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Review Paper

Two Decades of Computing at the University of Belize

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ABSTRACT

Computer science became a distinct academic discipline in the early 1950s. The first computer science degree program was founded in Belize around 45 years later, under the auspices of the nascent University College of Belize, which would subsequently become the University of Belize. We present a twenty-year synopsis of a degree program created in 1998 to build an undergraduate curriculum using the surge of computing in the country of Belize as a catalyst coupled with the recognition of the importance of computing for national development. The four-year undergraduate degree program has resulted in steady student enrolment over the past two decades featuring a female student population consistent with female enrolment in similar computer science programs globally. The study details the origins, development efforts, successes, challenges, and recommendations for the program's future development.

BACKGROUND

The Information Technology (INT) degree programs at the University of Belize represent a set of computer science/information technology degree programs introduced by the Faculty of Engineering and Information Technology over twenty years ago. The program's original mission statement was: "to provide students with an organised setting in which to conduct guided experimentation with and practical explorations of the physical machinery, the coded program, the designing strategies, the critical analyses and the ever-important human interaction that characterises the true computer scientist" (University of Belize, 2001). This study briefly describes the evolution of the INT degree programs, now housed within the Mathematics, Physics and Information Technology Department of the Faculty of Science and Technology. In addition, it discusses what has worked and what needs to be evaluated or attempted differently. This study utilised University of Belize enrolment data (Garcia, 2021).

In the late 1990s, the University College of Belize launched an initiative that gave birth to the INT degree programs. The goal was to meet the growing demand for computing professionals within Belize. The process began with the identification of and consultations with stakeholders in Belize. Selected stakeholders included representatives from the University College's departments and the private, government and quasi-government sectors. The University College held a series of meetings to apprise stakeholders about the proposed program and solicit from them what the stakeholders believed the goals and objectives of the final program should be. The consultations yielded the goals and objectives of the program, and the resulting program sequence included courses deemed relevant to the role of Computer Science in Belize's development (University College of Belize, 1998). The Associate degree in Computer Science West (ACSW), the precursor of the now INT degree programs, was born (University of Belize, 2001).

The program went through several changes from 1998 to 2000. There were pre-1998 spillovers of the Computing (CMP) program, and the Information Technology program (ITE) was short-lived. The Associate in Information Technology West (AITW) program was created in 1998, followed by the Bachelor in Information Technology West (BITW) and Bachelor in Information Technology (BINT) programs the following year. The Associate in Information Technology (AINT) and the Bachelor in Information Technology (BINT) established in 2000 as the then Department of Engineering and Information Technology's two-plus-two INT degree program regularised and normalised the disparate programs. In 2006, the BINT program underwent an extensive review with the participation of internal and external stakeholders, the University's administration, other university departments, and the Information Technology faculty, resulting in an updated program that addressed current advances in technology and shifts in technology use and deployment (University of Belize, 2006). Since 2006, the program has undergone three additional program reviews to ensure that it remains abreast with the developmental needs of Belize and emerging technologies. Figure 1 shows the enrolment in the degree programs for the period 1998 to 2017.

