (Beaven et al., 2018; Christensen et al., 2013; De Boer et al., 2013). However, drop-out seems to be a great challenge in front of the popularity of MOOCs (Gutl et al., 2014). Thus, there are some salient prerequisite factors playing a determinative role in sustainability, successful outcomes, and completion of a MOOC study such as a high-level of voluntary participation and intrinsic motivation (De Barba et al., 2016; Semenova, 2022), learner autonomy (Ding & Shen, 2022), self-regulation (Reparaz et al., 2020), course content (Henderikx et al., 2018), and instructor presence (Koseoglu & Koutropoulos, 2016). Having autonomy over one's own learning is reported to be the keystone for benefitting from MOOCs at the utmost. In that, it is emphasized that besides computer literacy, the learner should be highly self-regulated and directed, and personally interested in pursuing and fostering his/her learning in a MOOC (Chacon-Beltran, 2017). Motivation is shown to have affected and been affected by learners' participation throughout the course (De Barba et al., 2016). Moreover, it is reported that some learners may not regard a MOOC as a course, since it does not provide teacher scaffolding every time the students need (Orsini-Jones et al., 2015). The fact that there may not be enough interaction between students and content is also shared as a possible reason for the dropouts (Yildirim, 2015).

Previous Research and the Present Study

While the research on the integration of MOOCs into learning environments, in general, has distinctly increased, this case cannot be observed in terms of foreign language education, which is also articulated in the relevant literature (Palacios Hidalgo et al., 2020; Ding & Shen, 2021; Beaven et al., 2018; Caner et al., 2019; Nethi & Murray, 2014). This problem of research scarcity has been doubled with the emergence of some researchers who are of the opinion that MOOCs are not suitable for language learning because MOOCs cannot address the two basic requirements for foreign language learning: live communicative interaction with a native speaker and pro-activeness (Romeo, 2012). Rubio (2013) in this sense underlines the difficulty of designing and running a MOOC for foreign language teaching on the grounds that the learners do not have extrinsic motivation as they do not pay for these courses and do not get grades; and together with a low level of completion, only some of the materials on a MOOC are utilized. Moreover, Stevens (2013) thinks that MOOCs may not be conducive to the teaching of grammatical structures unless learners are assigned to learn grammar deductively and from each other. Some other researchers (Nethi & Murray, 2014) emphasize in this regard that MOOCs can provide satisfactory opportunities for receptive skills, yet fewer chances of learning productive skills. In that, MOOCs provide students with the opportunity to acquire knowledge about a foreign language, but they rarely offer opportunities of practice by using this knowledge (Jiang, 2022; Nethi & Murray, 2014).

On the other hand, more researchers have now revealed that MOOCs can be effective in promoting the development of language competencies (Panagiotidis, 2019; Nethi & Murray, 2014; Perifanou & Economides, 2014). In this sense, Dolores Castrillo (2014) suggests that the most suitable MOOCs for learning a foreign language are the connectivist MOOCs (cMOOCs) since they provide possibilities for interaction in the negotiation of meaning and for practicing various required language skills. It is claimed that integrating MOOCs into conventional language classes might bolster language learners' practice of their language skills, and assist them in achieving an acceptable level of self-regulation (Conde Gafaro, 2019). This emerged as the foremost incentive for conducting the present study. As a matter of fact, after the students successfully complete the four skills courses offered in the English preparatory program, and are entitled to take the proficiency exam, when they pass that exam successfully and move on to their departments (the medium of instruction is English), they follow the courses there and experience problems because they cannot use the language correctly/sufficiently, especially in written assignments, tasks and exams. The most common problem that the instructors who teach in this preparatory program hear in their interviews with the students who transfer to their departments, and the feedback received from the instructors who teach in the departments about the students, is in this direction. For this reason, it was concluded that the students of the current preparatory program have limitations in acquiring the necessary English in their departments and that the language skills of the students should be supported more in the program. Moreover, the clear observation that the relevant studies in the literature display contradictory results in terms of the use of MOOCs in language learning necessitates the conduction of more research. Thus, the present study is believed to make a contribution to enlighten the practitioners and policy-makers and direct the future research in this regard.

Research Questions

This study aimed to reveal the general consequences of an attempt to integrate MOOCs into traditional face-to-face English as a Foreign Language (EFL) classroom. To this end, the following research questions were raised:

1. To what extent do the students of the present study self-direct their learning?
2. Are there any significant differences among the students' self-directed learning scores in terms of such variables as their gender, department of study, and course completion rates?
3. What are the reasons for partly completing, or not completing their MOOCs?
4. In what way the action plan implemented affected students' writing skills?

METHOD

Research Model

This research was designed according to the action research pattern of the qualitative research method. Mills (2003) defines action research as "any systematic research conducted by teachers, administrators, counselors, or persons interested in the teaching and learning process to collect data on how a school is going, how teachers teach, and how students learn". This type of research is an approach to improving existing practices to correct an existing problem. As a matter of fact, in this study, action research was used because it was aimed to find solutions to the points where the standard curriculum is insufficient to improve the writing skills of students enrolled in the English compulsory preparatory program of a state university. Action research is a cyclical process. This process begins with the identification of the problem and the planning that will help solve the identified problem. In the second stage, this plan is put into practice. In the third stage, data on the implementation process and its results are collected and the process is closely observed. As a result of the analysis and interpretation of the data obtained in the fourth stage, the process is evaluated holistically. Based on this evaluation, the action plan is reviewed, and the process is re-planned, and this cyclical process continues until the desired result/solution is reached (Johnson, 2014; Koklu, 1993).

Similar steps were followed in this study. Accordingly, a direct data collection process was not applied to determine the problem, and a decision was made based on one of the researchers' experiences and observations since she had been working as a lecturer in the preparatory program for many years. In addition, the negative feedback received over the years from the faculty members who teach in the departments of the students who have completed the compulsory English preparatory program has also been effective in shaping the problem of the research. In line with the problem, an action plan to be implemented as a solution was designed and necessary permissions were obtained from the ethics committee of the higher education institution to implement the application. In order to understand the effects and effectiveness of the application, the data collection techniques and tools to be used were determined and applied at the beginning and end of the research. Afterwards, the obtained data were analyzed, and the outputs of the application were interpreted and evaluated in line with the researcher's experiences in the observation and application process. In line with the results reached, inferences regarding the changes and developments to be made in the next implementations of the action were reached.

Participants

While deciding on the participants of the research, the convenience sampling method was preferred. Convenience sampling is a non-random sampling method in which the sample to be selected from the population is determined by the judgment of the researcher. In this type of sample selection, data is collected from the population in the easiest, fastest, and most economical way" (Aaker et al., 2007: 394, Zikmund, 1997: 428). Accordingly, students studying in the English preparatory program of a state university -in the class where one of the researchers taught the Reading/Writing lesson- were chosen as the participant group. There are 14 students enrolled in this class. However, since one of these students did not attend the classes due to absenteeism, a total of 13 students, who regularly attend the classes, constitute the participant group. These students have an English proficiency level of B1(+) (Intermediate/Intermediate plus). Table 1 gives the descriptive information pertaining to the students:

Table 1. Distribution of the Participants by Demographic Characteristics

Demographic Variable	Groups	n	%
Gender	Females	4	40
	Males	6	60
Department	English Language & Literature	8	80
	Translation & Interpretation	2	20
How did you access the internet during the course?	Smart Phone	4	40
	Smart Phone & Laptop	5	50
	Smart Phone, Tablets, Laptops & PC	1	10
How many hours per day did you use the internet on average during the course?	0-2 hours	2	20
	3-5 hours	6	60
	6-7 hours	1	10
	8-9 hours	1	10
Did you complete your chosen course on Coursera?	No	6	60
	Partly	3	30
	Did not even sign up	1	10

According to Table 1, 60 % of the students participating in the research were male and 40 % were female. 80 % of the participants study in the department of English Language & Literature, and 20 % in the department of Translation & Interpretation. 50 % of the students accessed the Internet via both smartphones and laptops, while 40 % of them had only smartphones. The average daily internet usage time of 60 % of the participants is 3-5 hours, while for 20 % of them 0-2 hours. While 60 % of the participants reported that they did not complete their MOOCs, 30 % said they only completed it partly, and 10 % did not even create an account to join the MOOCs.

Data Collection Tools and Procedure

The implementation process of the research started in the second week of the Spring semester of the higher education institution where the study was carried out. In order to carry out the application, first permission was obtained from the Scientific Research and Publication Ethics Committee of the institution in question. After the approval, platforms such as Coursera and Edx, which are among the world's leading MOOC providers, were scanned and courses prepared to improve writing skills were determined. In addition, an interview was made with the students during the lesson to understand which aspect they had the most difficulty in writing and that they had problems with. Accordingly, it was determined that the students mostly experienced the correct and appropriate use of English phrases and expressions and article writing rules and techniques while writing articles or compositions. The detected MOOCs were examined in terms of their content, learning outcomes, starting date, weekly time that participants should allocate for these courses, and fees.

In the light of the information obtained, considering the needs and characteristics of the research participant group, two specialization packages were selected that were expected to support them in developing their writing skills. One of these packages is more focused on English grammar and the correct use of the language, while the other consists of lessons that focus on the requirements for advanced and effective article and composition writing. Both course packages are offered on Coursera, and one consists of three courses and the other four. Before this MOOC task was introduced to the students, the Self-directed Learning Scale was conducted. Afterwards, the Coursera platform was introduced by projection during the lesson, and it was explained in practice how to create a membership and login. Afterwards, the two selected course packages and their features were introduced by showing them. The access links of these courses were shared on the WhatsApp group of the class, and the students were asked to review the courses and decide on the more suitable course package for them within a week. In this respect, students are given the flexibility to choose the most suitable package for them and the courses they deem necessary, considering the aspects that they lack or think they need to improve. These specialization packages and the number of students who choose them are shown in the table below.

Table 2. MOOC Specializations and Course Types

Field of Specialization	Number of Learners	Courses	Number of Learners
Academic English: Writing Specialization	4	Grammar and Punctuation	3
		Getting Started with Essay Writing	3
		Advanced Writing	3
		Introduction to Research in Essay Writing	1
Learn English: Writing Effectively with Complex Sentences Specialization	6	Writing with Adverb Clauses	2
		Writing with Adverbial Clauses	2
		Writing with Noun Clauses	4

It was announced to the students that MOOC courses would affect their performance scores and they were given 12 weeks in total to complete them. During this process, the instructor of the course received feedback by asking the students on a weekly basis which lesson/topic they were and whether they encountered any problems. In the last four weeks before the completion of the MOOCs, she sent weekly messages from the WhatsApp group, reminding the deadline. As a result of not receiving any response from the students after a point, and receiving feedback on the low follow-up and completion rates when asked in the classroom, she asked the students for their e-mail addresses and passwords that they used to access the courses on Coursera. In this way, their progress in the lessons could be observed closely. At the end of the designated 12-week period, the deadline has been extended by one more week. Finally, short individual interviews were conducted with the students, and they were asked whether they completed the courses on Coursera and their opinions on the reasons for this.

Self-Directed Learning Scale

The Self-directed Learning Scale (SDLS) is a questionnaire developed by Lounsbury et al. (2009) for determining learners' self-directed learning skills. The scale was adapted to Turkish by Demircioglu et al. (2018). This is a ten-item and one-factor 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The learners who get higher scores are associated with stronger self-directed learning. The test–retest correlation of the SDLS is reported to have been 0.82, whereas the Cronbach alpha coefficient of the scale was found to be 0.85 in the Turkish adaptation process (Demircioglu et al., 2018). According to the test carried out to ensure the reliability of the scale within the present study, the Cronbach Alpha coefficient of the scale was determined as 0.92, which means a high degree of reliability.

Data Analysis

Content analysis technique was applied in the analysis of qualitative data, and the data were analyzed manually. Both researchers coded the data independently, and then these codes were compared, and an agreement was reached on the categories and themes. While reporting the qualitative data, students were named as P1, P2, P3...P10, and direct quotations were used to support the credibility and reliability of the findings. In the analysis of quantitative data, SPSS 21.0 program was used. Data on demographic information obtained using descriptive statistics are shown in the table as frequency and percentage. The skewness coefficient (skewness) and kurtosis (kurtosis) coefficients were taken into account in the normality test of the Self-Oriented Learning Scale scores. Parametric tests can be used by making square root, logarithmic or inverse transformations of scores that do not show normal distribution (Buyukozturk, 2011). In this direction, two independent samples t-test was used to compare the scale scores according to gender, department, and MOOC completion status by making appropriate transformations of the scores that did not show normal distribution (Table 4), and the ANOVA test was used to compare the internet access devices and the average daily time spent on the internet. When a significant difference was observed in the ANOVA test, the LSD post hoc test was used to determine between which groups the difference was. Finally, quantitative and qualitative data were interpreted together.

FINDINGS

Findings Regarding the Self-Directed Learning Scale

In Table 3, 4, 5, and 6, the scores regarding the Self-Directed Learning Scale and certain variables are given.

Table 3. Descriptive Statistics

Variable	N	Min.	Max.	$\bar{X}$	sd	Skewness	Kurtosis
Self-directed Learning Scale	10	1.30	4.40	3.25	1.06	-1.12[1]	0.23[1]

[1]: *Logarithmic transformation done.*

According to Table 3, the SDLS mean score of the learners who participated in the research was determined as 3.25±1.06, and considering the lowest (1) and highest (5) points that can be obtained, it can be said that the students directed their own learning at an average level. In order to identify whether the learners' SDLS scores differed significantly in terms of their gender, an Independent-Samples t-test was carried out. Table 4 gives the results of the test:

Table 4. Comparison of Scores in Terms of Gender

Variable	Gender	n	$\bar{X}$	Sd	t	p
Self-directed Learning Scale	Female	4	3.50	0.60	0.67	0.520
	Male	6	3.08	1.31		

In Table 4, it was determined that the learners' SDLS scores did not differ significantly according to their gender (p>0.05). In order to identify whether the learners' SDLS scores differed significantly in terms of their department of study, an Independent-Samples t-test was carried out. Table 5 gives the results of the test:

Table 5. Comparison of Scores in Terms of Departments of Study

Variable	Departments	n	$\bar{X}$	Sd	t	p
Self-directed Learning Scale	ELL	8	3.51	0.91	1.72	0.123
	T&I	2	2.20	1.27		

ELL: English Language and Literature; T&I: Translation and Interpretation

Table 5 shows that the learners' SDLS scores did not differ significantly according to their departments of study (p>0.05). In order to identify whether the learners' SDLS scores differed significantly in terms of their MOOC completion rates, a One-Way ANOVA test was carried out. Table 6 gives the results of the test:

Table 6. Comparison of Scores in Terms of MOOC Completion

Variable	MOOC completion	n	$\bar{X}$	Sd	F	p
Self-directed Learning Scale	A-No	6	3.31	1.08	0.62	0.564
	B-Partly	3	2.80	1.17		
	C-Did not even sign up	1	4.20	-		

According to Table 6, it was determined that the learners' SDLS scores did not differ significantly according to their MOOC completion rates (p>0.05).

Qualitative Findings of the Study

In the final stage of the action plan, a short semi-structured interview was held with the students individually to determine why the implemented action plan did not work out, and the reasons for not completing the MOOCs were asked. Accordingly, the themes and categories reached are shown in Figure 1 below:

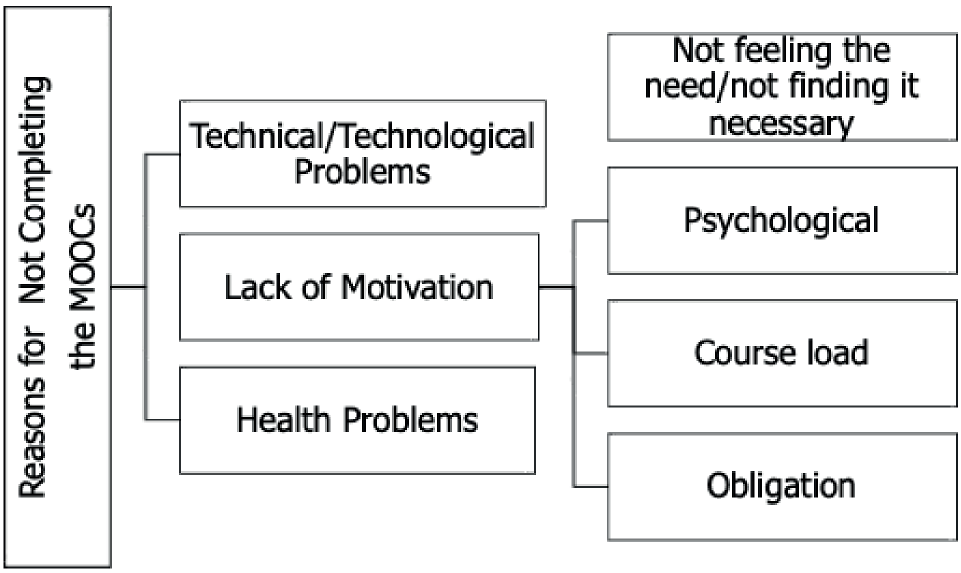

Figure 1. Themes related to the reasons for not completing the MOOCs

It was determined that the reasons why students did not complete the MOOCs they chose were mostly motivational. Students mostly explained this as "a lack of motivation and laziness". Accordingly, the motivation-based reasons for these students not completing the MOOCs can be listed as not seeing it as necessary, psychological reasons, course load, and homework being compulsory. Students who did not complete the courses because they did not consider it necessary indicated that they considered the courses and assignments in the curriculum alone sufficient in order to be successful in the preparatory program and that they could get the grades they wanted with their individual studies. The following views of some students can be given as an example of this finding:

> *I did not spare enough time for this practice as I found our activities and studies in the course sufficient, and I also studied the subjects myself.* (P2)
>
> *If I wanted to, I would go to the library and find a way to complete the courses, but I didn't think it was something to focus on because I didn't see it as necessary to complete the semester. Of course, it would definitely add something new, but there was no need for all that effort and sacrifice, at least for that period.* (P5)
>
> *…I think students who haven't completed Coursera don't bother because they don't have to complete it.* (P9)

Some students stated that they see the necessity of the MOOC task as a factor that negatively affects their motivation to complete the courses. One student said, *"The difficulty of these courses also causes students to attend the course only so that they can be seen in the system, rather than learning something like I observed in my own roommate."* (P1). The expression supports this finding.

The student number 3, who evaluated this situation from a psychological point of view, expressed his situation as *"I absolutely have no idea, herd mentality I guess"*. Another student complained that the course load in the preparatory program was already heavy and attributed this to his failure to complete the MOOCs. The student expressed this opinion as *"I didn't want to do it because the lessons and exams were heavy"* (P10). There are four students who stated that they could not complete their MOOC courses on Coursera due to technical/technological reasons. These students stated that they could not complete the lessons due to low and/or limited internet connection and the difficulty of following the lessons on a smartphone. The statements of some students supporting this finding are given below:

> *The main reason is low internet connection. (P7)*
>
> *Because I was staying in the dormitory where I was not at home, there was no internet connection, which is a general problem for dormitories anyway. (P4)*
>
> *An average or above-average student staying in a state dormitory prefers to use his already limited internet for his pleasure rather than his lessons, and the quota is insufficient even for 1 month of daily use. (P2)*
>
> *It was very difficult to follow while using the smartphone. (P8)*

Finally, there is a student who stated that he could not follow the MOOC courses they chose due to health problems. This student stated that he had to use digital technologies for a limited time due to his health problem. The student explained this reasoning with the following words: *"Unfortunately, I cannot use digital technology continuously and as I'd like to due to the time limitation and for my eye health. So, I just have to make use of the books."* (P5)

On the other hand, student number 6 made the following suggestion, taking into account the psychology of the students and the conditions they are in, so as to ensure that these MOOCs are completed by the students:

> *I think the only way to convince average and above students to participate in this program is to make the preparatory program more difficult. In that case, the student can see this course as a good resource in the face of difficulties and can give himself to the course in a motivated way, but this of course causes other problems.*

DISCUSSIONS

It is obvious that the transition to a fully online platform for foreign language teaching during the Covid-19 pandemic turned out to be quite challenging and demotivating both for teachers and students (Ekaterina, 2021; Mahyoob, 2020; Zboun & Farrah, 2021). However, online education has not been totally abandoned during the post-pandemic transition, and the integration of virtual learning environments into conventional classrooms is still being strongly articulated by the researchers due to the benefits it provides based on the empirical evidence (Cobo-Rendon et al., 2022; Censuswide Future of Learning Report, 2022). MOOCs, in this regard, seem to have been utilized to a greater extent during the pandemic (Tlili et al., 2022) and are thought to be preferred more as supporting learning environments during the post-pandemic era. Accordingly, the present study was designated to back up the face-to-face university EFL learners in the English preparatory class who were falling behind the anticipated objectives of the curriculum with the supportive and compensative merits of virtual learning environments, namely with language learning MOOCs in this instance.