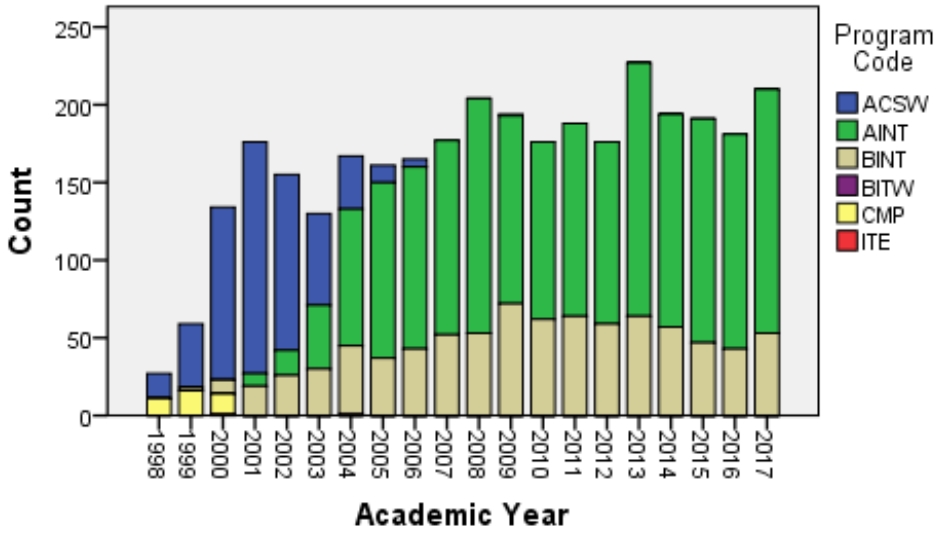

Figure 1. Enrolment in the degree programs

Program Philosophy

Creating a new degree program is not only challenging an endeavour but an exciting academic initiative that requires adequate preparation based upon a clear, unambiguous vision. Answers to specific fundamental questions are crucial in developing such a vision. Chief among these is the purpose of the degree, the intended target audience and the overarching values of the program. In regards to intended goals, forging new relationships across academic institutions and communities would be reasonable. However, of greater importance to the Engineering department was building a self-sustaining program that engendered excitement for both its faculty and students while simultaneously addressing the needs for national development. Notwithstanding all this, the underlying motivation to create the degree program was, first and foremost, to meet the developmental needs of Belize by providing an avenue for the development of the technological skills of the country's most important resource, its people.

As Belize continued to develop, its demand for technological skills and resources increased. It became evident that it was in Belize's best interest to cultivate those skills locally rather than import them. In so doing, not only would the economic growth and prosperity of the country be enhanced but, to a great extent, assured. To keep abreast of the current demands and changes of an ever-evolving field, it was then necessary to continually review and revise the program to ensure its success and credibility (University of Belize, 2006). Therefore, at the inception of the four-year BINT degree program, the Department, after careful deliberation, made a conscious decision to offer both the Associate of Science and the Bachelor of Science programs instead of only the four-year Bachelor of Science program. The basis of this decision was pervasive factors related to individuals wishing to pursue a career in computing and the requirements of the Information Technology Industry and other stakeholders for IT professionals at two distinct levels (University of Belize, 2015).

Over two decades later, the consensus is that these choices were correct. Students have graduated and successfully managed to assimilate into a wide range of careers that include software engineering and development, hardware and infrastructure deployment, and system administration. However, beyond these traditional positions, graduates have also acquired jobs in niche areas of computing such as cybersecurity. A notable theme common among all these garnered occupations is human-centred computing (Jaimes et al., 2007). This theme stems from the fact that while the BINT is more aligned with a Computer Science degree, it does not forgo the inclusion of those academic components that highlight the interaction between persons and their settings and how digital means facilitate that interaction.

It is not possible to discuss a program's philosophy without considering the terms interdisciplinary and multidisciplinary. To label a new program as genuinely interdisciplinary suggests that the program represents an altogether new field of inquiry derived from combining elements from different academic disciplines. In contrast, a multidisciplinary program combines discipline-specific aspects without compromising the academic disciplines themselves, for example, mathematics and computer science (Heikkinen & Räisänen, 2018). A prospect that has been the topic of many departmental conversations and meetings is creating a new discipline at the undergraduate level. While this prospect is tempting, there is consensus that there is a genuine risk that doing so could make students less employable in a field that generally favours traditional occupations (CompTIA, 2021). For this reason, choosing between a conceptual, knowledge-based program versus a purely interdisciplinary one has proven challenging. However, a critical deciding factor has been that the industry almost always prefers an administrator or software engineer instead of someone with hybrid knowledge. So, as long as employers emphasise disciplines in their employment practices, we concluded that our priority for the foreseeable future is to maintain our multidiscipline-specific program and eventually become a truly interdisciplinary program.

Program Composition

The Associate in Information Technology (AINT) and Bachelor in Information Technology (BINT) Program Descriptions are available via the web (University of Belize, n.d.). The evolution of the degree programs from their initial Computer Science track to the Information Technology track resulted from the changing requirements and needs of the IT industry and other stakeholders. The name of the degree programs changed from Computer Science to Information Technology, but the strong Computer Science core still exists. Modification to other program content reflects and incorporates the technical changes within the IT profession, the changes in computing and communications technology, and the growing cultural and economic importance of computing in our society.