In order to make sure that the study reveals some in-depth implications in terms of providing us with a general frame of reference for a MOOC study, the learner profiles were further clarified as regards to their technological and language readiness. In that, it was determined that all the students owned at least a smartphone, or both a smartphone and a laptop in most cases in order to pursue their MOOCs. The students mostly spent 3-5 hours a day on the internet, and they all had at least B1(+)-level of English to easily follow their online courses on Coursera. In terms of their self-directed learning scale results, it was found that their mean score is at an average level, which means that they can at times regulate their own learning. As a result of the statistical analyses, it was determined that the learners' self-directed learning scores did not show any significant difference in terms of their gender and department. It was further identified that the learners' self-directed learning scores did not show any significant difference in terms of their course completion rates, either. A small number of students who completed the MOOC package stated that these courses contributed greatly to their writing skills and language development, and this was also observed in their end-of-year articles. On the other hand, keeping all these characteristics in mind, however, it was revealed that the majority of the students did not complete their MOOCs. Namely, despite the learners' technical readiness and the instructor's regular follow-up of their progress, this did not culminate in a desired and anticipated outcome of a successful MOOC completion. Thus, the researchers went on to investigate some possible reasons for the indifference shown by the students in terms of their MOOC study.

It was determined that the reasons why students did not complete the MOOCs they chose were mostly motivational. Accordingly, the motivation-based reasons for these students not completing the MOOCs can be listed as not seeing it as necessary, psychological reasons, course load, and homework being compulsory. Students mostly explained this as "lack of motivation and laziness". Students who did not complete the courses because they did not consider it necessary indicated that they considered the courses and assignments in the curriculum alone sufficient in order to be successful in the preparatory program and that they could get the grades they wanted with their individual studies. In fact, lack of persistence and low retention rates are two common phenomena often encountered in the relevant literature on MOOCs (Bloch, 2016). The sustainability of a MOOC in this sense necessitates a high level of self-directed learning skills (Chacon-Beltran, 2017; Conde Gafaro, 2019; Zhu, 2022) and motivation (Beaven et al., 2014; De Barba et al., 2016). The fact that the learners within the present study did not demonstrate self-directed learning behaviors at a satisfactory level may account for their indifference towards completing their MOOC study. Conde-Gafaro (2019) underlines, in this regard, the fact that MOOCs are generally designated for learners who can regulate and direct their own learning, thus these courses could be challenging for those who take them for the first time. Moreover, Semenova (2022) states in this sense that motivation is a significant predictor of the level of engagement in MOOCs, and it has also a significant relationship with course completion.

Motivational issues are the most reported reasons within the relevant literature for higher drop-out rates of MOOCs (Badali et al., 2022). Lack of intrinsic motivation, in this regard, stands out more in terms of the discontinuation of a MOOC study. This fact also underlines the finding that the students in the present study did not find a suitable triggering incentive for completing their MOOCs. Although participation in the MOOC courses was announced to be graded within the total class performance grades (extrinsic motivation), this did not affect learners' motivation satisfactorily, implying the role of intrinsic motivation to pursue a MOOC.

The MOOCs the students of the present study were supposed to sign up for are prepared and delivered by native speakers. Since students use the "audit" option and take the course free of charge, they cannot benefit from feedback, etc. from the instructors. These are called specialization courses, each one of which consists of 3-4 lessons. Therefore, they are self-study courses that do not include any direct guidance and feedback from the instructors. There is only automated feedback on short answer multiple choice type questions. Course design/expectations management is reported to be a significant barrier that influences learners' intention achievement in MOOCs (Henderikx et al., 2018). Furthermore, in this regard, the instructor presence (Koseoglu & Koutropoulos, 2016) and the learners' interaction with each other and with the instructor play determinative roles in course sustainability and completion. A study by Goh et al. (2017) revealed that instructor presence, interesting learning contents, consistent feedback, and interaction are vital to sustaining the engagement of students in MOOCs. Moreover, the instructor's regular attention and guidance is a determinant in learners' construction of their foreign language writing skills, and in their ultimate achievement in a writing course, since foreign language learners are generally in dire need of guidance and a step-by-step assecuration while improving their productive language skills. Therefore, the fact that there was no interaction between the learners and the instruction of the MOOC may have led the learners to lose interest after a while.

It was further identified in this study that some students stated that they see the necessity of the MOOC task as a factor that negatively affects their motivation to complete the courses. In fact, as MOOCs are generally voluntary courses, obliging learners to take these courses may have discouraged them. Moreover, it was understood that although the students in this study were mostly computer users who spent plenty of time regularly on the internet, this did not result in their MOOC completion. This finding contradicts with that of Namestovski et al's (2018) who found that regular computer users have a better chance of completing an online course. As the students complained about the course load they already had, the obligation of a MOOC study did not turn out to facilitate their in-class learning, yet it rather brought a new cognitive load which may have in turn led to dropouts. Furthermore, Yasar (2020) shares findings that are not in parallel with the present study. In that, it is reported that MOOC utilization in language learning classes improved learners' communication skills provided that they are fun, surprising, simple, universal, and interactive.

CONCLUSION

One of the most significant implications of the present study is that MOOCs may not be a first-line supportive environment for productive skills (writing in this case) in foreign language teaching. Moreover, the integration of MOOCs into conventional foreign language classes should be organized carefully and well to let them be an important part of the whole teaching-learning process. The utilization of MOOCs as a component of a blended learning practice intertwined with face-to-face teaching could provide better results than their stand-alone use, or use as supplementary/supporting material. The MOOCs designed specifically by the instructor of the face-to-face classes could be more effective in maintaining learners' persistence. However, it should be noted that each of the implications drawn from this study requires further experimental investigation. Moreover, the findings of the present study should be cautiously interpreted together with its limitations. The fact that this study was only the first cycle of a whole action research study planned to understand what can be done for those learners falling behind in their departmental study as they have problems with satisfactory language use may limit our capability to see the bigger picture in terms of learning outcomes. The findings of the study should also be evaluated with the limitations of qualitative research. Conduction of more studies, especially those combining the findings of both a qualitative and a quantitative one, is thought to supply better implications for the integration of MOOCs into conventional foreign language classes.

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PERSPECTIVES OF ENGLISH LANGUAGE INSTRUCTORS ON POPULAR LEARNING MANAGEMENT SYSTEMS AND SOFTWARE

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ABSTRACT

With the sudden outbreak of the Covid-19 pandemic, the education sector adopted distance and online learning through several web-based systems. Then, considerations of educational practitioners concerning these systems would be of pivotal significance for revealing the quality of online language education. Moreover, the challenges they encountered while conducting e-lessons and proposed solutions would lead to improvement in the systems and encourage other shareholders in the school system to determine a new route map in light of the results. To that end, 28 volunteer English language instructors from 14 universities were recruited to attend the interviews. Accordingly, negative considerations of the instructors about exploiting the systems in foreign language classes were detected. As conclusive results regarding the challenges and suggestions of the participants cannot be reported through a system-based analysis, system-independent offers were presented to policymakers and researchers. Finally, the researcher has drawn out a set of implications for future implementations.

Keywords: Covid-19, Learning Management System, LMS, teacher perception, video conferencing software, virtual classroom software.

INTRODUCTION

As in distinct fields of the current era, Information and Communication Technology (ICT) has reshaped teaching and learning with the coalescence of several technologies for educational purposes. Moreover, the sector of education has had to adapt to an immense and unexpected shift from frontal instruction to digital instruction in the early spring of 2020. After widespread Covid-19 turned into a universal pandemic, the council of Higher Education obligated universities to deliver education via web-based platforms. Thus, various systems came to the fore to be utilized in online teaching, such as Massive Open Online Course (MOOC), virtual classroom software, Learning Management System (LMS), and other cloud-based classroom management systems. Even though e-learning practices were already maintained as an inseparable part of education within blended, hybrid, or flipped classes in many universities in developed countries even before the pandemic, developing countries, such as Turkiye which mostly based their education system on the on-site mode of instruction were unprepared for such an outbreak. Therefore, an urgent step for online learning programs with the rapid implementation of advanced technology was taken with the help of these systems.

At first sight, the platforms were generalized as efficient in alleviating workload, presenting and sharing some resources, and using time effectively with the guidance of the system, and hence this would instigate teachers to devote themselves to the profession and online implementations with all heart. Put differently, at the beginning of the pandemic, these systems were in general regarded as savers owing to connecting faculty members and students, allowing them to keep teaching and learning in a unified setting by forming a virtual relationship without the restriction of space or time. As a result, the institutions assumed all of them to be real-time portals designed to provide interaction and a high-quality educational experience. However, along with the prior difficulties within language education, the challenges these systems accompanied have levelled up in the pandemic, such as the appearance of multiple crack-ups in online education with detrimental effects on students' performance and teachers' well-being. It reached such a point that even the selection of systems, the core assets of e-teaching, turned out to be a tedious process demanding a long list of items to be considered, such as the needs and expectations of all stakeholders. Within this scope, overall considerations of educational practitioners related to these systems would shed light on the efficacy of the portals and educational practices (Farid et al., 2015). Even though faculty members were at the forefront of education, a niche has been detected in the literature with the limited number of research about their overall perspectives toward the systems depending on the user experiences. Instead, related studies seemed to abound in appraising or revealing learners' points of view (Demir et al., 2021; Guoyan et al., 2021; Mohammadi et al., 2021). Accordingly, the impetus behind the operationalization of this study was to explore the considerations of instructors of English as a Foreign Language (EFL) in Turkish state and foundation universities with regard to using virtual education systems to teach the target language.

BACKGROUND

LMSs and Video Conferencing Software with Their Use

The ease of use of LMSs has been generally associated with some of their essential characteristics in the paradigm of language teaching, such as presenting learning material, managing course catalogues, holding examinations, organizing the materials, and keeping system records (Al-khresheh, 2022; Bradley, 2021). LMS has been often deemed to enable multi-faceted communication, and it has been featured in language education principally given this function (Demir et al., 2021). Moreover, the systems have come forth with their facility to provide different types of feedback (e.g., private, public, or formative) to learners (Rubin et al., 2010). Though some researchers regarded LMS to be more effective after the determination of the audience and their needs (Trisiana, 2020), some considered them unsuccessful in the language teaching context thanks to the lack of support from management officials (Dhawan, 2020), or falling behind in both presenting real-life learning environments (e.g., Brady et al., 2010) and respecting personal values (e.g., Cigdem & Topcu, 2015). For instance, Algethami (2022) and Manegre and Sabiri (2020) touched upon the varied manners of teachers toward using LMSs thanks to the lack of opportunities for technical training. Yet, Snoussi (2019) directly reflected on the thoughts of teachers about limited facilities for gaining technical literacy, and the incompatibleness between LMSs and academic programs. In addition to addressing this trouble as Guoyan et al. (2021), Almanthari et al. (2020) also handled the negative beliefs and self-incompetence issues and put them down to teachers' lack of knowledge and self-confidence, or previous bad experiences within e-learning platforms. Overall, these studies not only called for improvements in technical or financial support but also the need for abounding the practices of teacher education and professional development to increase e-learning awareness of teachers. Otherwise, as Meriem and Youssef (2019) noted, the other shareholders might encounter the vexed issue of teachers' resistance to change to online education.

Considering the aforementioned studies that resulted in different findings, before referring to the appraisals of LMSs through the eyes of teachers systematically, it would be worth listing some of the recently common LMSs with their typical characteristics. To begin with, Blackboard Collaborate (BBC), which was founded to bring innovations in education everywhere and increase efficiency, provides the preparation and management of training content (Liaw, 2008). Furthermore, it allows educational organizations to build vibrant online communities and improves data flow. It also enables to storing, sharing, and organizing of digital content so that electronic portfolios can be employed to assess student progress (Tsang et al., 2007). Mohsen and Shafeeq (2014) have incorporated BBC into their research design to examine the perceptions of teachers on its use in English classes. The researchers detected their positive attitudes toward blackboard applications mostly due to supporting the interaction between teachers and students. Likewise, Hakim (2020) has revealed the positive manner of teachers in adopting BBC in language teaching. On the other hand, West et al. (2006) have reported the discontent of teachers with BBC owing to the tools and some features complicating its use. In the same vein, Khafaga (2021) has confirmed the doubts of teachers in terms of conducting reliable evaluations of learners in exams although teachers perceived its use to be as efficient as face-to-face instruction, which was related to their incompetence to exploit it thoroughly.

Another LMS, Moodle is open-source code education management system software. Besides the fact that Moodle is completely free, academic staff can easily operate it via Windows and Linux systems. Most educators utilize Moodle without any programming and database experience. Since it is an open-source system, closing security vulnerabilities is much faster than commercial systems, and a large number of new features are constantly being developed and distributed free of charge. Teachers can easily manage material sharing and create forums or chats. Moodle also helps teachers prepare online quizzes aside from providing information exchange among users all around the world (Alkhateeb & Abdalla, 2021). Almarashedeh (2016) and Hsu (2012) have corroborated the fact that teachers were satisfied with Moodle in the general sense. Moreover, Al-Ajlan (2012) has featured the superiority of Moodle considering its quality and facilities of additional tools over BBC and Sakai. Similarly, Cavus and Zabadi (2014) have affirmed that Moodle was respected by teachers for being user-friendly with regard to presenting materials and sharing documents, unlike Sakai. In fact, as described by Girgin et al. (2022), Sakai is a web-based, platform-independent application with open resource codes and educational features in addition to being free and appealing to a large number of language learners. This application has many common features of the course management systems besides containing information or document distribution, assignment transfer, online assessment, and grade book and live chat modules. Despite these listed characteristics, the lack of credibility, accessibility, and additional advantages Sakai can provide teachers in different settings might have come into play regarding the results of the studies by the foregoing scholars (Wright et al., 2014). As for Microsoft Teams, researchers have predominantly found that teachers viewed it as productive in course preparation, implementation, and learner evaluation (Rahman, 2022). By the same token, Saranya (2020) has focused on its ease of use during the debates in the lesson and the evaluation procedure aside from the user-interface trait. Finally, Rojabai (2020) has mentioned its benefits for teachers in terms of facilitating communication, downloading files or records easily, and assigning new roles to users. Similar results were also reached for Google Meet by Siang and Mohamad (2022) who discovered that a clear majority of the teachers had a positive manner toward the employment of this system.

Similar to LMS, some virtual classroom software (also known as video conferencing software) for e-teaching (e.g., Zoom) must be investigated to clarify their outstanding items. As a case in point, Adobe Connect, a virtual course, or content preparation-publishing platform has synchronous and asynchronous learning modules. Adobe Connect, which can appeal to students' different learning styles and provide a virtual classroom environment, also allows the content design to attract the attention of students. It also resembles the features of formal education in sharing desktop, file, and web addresses, whiteboard applications, and chat with video and audio (Yilmaz & Aktug, 2011). Moreover, Caliskan et al. (2020) have reported Adobe Connect as an acceptable lecture program serving as satisfactory support by enhancing the interaction between teachers and learners. However, Khanlari et al. (2022) have stated that though Adobe Connect was identified as the most adopted system in their investigation, it took the lowest rate in teachers' satisfaction levels. Hence, these implementations have seemed to act as stimulatory for further studies to be conducted in the field to reach conclusive results about the use of Adobe Connect. Similar to Adobe Connect, BigBlueButton (BBB) is an open-source web conferencing system frequently used in the online learning-teaching process that can operate on Linux, Windows, and MacOSX. BBB includes eminent features, such as audio and video sharing, desktop sharing, uploading and presenting documents, whiteboard applications, and instant messaging (Basar & Ganefri, 2019). Nevertheless, Ukoha (2022) has displayed the view of educators on the complexity of BBB owing to its inability to support learning. In parallel, Rehn et al. (2017) have presented the concerns of teachers using BBB in that lecturing via this system would require detailed planning, and entail professional development practices they could fulfill with the additional support of colleagues. Finally, through Perculus, teachers can control the images and sound with the webcam or microphone, besides sharing, working on documents, or making presentations. Perculus also offers simple start-up live sessions, sends invitations to attendees, and presents user management capabilities with easy management interfaces (Durak et al., 2022). It has also been pointed out that Perculus was the most utilized platform like Advancity's LMS following Adobe Connect in Turkish universities due to the liability of teachers in storing data in cloud systems in the country context (Kacan & Gelen, 2020). Yet, Camlibel-Acar and Eveyik-Aydin (2022) have reported that Perculus was noted to be limited particularly in speaking activities, and hence would be replaceable with another LMS. Overall, the literature posed several study results reflecting on distinct LMS types with different characteristics from the perspectives of teachers. In so doing, the literature also indicated that there was a pressing need for more comprehensive and deeper analyses in the field.

Challenges in Utilizing the Systems throughout E-Lessons

After searching for studies mainly on the overall challenges of online language education through the lens of teachers based on their digital instruction experiences, it has been discovered that the majority of the research was carried out specifying one particular system or its features to uncover the difficulties faced by faculty staff. Therefore, this limited number of studies has been directly involved herein to discuss the issue at length. Accordingly, Bouhnik and Marcus (2006) have found less efficient learning practices in online settings due to the lack of vibes between teachers and students. Aside from reaching the same result, Rahman (2020) has also highlighted the problem of learner motivation which seemed to be badly influenced by this web-based learning experience. Likewise, Algethami (2022), Gacs et al. (2020) and Hakim (2020) have realized that drawing learners' attention to the course was one of the biggest hurdles besides their low internet access. Almanthari et al. (2020) and Vershitskaya et al. (2020) have referred to this poor internet connection problem and furthered that the infrastructure of the platforms must be repaired to have lessons without any disruptions. Dhawan (2020) has supported this claim and underlined the digital divide stemming from the unequal distribution of ICT tools, which would then bring about low-quality education. Similar to Almaiah et al. (2020) who have addressed the technical troubles required to be handled then and there in electronic settings, Algethami (2022) has emphasized the same difficulty for online exams raising doubts about the evaluation process due to the credibility issue. In this way, he has also called for a high level of ICT assistance to overcome this challenge (Alqahtani & Rajkhan, 2020).

Meriem and Youssef (2019) have noted that teachers indicated a lack of school culture in sharing, poor skills of learners in the use of computers despite being labelled as digital natives, and handicaps in communication. Aldowah et al. (2019) have reported teachers' views by concentrating on the delicate subject of course content and design. In the same vein, Almanthari et al. (2020) have revealed that teachers complained about the inconsistency between e-learning and the contents in the textbooks. As a result, teachers have felt compelled to prepare extra-curricular instructional materials that could be easily adapted to e-courses, which would require an additional workload. Finally, Snoussi (2019) has alluded to the lack of self-discipline of learners in virtual systems based on the fact that they underestimated the significance of online learning by being engaged with irrelevant tasks throughout the lessons. Correlatively, Alqahtani and Rajkhan (2020) have signified the necessity of increasing the awareness of students toward e-learning by forming strong interaction ties with the teachers.

Taken together, most of the prior research in the field has predominantly centred upon teachers' well-being, self-efficacy, and commitment (Guoyan et al., 2021), particular factors influencing the use of LMS (Kaewsaiha & Chanchalor, 2020), the assessment of specific LMSs according to the functionality, user experience and satisfaction (Demir et al., 2021), students' perceptions about their use (Taat & Francis, 2020; Thongsri et al., 2020, among others), teacher attitudes (Savolainen et al., 2012; Zhang & Chen, 2022, to name a few), or the effects of these systems on learner outcomes (Rubin et al., 2010). Surprisingly, to the best of our knowledge, no studies with a solid and cumulative base have been carried out yet to examine the standpoints of teachers, as moderating the course work, concerning the use of distinct virtual education systems while giving lessons on the target language. In addition, no extant literature has been detected to scrutinize the overall challenges the instructors faced during English lessons according to ten different virtual education systems. To put it another way, the current research will help us gain a deeper understanding of the overall views of EFL instructors about the systems instead of reflecting their stances toward a specific aspect of web-based portals or e-teaching practice. Hence, it will also provide new insight for future studies and contribute to the literature. To that end, the following research questions were posed as follows:

1- What are the English language instructors' considerations about virtual education systems to teach the target language?

2- What challenges do the instructors encounter while conducting English lessons on virtual education systems and are their suggestions to overcome these troubles?

METHOD

Participants

This qualitative study was conducted on 28 EFL instructors affiliated with schools of foreign languages of 14 distinct state and foundation universities located in 12 cities in Turkiye (i.e., Ankara, Batman, Kutahya, Nevsehir, Erzurum, Bursa, Izmir, Bartin, Sivas, Malatya, Karabuk, and Isparta). Two instructors from each institution were selected to be incorporated into the research according to the convenience sampling method. Though one of the random sampling techniques was intended to be employed, as schools utilizing the included 10 distinct systems may not be reached in this way, the researcher was obliged to refer to non-probability sampling.

Data Collection and Analysis

The data was gathered with 7 open-ended questions through semi-structured interviews, and it took nearly two and half months for the researcher to have interviews with the participants on Zoom in 2021. Considering the preliminary phases of the study (e.g., the formal correspondence among the universities for ethical approval, inviting attendees, and arranging appointments for each instructor according to their schedules), it took five months to complete the data collection process thoroughly. The interview was prepared in light of the research questions after meticulously reviewing the literature, and being acquainted with similar research designs and the scope of their interviews. Having obtained the expert views of three associate professors in the field, the researcher put the questions in the final form and posed them to volunteer participants in their mother tongue. Accordingly, the questions centred upon the convenience of the systems to language teaching, the sharpest differences between online lessons via these systems and face-to-face education, their advantages and disadvantages, capacity, and problematic sides, the must-have feature of the systems, and the suggestions of the participants on the way to enhance these systems for English education.

Initially, each instructor's answers to all questions were typed in the form of verbatim to generate transcripts. Afterwards, they were all translated from Turkish to English. Accordingly, transcripts consisting of a total of 19.258 words were created from 309.11 minutes of recordings of all participants. Content analysis technique was used in the analysis of open-ended questions in the interview by respecting the principles generated by Braun and Clarke (2006) and George (1959) (Table 1). Then, a theme-category-code list of the data was created.

Table 1. Data analysis flowchart

Phase 1: Familiarization with data
Phase 2: Independent generation of the first coding
Phase 3: Independent sorting of codes into categories and themes
Phase 4: Meeting to compare categories and themes and check inter-coder reliability
Phase 5: Revision and finalization of categories and themes
Phase 6: Frequency counts

While referring to the opinions or quotes of the instructors who participated in the study, a number was given to each of them and an 'I' representing the expression of the instructor was prefixed with it. To avoid misinterpretations, the researcher took into account whether the participants using two or more systems reported their considerations according to one specific system (e.g., the one they favour or formally have to adopt) or for all of them during the data analysis. The lists of codes were checked by another researcher with a PhD degree in English Language Teaching (ELT) to ensure inter-rater reliability. In the end, with a rate of 0.81, they were reported to reach a perfect agreement (Cohen, 1960).

THE ROLE OF THE RESEARCHER

As Greenbank (2003) highly stresses, to demonstrate their competence in the administration of the study, the qualitative researchers must discuss relevant parts of themselves, including any prejudices and presumptions, goals, or past experiences. In this context, the researcher was not biased in shaping the findings of the analysis. Accordingly, s/he acted as an objective observer from the outside by embracing the *etic* approach to interpret the responses impartially (Punch, 1998). To elicit more profound aspects of the dialogues, the researcher first asked general inquiries, listened, thought, and then asked more probing questions via semi-structured interviews. In brief, in light of the suggestions of Denzin and Lincoln (2003), the researcher aimed to see the big picture by combining concepts and ideas from an extensive spectrum of resources.

FINDINGS AND DISCUSSION

In this study, 14 categories and 41 codes were created under 2 themes in total, and each research question was discussed in separate tables. As Table 2 reads, the researcher created 20 codes, 7 categories, and 1 theme to examine the general considerations of English language instructors about adopting e-learning systems in their courses. To begin with, the convenience of these systems was gauged and the results were displayed under three codes. Accordingly, only 5 attendees positively regarded the relevancy of the platforms with language education. Similarly, 6 instructors using Sakai, BBB, BBC, Zoom, and Perculus reflected their partial appropriateness. To illustrate, the view of I20 was as follows:

> *On the one hand, students became more autonomous via online education. It encouraged them to think critically, and reflectively, and take responsibility for their learning. I think we try to control everything in face-to-face lessons and teacher talk happens to predominate over student talk. In addition, the current situation turns out to be an advantage for part-time learners who have to work and attend the course. On the other, the interfaces of the system do not seem to be compatible with language education.*

Nevertheless, 17 participants reported the inestimable value of on-site teaching rather than a virtual setting. For instance, I8 expressed that:

> *I have been teaching for 25 years, and I must see the students in person only then do I think that it is a fruitful and healthy education.*

Table 2. Appraisals of instructors about the systems

Theme	Categories	Codes	Examples	Systems and the number of participants stating them in their explanations
The consideration of English language instructors about e-learning systems	Appropriateness of the systems for language teaching	Appropriate	I think it's appropriate to give English lessons	Teams & Edmodo (N:2) Zoom (N:1) Google Meet (N:1) BBB (N:1) Total: 5
		Partially appropriate	Despite not being as much as face-to-face education, the system is convenient	Sakai (N:1) BBB (N:1) BBC (N:1) Zoom (N:1) Perculus (N:2) Total: 6

		Inappropriate	No type of online education system can replace face-to-face education	Teams (N:3) Perculus (N:5) Zoom & Teams (N:2) Google Meet (N:1) Zoom (N:1) Zoom & Teams & E-course (N:1) Sakai (N:1) BBC (N:1) Adobe Connect (N:2) Total: 17
	Satisfaction with the system	Satisfying	Thanks to education platforms, we have compensated for the difficulties	Teams (N:2) Perculus (N:1) Teams & Edmodo (N:2) Sakai (N:2) Zoom (N:2) Google Meet (N:1) Zoom (N:1) BBB (N:1) Total: 12
		Partially satisfying	In such kind of a circumstance, we can say that it is the best of a bad lot	Teams & Zoom (N:1) BBB (N:1) BBC (N:2) Perculus (N:2) Teams (N:1) Total: 7
		Dissatisfying	It is far below my expectations in terms of language teaching	Perculus (N:6) Google Meet (N:1) Adobe Connect (N:2) Total: 9
	The efficiency of the lessons	Efficient	We can concretely teach English with funny lessons	Teams (N:2) Sakai (N:2) BBB (N:2) Google Meet (N:1) Total: 7
		Partially efficient	The stress caused by course records reduces interaction and pushes students to write	Zoom (N:3) BBC (N:1) Google Meet (N:1) Teams (N:2) Adobe Connect (N:2) Total: 9
		Inefficient	Online lessons are inefficient compared to face-to-face	Teams & Perculus (N:1) Perculus (N:7) Teams & Zoom (N:1) Google Meet (N:1) Zoom & Teams & E-course (N:1) BBC (N:1) Total: 12

	Benefits of on-site teaching	Digital skills	It not only teaches students language learning but digital literacy and correspondence	Teams (N:1) Teams & Edmodo (N:2)
				Total: 3
		Relief	The peer pressure has relieved and encouraged students to attend the class more	Perculus (N:1) Zoom (N:1) Google Meet (N:1)
				Total: 3
	Weaknesses against on-site teaching	The lack of real interaction	The lack of real communication inevitably creates shyness and anxiety in students in terms of participating in the lesson	Teams (N:2) Teams & Perculus (N:1) Teams & Zoom (N:2) Sakai (N:2) Perculus (N:6) Google Meet (N:2) Zoom (N:1) BBC (N:1) Adobe Connect (N:2) BBB (N:1)
				Total: 20
		The lack of real classroom dynamics	We need to incorporate more than one platform into the course since one e-system alone is not enough	Zoom & Teams (N:2) Perculus & Zoom (N:1) Perculus & G.Meet (N:1) Zoom & Moodle & CLMS & hybrid education (N:1) Perculus & Zoom (N:1) Perculus & Teams (N:1) Teams & Moodle & Perculus (N:1) BBC & Teams (N:1) Adobe Connect & Moodle (N:1) BBB & e-campus (N:2)
				Total: 12
		The tension of being recorded	The fact that the lessons are recorded causes them to experience the stress of making more mistakes	Zoom (N:1) Perculus (N:1)
				Total: 2
		The fear of internet disruptions	The fear of being warned by the administration if homework or exams cannot be gathered due to internet problems	BBC (N:1)
				Total: 1

	Bureaucratic and administrative issues	Inflexibility in system selection due to official decisions	There are more effective programs other schools prefer but we have to continue our lessons in one common platform	Teams & Zoom (N:1) Perculus (N:4) Adobe Connect (N:2)
				Total: 7
		Personal data protection law	Due to personal data protection law, we cannot force students to open cameras	Teams & Zoom (N:2) Zoom (N:2) Perculus (N:1) Adobe Connect (N:2) BBB (N:1)
				Total: 8
		The lack of training	I could have used it more effectively in lessons, yet a comprehensive training program has not been provided	BBB (N:1) Perculus (N:1) Zoom (N:1) Teams & Zoom (N:1)
				Total: 4
		Budget (corporate deal)	The university needs to allocate funds to these platforms, otherwise, we will still experience network failures or limited usage	Perculus & Zoom (N:1) Zoom (N:2) Moodle (N:1) Perculus (N:1)
				Total: 5
	Professional concerns	Digital incompetence	We cannot associate the problems only with the systems, in addition, we are not used to giving online lessons; we are not competent enough, indeed	Perculus (N:1) Google Meet (N:1)
				Total: 2

Note: Cambridge Learning Management System (CLMS), E-campus (A university-based LMS)

In the same vein, I17 referred to the divergence of digital instruction on the portals from in-class teaching:

> *Making live lessons herein means sharing videos or reflecting the books onto the screen in the simplest form. It is certainly insufficient as it stands.*

Taking into account these comments and the rates in the table for the first category, as in the work by Brady et al. (2010), the majority of the instructors appeared to have run counter to web-based language teaching. Moreover, they seem to have overgeneralized these platforms without specifying either their functions or their potential benefits to English teaching and learning. This is because the same system (e.g., Zoom) was found to be reported in three different codes in the table by the attendees working in the same school. However, similar to the findings by Khanlari et al. (2022), Perculus and Adobe Connect can be notably regarded as the least appropriate programs for language classes by respecting the ratios in Table 2.

As for the second category, though the instructors cannot associate these platforms with the learning context thoroughly, they seem to appeal to the systems to neutralize the troubles throughout e-teaching and hence consider them satisfactory. The possible reason they took this stance must be they assumed the system as 'a saving grace'. To give a clear portrait of this issue, I2 exemplified:

> *In fact, this matter is beyond our satisfaction but a circumstance directly related to the consciousness or unconsciousness of the students toward online language learning as well as their learning habits.*

Despite the differences in their regards, Perculus and Adobe Connect came forth as the most disappointing systems out of all once again concerning the participants' satisfaction. This result was also in parallel with the efficacy rates in the third category. In other words, congruent with the studies by Bouhnik and Marcus (2006), and West et al. (2006), these two systems were not considered as either efficient or partly efficient by any of the instructors in the current research. However, notably, Perculus appeared in the segment of 'inefficient' as the most complaint system due to its potential weaknesses. In addition, the researcher made an inference about the effectiveness of these systems that they were the single platform of the school. Counter-intuitively, the instructors did not seem to prefer referring to multiple systems to support the e-learning process but would opt for exploiting only one platform integrated with all essential devices (Table 2). Similar to I25, I27 explained that:

> *It turned out to be very advantageous to use a single corporate program upon making it official and to operate it from one hand.*

As for the advantages and disadvantages of these web-based platforms, the table showed that their deficiencies (N:35) overwhelmingly exceeded the benefits (N:6). Though they were reported to make learners attain digital literacy or citizenship and offer a more comfortable atmosphere to encourage them to attend class (Snoussi, 2019), the systems were mostly counted as insufficient due to their non-overlapping characteristics with face-to-face settings. Upon concentrating on 'relief', as was shared at the beginning of the discussion part, the views of I20 reflecting the profit of Perculus in aiding learners to attain autonomy were detected not to correspond to I2 who declared the need for the improvement of Zoom for students to become autonomous. Considering that I20 was reluctant to use the system in general terms, whereas I2 was satisfied with Zoom and heard of the complaints of colleagues using Perculus, the participants assessed these systems majorly based on their subjective norms (Cigdem & Topcu, 2015) rather than the platforms themselves.

Despite being a typical problem of online education, a good number of instructors associated the trouble of lack of real interaction with the systems thanks to their failure to instigate learners to take the floor. Appertaining to this point, I18 stressed:

> *We can assume the existence of classroom culture in real courses, and via that culture, students attempt to hold the floor and speak. I embolden them to speak more, but my struggle often ends up with asking and answering the questions on my own.*

Correlatively, I2 underlined the significance of energy in traditional classes and addressed this lack in computer-generated platforms:

> *In face-to-face education, you can use the dynamics of the classroom; in addition, as your gestures and facial expressions come into play, you can make eye contact with students.*

These comments were not surprising considering the third and ninth codes with the examples in the first and third categories, which foreshadowed the emergence of those judgments. Moreover, the systems listed under 'the lack of real classroom dynamics' seem to have met on the same ground in that they were all adopted with other platforms to cater to the requirements of a real class, though their combination was not favoured by the instructors. Put differently, these platforms would not offer a learning environment as in a real classroom setting even when combined. Finally, Perculus was ranked first again considering these two foregoing codes in the category of their weaknesses. I9 clarified it similarly:

> *Even the student who really wanted to listen to the lecture was unhappy with Perculus.*

As to the following code, despite being referred to as an advantage of these systems in the above-mentioned category, some instructors (N:2) reported stress of learners due to being recorded throughout the lesson. However, recalling the first comment at the beginning of the discussion and respecting the remarks below, the anxiety of being recorded seemed to be a minor challenge. Similar to I11, I15 expressed:

> *My students, who remain silent in the classroom presuming that they should not utter a word for the fear of how their faces would look, managed to show themselves herein by speaking or writing.*

Dissimilar to this fear, one of the instructors shared the tension of losing the Internet connection at an improper time. This result alone signals the necessity of a new section entitled 'features of the systems' to be discussed at length in the following phases of the study. Overall, the researcher has so far investigated the five categories directly correlated with the systems utilized by the staff. Still, as some other issues that may not be directly related to the systems could affect the online course flow, they would also be worth examining in-depth.

The last two categories were generated as having an indirect liaison with the systems. Firstly, the researcher stated some bureaucratic issues that the majority of the participants (N:24) mentioned, such as the identification of the systems by principals without getting the opinions of instructors, which would hence make them feel like laypeople (Alqahtani & Rajkhan, 2020; Dhawan, 2020). Moreover, they highlighted their feeling of a dead end with the personal data protection law which they regarded as a barrier to forcing learners to turn on their cameras (Aldowah et al., 2019). By the same token, some attendees complained about the disruptions due to not allocating the budget to buy the official program (Almaiah et al., 2020; Vershitskaya et al., 2020). Only then did they assume to be able to maintain the lessons without network failures or Internet outages. The last code in this group goes hand in hand with the last category of the theme. That is, professional development opportunities provided by the school would enhance teacher competence in parallel (Rehn et al., 2017). Nonetheless, the schools with which the participant instructors were affiliated seemed to underestimate the weight of teacher education as is seen in Table 2. As a case in point, I7 put down her failure to use the whiteboard applications on BBB effectively in the lessons due to the lack of training provided by the school on this subject. Therefore, it cannot be regarded as unpredictable to detect professional concerns of the staff about the lack of digital competence. One of the instructors touched upon the absence of training on how to adapt face-to-face education pedagogy to online teaching. I4 and I17 dealt with the delicate balance between synchronous and asynchronous lessons (see Jeffrey et al., 2014) and I4 explained:

> *One day, a professor with some studies in this field came from another university to provide us with training. S/he said that if we get prepared for asynchronous lessons with comprehensive content, it can be much more efficient than synchronous. That is, s/he emphasized that it would not be wise to conduct the live lesson during the Covid-19 crisis. S/he then furthered that we must keep it at an equal rate while planning the synchronous and asynchronous courses.*

This remark also accentuates the importance of organizing activities about teacher education and Continuing Professional Development (CPD) by schools to improve the digital skills of the instructors (Algethami, 2022). All in all, the researcher disclosed the negative considerations of the instructors about exploiting the systems in foreign language classes despite having some profits for learners and instructors (cf. Hakim, 2020; Rahman, 2020). Furthermore, Adobe Connect and especially Perculus were discovered not to meet instructors' satisfaction and requirements of the e-lectures (see Camlibel-Acar & Eveyik-Aydin, 2022, for further discussion). Thus, they must be only considered as complimentary applications of the other systems (cf. Caliskan et al., 2020). Moreover, Moodle, which was incorporated into the study thanks to the instructors keeping both the lessons and other tasks through this system, only appeared as a supplementary platform in the analysis of the fifth category. Finally, BBB seemed to be popular among the systems in the first half of the analysis.

Taken together, the scholar addressed the first research question to understand the overall opinions of the instructors regarding the systems during the days at the peak of the pandemic. To cast light on the difficulties the instructors encountered during the e-courses, an in-depth investigation of the systems must be continued as the second research question of the study. To that end, the researcher created another table with 7 categories, and 21 codes centred on 1 theme by respecting both the challenges and suggestions of the participants. According to the codes, and the research question which scoped the examination to the in-class experiences of the instructors, the second phase of the study was maintained with a systems-based analysis.

Table 3. Challenges of the instructors in e-classes

Theme	Categories	Codes	Examples	Challenging systems	Suggested Systems
The features of e-learning platforms	Communication and interaction tools	User-user messaging	Improvements can be made to the interfaces to see the messages in the chat box on the same screen without interrupting the course flow.	Perculus, Teams	Zoom, Edmodo
		Synchronous communication	We experience some problems blocking synchronous interaction, such as having to invite students to speak and sometimes being rejected.	Perculus, Teams, Google Meet & Perculus	Teams, Zoom
		Whiteboard applications	At first sight, there seems to be no options menu on the whiteboard. The system needs to be planned more neatly. As there are so many features, everything turns out to be complicated.	BBB	Google Meet, Perculus, Teams
		Online note-taking	You have to exit the screen to write a note on BBB.	BBB	Perculus, Teams
		Announcements			Teams, Edmodo
		File transfer operations	It should be easier for students to share files; when necessary, they should be able to transfer the files with our permission. Sharing different files concurrently in each breakout room should be also feasible.	Google Meet, Zoom	Perculus, BBB, Moodle, Google Drive, e-campus
	Collaboration tools	Group work	I do not think it is efficient in terms of group work.	Google Meet	Teams, Zoom, BBC
		Web 2.0 tools	We cannot encourage students enough to participate in the course and enhance learning due to the problem of integrating Web tools.	Perculus	Teams, Google Meet, Zoom

	Management tools	Recording	The course records have been kept only for twenty days, thus I download the link and upload it to the university's own system right after I finish the lesson.	Perculus, e-campus, Zoom	Google Meet, Teams
		Storage capacity	It has a limited capacity; we cannot upload extra materials but a few videos.	Perculus	Teams
	Assessment process	Exam management	The exam unit brings the questions into the appropriate format. We transfer the answers to the e-campus system with the support of the exam unit since we cannot directly get the answers from Zoom right after the exam.	E-campus, Perculus	Zoom, Teams, BBB
		Online grading tools			Teams, Adobe Connect, Moodle
		Tracking learner performance or assignments	We cannot see the details of which student did what, when, where, how, etc. on the system. Yet, we should provide the chance to give a voice to all students, especially the shy ones.	Perculus	Teams, Google Meet, e-campus
		Feedback	I could not give feedback because sometimes they write the answers in the chat box, but I cannot feel assured that they would pronounce the expressions correctly.	Google Meet, Edmodo	Teams, Google Meet
		Exam preparation	The content of exam or quiz preparation can be improved; moreover, the variety of question types needs to be increased.	Perculus, Teams	Sakai
	Content development tools	Sharing content (re-use)			Moodle, Zoom, e-campus
		Lesson Templates			Perculus

Software/ hardware	Web browser compatibility	As a BBC infrastructure problem, the more you record or share something, the lower the quality (sound, video) you will get.	BBC, Adobe Connect	Moodle
	Time restriction	One of Zoom's limitations is that it restricts the lesson to 40 minutes.	Adobe Connect, Zoom, BBB	Google Meet
	Database compatibility	Due to database problems, some colleagues could not get used to implementing activities on Teams.	Teams, Perculus, Zoom	Zoom
Reporting tools	Class reports	We cannot take class attendance reports on Zoom.	Zoom	Teams, Google Meet, BBB, e-campus

Table 3 illustrates that the participants concentrated on the communication, collaboration, and interaction issues a lot in the interviews while speaking of the difficulties they encountered during the use of systems in e-language classes and their proposed solutions accordingly (Demir et al., 2021). Firstly, as is seen in the example, the interfaces of the systems and the interferences in the course were tackled and the problem was mostly imposed on Perculus and Teams. Surprisingly, I21 compared the two and indicated that Perculus seemed to be more practical than Teams in terms of screen sharing. However, I10 and I22 expressed that trying to liken communication to face-to-face classes through chatting was quite time-consuming on Perculus, and also the lessons were to fit on a small screenshot while you continued the instruction on the main screen on Teams. As I2 alluded to the powerful interfaces of Zoom in the interview, this system could make up for their failure at that point and hence can be offered as an alternative to these two. I19 also shared that Edmodo resembles a social media program, especially as an interface. Therefore, Edmodo enabled instructors to write students a private message or, create a discussion part about the topic they dealt with in class as an after-task activity thereby students would share comments below it. As for 'synchronous communication' that stands out as one of the most debated points, the deficiencies of Perculus, Teams, and Google Meet herein were listed on the top. I4 and I9 elucidated that on the Perculus system, they experienced a serious problem with the sound transmission due to echoes, and it also took time to determine that this problem was caused by students. Moreover, as less than five students can turn on the microphone, or camera or activate the sound system simultaneously after being invited to the course, it was not possible to get instant answers as in on-site teaching. This challenge with speaking activities was also criticised by I24 in that instructors wasted time while giving the floor to learners, which disrupted the flow of the lesson. Accordingly, concerning the connection problem and the tedious process Perculus caused in speaking practices, I21 reported as a suggestion based on their experiences that they turned on the cameras or microphones on Teams when Perculus was active behind concurrently and thus conducted a more fluid speaking lesson. Finally, I15 phrased that they did not find it very efficient to assign students to separate rooms on Google Meet, and wished to have more alternatives concerning rooms as on Zoom.

Despite not being directly addressed in the interviews a lot, the severe criticism of the whiteboard applications was made by I7 with the use of BBB as illustrated by the example in the table. As a solution, I15 stressed the ease of use of Google Meet in that when students composed writing on a common text and the instructors provided feedback, the system would allow them to correct the text altogether by providing a lot faster use than a standard class board. Furthermore, I7 referred to the need for exiting from the main screen to write a note on BBB. S/he then furthered that Teams was dissimilar to BBB since it would provide users with sharing both the source and the necessary notes on the same screen (Rojabai, 2020). Additionally, I4 suggested

Perculus while giving synchronous lectures in that it enabled them to take notes on the screen without any interruptions. In what follows, though the fifth code was not declared as a challenge by any participants, the 'announcements' were generated considering their remarks about the prominent features of the systems. As a case in point, I2 and I17 mentioned that they were contented with Teams for announcements (Tsai, 2018). Similarly, I5 and I19 clarified the same function of Edmodo in making general announcements. Finally, I12, I15, and I16 introduced the obstacle of file transfer on Google Meet, and Zoom. This difficulty of use was suggested to be recovered via Moodle or Google Drive (Al-Ajlan, 2012; Cavus & Zabadi, 2014). I20 highlighted the support of the e-campus system while sending the assignments easily, and sharing the documents of students through this channel. Moreover, I21 made further comments that they can give written or video project assignments and ask students to upload them on Perculus by arranging a speaking exam. By the same token, I27 addressed the same drawback on Zoom and added that they had to upload supplementary resources and install some devices to the system on their own; only then they could send these materials to students. Hence, this process on Zoom was announced to be a little more laborious and time-consuming than BBB.

Similar to the above-mentioned tools to enhance the communicative practices of learners in virtual settings, collaborative appliances would also be worth mentioning to investigate the features of the systems in-depth through the lens of the instructors. To begin with, I15 notified Google Meet was incomplete in terms of arranging group work activities. As a suggestion, I5 accounted for Teams with its new chat-room applications and said that it updated the Rooms, which allowed them to divide students into as many groups as they wished similar to the breakout rooms on Zoom. Moreover, I13 and I25 presented the appropriateness of BBC on group work activities for learners despite the limited management of rooms by instructors. As to one of the hotly-debated codes, Web 2. tools were highly underscored in the interviews due to their considerable amount of support on language teaching, particularly during the pandemic. Initially, Perculus was noted as a leading challenge for instructors since it did not supply a setting conducive to integrating Web 2. tools. Then, I1 featured the use of educational tools with Teams, such as Kahoot, Padlet, Google Docs, and Google Slides, which aid them in compensating for the difficulties of online lessons. I18 reinforced this view and added Jamboard, Miro, and MindMeister to the list of these tools in terms of providing ease of use and practical applications. Furthermore, I5 and I19 referred to Flipgrid to be integrated into Teams, I15 addressed different tools, such as Nice to e-meet you and Padlet to strengthen Perculus and Google Meet, I3 pointed out Quizlet and Google Slide in e-campus, and finally, I9 alluded to Newport and Hypersay via Zoom to enrich the course.

While discussing the recording of the systems, e-campus, Perculus, and Zoom took a lot of stick. For instance, apart from the explanation in Table 3 concerning e-campus, I1 cited that things would get really tricky while sharing videos of the lectures on Zoom. I11 approved this view and added that one of the biggest shortcomings of Zoom was recording only the main room, yet considering that students could understand their errors when watching it later, s/he required this problem to be repaired at hand. Accordingly, I18 suggested the use of Teams; otherwise, when the lessons were given on Zoom, the recording would be saved on the computer; hence it would be necessary to transfer this record to Google Drive or a Cloud environment for students to access its link. Likewise, I1 added that s/he found the way out on Teams with its automatic cloud-saving feature, thereby they did not even press a record button every time since it would save all lessons to the cloud at the time. In the same vein, I12 noted to opt for Google Meet since the lessons were saved on the drive automatically, and would not be an extra workload. Similar to the recording, Perculus seemed to stand out again while discussing the issue of storage. I1, I2, and I18 signified Teams at that point and revealed that they did not experience any restrictions concerning saving and uploading on the system.

Another significant issue identified after the analysis of the transcripts was the assessment procedure of students on these systems (Algethami, 2022; Khafaga, 2021). The related problems caused by the two systems seemed to be e-campus and Perculus, as Table 3 reads. Accordingly, I21 dealt with this trouble over Perculus and reported that even when it was concurrently active behind, they had to appeal to Teams for the speaking exam due to the connection problem. Though Teams appeared as a suggested platform, any instructors adopting Teams did not highlight its profit in this respect; on the contrary, I19 mentioned the necessity of increasing precautions in the exams on that system. Moreover, I20 and I22 touched upon the insufficiency of e-campus in accommodating a good number of students, which resulted in the crash of the whole school system in the exams. As discussed in the first question, I22 also underlined the programs were procured from publishing houses to be integrated into the system. Yet, as these were a bit costly, the school was to allocate a budget to the tools and applications. In addition, these instructors cited its lack of support to detect students' cheating in midterm and final exams. Therefore, I20 noted to have applied to Zoom for student control, their login to the system, identity control, and the implementation of exams. However, neither I4 nor I9 did remark any challenge with the exam management in spite of employing the same system with I20 and I22. Regarding this matter, I27 remarked that they resorted to BBB herein again as in each phase of online education due to its user-friendliness. Still, respecting that I27 thought e-teaching was more practical than traditional classes, s/he might have overgeneralized the functions of BBB without specifying its efficiency in preventing cheating. This was also in parallel to I15 who considered virtual classes on Google Meet more fruitful than on-site teaching, yet the instructor did not state any experience with exam management.

Aside from its use as an online grading tool, I8 mentioned integrating some programs, such as Turnitin into Teams, and detecting the plagiarism of the uploaded written assignments, which also served as a suggestion for the instructors experiencing difficulties with cheating. Furthermore, similar to Hsu (2012) and Almarashedeh (2016), I26 distinguished Moodle in that it eased evaluating students via quizzes on the system. Finally, I28 detailed that via Adobe Connect, they can assess students from different aspects and reveal which questions students answer more easily or have difficulty with. As for exam preparation, I3 and I10 disclosed their dissatisfaction with Perculus in that the exam setting, supervision, and evaluation phases needed improvement. I24 noted the difficulty of preparing exams and other similar assessment forms on Teams due to typing the questions and options one by one into the system. At that point, Sakai can be cited as a suggestion by I6 and I23 owing to easing the process of online education thoroughly (cf. Cavus & Zabadi, 2014).

Having scrutinized the exam procedure in online education, observation of learner performance and the feedback issue must be discussed in detail as the last codes of that category. As a response to I9 concerning the challenge of using Perculus in the given example in Table 3, I5, I18, and I19 advised Teams since it enabled them to track homework without keeping a list on the system since it already recorded who has submitted and who did not with the numbers. I2 also emphasized the efficacy of this system while gathering portfolios without keeping physical files to prevent workload. Similarly, I15 suggested Google Meet, and I20 gave prominence to e-campus for the management of portfolios within these systems. Finally, when the answers leading the researcher to create 'feedback' were examined, Google Meet first appeared with the written example by I11 in the table. In addition, I5 added Edmodo to this list with the explication that students could neither see each other's videos after uploading to the system nor share feedback, which eliminated the opportunity to provide peer feedback. To address this disadvantage of the system, I2 referred to Teams and furthered that s/he felt comfortable while providing feedback to students since they could see the notification readily after the corrections were completed on the same file shared by the students (Tsai, 2018). Interestingly, I12 accented the use of Google Meet to encourage instructors to give feedback to learners aside from allowing students to view all homework and texts on the system. However, this was completely in contrast with the view of I11 about the efficacy of Google Meet on feedback. Although both of these instructors adopted Google Meet in online education, their clash of ideas signals that they may not know the features of the system well, they did not utilize the platform in online classes different from their statements in the dialogues, or they gave an interview with hearsay information.

Regarding content development tools, the advantage of integrating Moodle, and Zoom was first presented by I14 in that the students can view and click on the weekly course schedule, and then they would follow what they need to do in line with the curriculum (Alkhateeb & Abdalla, 2021). Moreover, I3 highlighted the benefit of e-campus on students since when staff uploaded weekly materials, contents, and programs to the system; they would read them all therein. As for the software and hardware of the systems, BBC was on the blacklist due to requiring high-tech Internet speed despite offering ease of use in general. In parallel, I26 and I28 handled the same problem on Adobe Connect particularly owing to the insufficiency of this system during the speaking exams. They also detailed that due to the net problems, they were obliged to reschedule some lessons taking them to the weekend. Nevertheless, after applying to Moodle to make exams regularly, they deemed it worth recommending to colleagues. Concerning the database complexity, I1 furthered the explanation in the example (Table 3) that as Teams had complex software unlike Zoom, it had a high potentiality to slow down the computers. On the contrary, I11 underlined that in addition to plans A and B, there must be also C and D against unexpected disruptions based on the database of Zoom. This divergence between I1 and I11 showed similarity with the above-discussed problem of feedback due to the same impetus behind that trouble. Returning to the subject of the database, I21 stated that Perculus was poor in terms of technological equipment. Though they were notified when a student opened a tab, s/he complained that they were not authorized to block the access of some tabs to students. Finally, time limitation was debated on Zoom, Adobe Connect, and BBB with 75 minutes. Accordingly, I12 stressed that different from Zoom with a 40-minute time limit, the advantage of Google Meet was not exposing users to time restrictions. In contrast, I13 specified that at the end of 40 minutes on Zoom, the lesson was automatically over, yet on BBC, they had to arrange the time themselves, which she called an extra responsibility. This fact alone reveals that apart from the features of the systems, the characteristics of the instructors, their personal values, and their beliefs must have had a tremendous impact on their responses to the interview questions.

As for the last category, the researcher addressed the class reports and detected the failure of Zoom at this point. As a way of solution, I15 specified Google Meet and declared it as a platform that improved with add-ons, such as taking attendance. Likewise, I20 and I21 regarded the e-campus system as advantageous for the attendance of students. The instructor also added that it was uncomplicated to check how many minutes they attended the class or what time they left the course thanks to the 'download data' section. Furthermore, I18 and I27 addressed Teams and BBB and reported that they itemized the attendance on Excel, and showed when the student entered and left the courses, and how long they stayed in the course at which time, respectively. Overall, with a systems-based analysis according to the codes and themes, the researcher recorded distinct findings from the investigations of the first research question. For instance, Perculus was discovered to be listed in the proposed solutions despite being also covered in the challenges. Similarly, though the instructors highly suggested Teams, it was included in the list of trouble as well at the end of this examination. The researcher also revealed the advantages of using Google Meet dissimilar to the first analysis. However, some problems were identified with the system of BBB, hence contrary to the prior exploration, it turned out not to be completely ideal in some aspects as highlighted by Ukoha (2022). In congruent with Khanlari et al. (2022), and West et al. (2006), BBC and Adobe Connect were reported to cause some challenges due to the software or hardware. Furthermore, Moodle always appeared in the suggestion list, and Sakai came forth in terms of feedback.

As is seen, the difficulties that the participants faced were reported meticulously in Table 3. Nonetheless, the researcher could not reach a conclusive result regarding the challenges and suggestions after conducting a system-based analysis in light of the codes. As each classroom was a unique and complex setting, neither the instructors nor their judgments about the platforms could have helped to identify the impeccability of those systems in online education. All the same, the participants were detected to be prejudiced against the systems in general, have some sensitive points about the platforms (i.e., time restriction), opt for a neutral stance due to their incompetence (e.g., I6, I23), simply oppose the change (e.g., I8) or come out against online language teaching (e.g., I16, 125). Thus, the result overlapped with the research by Algethami (2022), Meriem and Youssef (2019), and Rehn et al. (2017). To give a clear portrait of the consequence of this issue, in line with Brady et al. (2010), and Meriem and Youssef (2019), the researcher highlighted that the majority of the instructors (i.e., I1, I2, I3, I5, I7, I9, I10, I13, I14, I16, I17, I20, I21, I26, and I28) depicted interaction, communication, and collaboration as the cornerstone of online language teaching, thus enjoyable, game-based activities based on group or pair work must be incorporated apart from the school system. Finally, some instructors (i.e., I4, I12, and I21) alluded to Canvas and Schoology and stated their willingness to try them in online lessons at least once with the courtesy of the school.

According to the overall, system-independent suggestions of the participants, the issues of accessibility and ease of use (Wright et al., 2014), improvements in the interfaces (Durak et al., 2022; Saranya, 2020), sound system, and screen sharing were mostly handled. By the same token, more dynamic breakout rooms for teachers to observe the class (Rahman, 2020; Tsai, 2018), the balance between the synchronous and asynchronous lessons for blended learning (Jeffrey et al., 2014), variety in Web 2. tools (Al-Ajlan, 2012), and physical and infrastructure problems (Alqahtani & Rajkhan, 2020; Dhawan, 2020; Vershitskaya et al., 2020) were addressed. That is, the attendees reported that both technical matters and the operationalization of the course should be considered. Additionally, some instructors noted the necessity of applying platforms through which direct verbal feedback can be given and visual platforms based on a separate video technique for students to develop their speaking and communication skills. In what follows, aside from finding ways to ensure their active participation in the lesson, it was also among the suggestions that the system should not allow students to log in to the platform who exceeded absenteeism.. Likewise, as curriculum, syllabus, and course-maps limit instructors, they reported needing flexible hours to take more initiative and build resilience. Different from the others, some participants implied the need for the flipped learning technique in online education to be employed for giving feedback and important reminders (Long et al., 2017). As a couple of instructors supported hybrid education, they demanded to continue to utilize these systems with applications and tools in face-to-face education. Moreover, some participants emphasized the pressing need for training on how to activate several functions of the systems, and how to attract students to online education different from face-to-face courses. Finally, they stated that these platforms should be redesigned by taking into account the students who need special educational support due to their serious illnesses, such as dyslexia.

CONCLUSION

The research concentrated on the significance of EFL instructors' general considerations about virtual education systems and the difficulties they had while applying these systems in e-classes. Accordingly, 28 instructors who adopted various web-based platforms and affiliated with schools of foreign languages of 14 foundation and state universities from different regions were recruited for the study. It concluded with the disclosure of instructors' negative considerations concerning the systems in foreign language classes despite some of their advantages for learners and faculty members. Moreover, both technical matters and the operationalization of the course were suggested to be considered in order to conduct a fruitful lesson through these e-platforms. That is, supplying the quality of the systems would matter to have successful digital educational experiences in the end (Guoyan et al., 2021). Depending on these findings, the researcher will draw a set of implications for language teaching practices.

The education sector was in a muddle when the pandemic struck the world. Despite being in the post phase nowadays, some restrictions may appear against any waves or variants, and accordingly, we may be compelled to apply to online platforms again in a new crisis. Considering that students did not attend classes in March 2021 as much as in the first days of March 2020 in Covid-19 pandemic, in other saying, the number of students participating in the class decreased at the end of the semester, the school team must be prepared to find ways to draw learners to the systems. Therefore, this study alarms all educational practitioners, policymakers, researchers, and teacher trainers in the higher education context to take precautions against possible outbreaks in the near future and extend their knowledge on the implementations of several virtual education systems throughout the pandemic and afterwards. Moreover, regarding the considerations of teachers, this study gains importance in that it shall cast light on which aspects the platforms must develop, and stress the need for the professional development unit to provide opportunities for CPD to the teachers. Hence, it also serves as a reviver to software companies by signalizing the points requiring updates.

As for the suggestion for further studies, the quantitative data collection instruments can be included in the study to triangulate the data. Furthermore, comparisons with the demographic information of the instructors as dependent variables can pave the way for reaching more striking results. School principals, deputy principals, and the CPD unit can also be invited to partake in the interviews to perform multiple analyses and broaden the scope of the research. Additionally, considering that quantitative data can be included, the number of participants needs to be increased. Finally, as the discussed literature has exposed, the credibility of the assessment methods would be worth examining considering the grading not only as a means of reflecting learners' success but also its indirect impact on the education system.

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BOOK REVIEW

HYFLEX COURSE DESIGN AND TEACHING STRATEGIES

Edited by Angela BARCLAY, Krista CECCOLINI, Kathleen CLARKE, Nicole DOMONCHUK, Sidney SHAPIRO, Jupsimar SINGH, Mel YOUNG and Jenni HAYMAN

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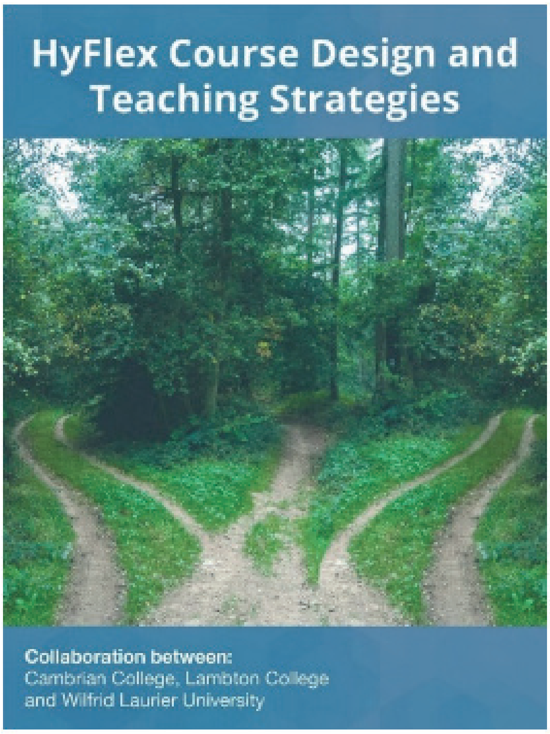

INTRODUCTION

Digital transformation in education, especially after the Covid-19 pandemic, has been phenomenal. As an instructional design approach, blended learning aims to integrate online and in-person learning in a meaningful way. Blended learning offers great opportunities for learners and teachers on interaction, flexibility, and course content access. One of the blended learning models, HyFlex is considered to have great potential for higher education in the new normal. “Hy” refers to “hybrid”, and “Flex” refers to “Flexibility” in blended learning practices. In a HyFlex course design, learners can choose which mode to participate in from session to session as Beatty (2022) suggested. As a comprehensive work, this book covers the concept of HyFlex design with examples from faculty.

REVIEW OF THE BOOK

The "HyFlex Course Design and Teaching Strategies" E-Book is about HyFlex learning and teaching. The book has 4 modules, and every module has 5 units. Besides, every module of the book starts with a clear statement of learning outcomes. Through the units, there are helpful activities to support learning. It is remarkable that the book includes video interview links of experienced HyFlex. Also, there are video transcripts for each of the video. The last units of each module are about learning activities to support module outcomes.

The first module, HyFlex Course Planning, covers historical and practical explanations about HyFlex model-based courses. The rationale for implementing such a blended learning model is explained by the author. One of the most specific aspects of HyFlex courses is to let learners choose how to participate in the course. Learners can choose three modes to participate in. These modes are in-person, synchronous online via videoconferencing, and asynchronous online via the learning management system (LMS) of the course. Learners willingly choose one or many modes for learning throughout the semester. The book informs on the design approach and the fundamentals of HyFlex courses and highlights the difference between hybrid and flexible designs. It clearly implies why defining learning outcomes and objectives and why these elements are crucial in the HyFlex design concept. Afterwards, the book explains how to make a Hyflex course plan including an assessment plan. It also mentions what to do if there is already a course plan, however it leaves extending modifying process to further modules.

The second module, HyFlex Lesson Planning and Content Design, focuses on creating weekly lesson plans, the ways for increasing engagement and participation in HyFlex courses. It elaborates the need and the benefits of making lesson plans, particularly in HyFlex courses in long-term. And then the unique features of the HyFlex lesson plans are implied. Hence, it is emphasized that there are four advantages of HyFlex learning as learning choice, equivalency, reusability, and accessibility which is assisted by the principles of Universal Design for Learning (UDL). The book suggests that these elements are critical in design process. There are always unpredictable situations in the process and widening accessibility options can help reaching learners of every modality in a HyFlex course. Another issue is choosing relevant learning activities which encourage participation and interaction of learners with various modalities. The learner must interact with the content, the teacher, and their peers, therefore the book informs how to keep these connections effective.

The third module, Engaging Multimodal Learners in HyFlex Courses, covers the theoretical and pedagogical approaches of HyFlex. The most distinctive part of HyFlex is flexibility and the book explains how learners experience this flexibility throughout the course. The book discusses why engaging multimodal learners is a difficult task to complete. This situation requires creative solutions and approaches to traditional design perspective. Equity is one of the essential elements of designing HyFlex course. The book suggests prioritizing the asynchronous mode to ensure equity with the synchronous and face-to-face delivery modes. Also, it mentions that HyFlex design process usually takes more time than other blended models and gives examples of how to manage all modes in the course. Another crucial part of HyFlex courses is the tech. The relevant technological tools can facilitate managing digital learning environments which improves the quality of learning-teaching process. The book offers valuable practical and motivational ideas for increasing the effectiveness of blended learning experiences.

The final module of the book, Evaluating the Effectiveness of HyFlex Teaching, entails the importance of assessment and evaluation phase of HyFlex courses. The book mentions the lack of research that focuses on the effect of HyFlex so far. Therefore, the book offers various ideas on how to handle this process successfully. In this part, the book offers possible strategies for evaluating effectiveness when the learners, the designer, and the learning process are considered. The book emphasizes that evaluating the effectiveness of HyFlex is complex since three modes exist in the model. The book suggests using a holistic evaluation approach which suggest collecting evidence for learning from all stakeholders of the program. The book suggests multiple techniques for data collection in assessing the effectiveness of the HyFlex courses.

CONCLUSION

The Hybrid-Flexible approach is a very real need to serve both online and on-ground learners with a limited set of resources (time, faculty, space) which leads to a multi-modal delivery solution (Beatty, 2022). Present book covers crucial parts of the theory and practice of the HyFlex course design and clearly guide the readers on how to plan a HyFlex course; engage multi-modal learners and evaluate the effectiveness of HyFlex learning.

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