The initial four-year Bachelor of Science degree program incorporated as the first two years of its program sequence the two-year Associate of Science degree. The program evolved into the current Associate of Science in Information Technology (AINT) degree and the Bachelor of Science in Information Technology (BINT) degree. The sequences for these programs were last revised in 2019 and have been in effect since August of that year. The BINT two-plus-two program is a seamless integration of the two distinct degree programs (AINT/ BINT) into a single 138 hour (minimum) program sequence (University of Belize, 2019). The program composition includes General Education Core, Support Core, and Professional Core courses (see Figure 2).

General Education Core (GEC) is 30 hours and includes composition, social and behavioural sciences, Spanish, and History. Support Core (SC) is 21 hours and includes algebra, trigonometry, three semesters of calculus, technical writing, and linear algebra. Professional Core (PC) is 87 hours and includes programming, data structures, software engineering, programming language concepts, operating systems, computer organisation, human-computer interaction, web design, computer networking, and telecommunications. The Professional Core includes 12 hours of computer science and information technology electives such as advanced database management, advanced web technologies, mobile application development, digital logic and signal processing, computer and network security, advanced networking, and practical electronics. Also, as part of the Professional Core, students are required to complete a capstone work experience course (3 hours) at the Associate level; and a seminar course (3 hours) and a capstone senior internship course (12 hours) at the Bachelor level.

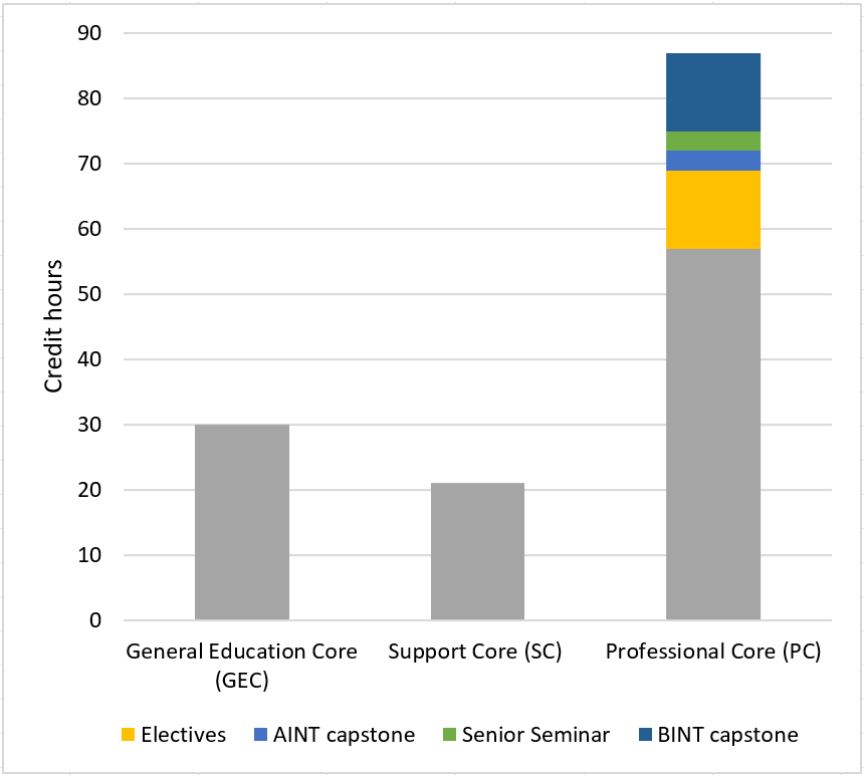

Figure 2. Program requirements

APPROACH

The study involved the review of unpublished internal documents relevant to the inception, development, and operation of the INT programs of the University of Belize for the period 1984 to 2021. An integrative literature review was conducted primarily on computer science and information technology degree programs and the relationships that such programs have with students and industry. The data source for this study was an unpublished transactional dataset of student records from 1998 to 2017 from the University of Belize. Columns utilised from the dataset included student id, program, enrolled semester, year, course code, graduation date, and gender. The dataset had 26,164 transactions that represented aggregates of 3289 enrolments, 1285 students, and 376 graduates. Descriptive statistics generated from the data focused on program enrolment, graduates, and gender distribution.

PROGRAM REVIEW AND EVALUATION

Objective introspection of the program reveals what things done right, areas that need improvement, and overall program performance for 1998 to 2017. The review and evaluation of the program use both qualitative and quantitative analyses, with a particular focus on enrolment, graduates, and gender diversity.

Qualitative Assessment

The program assessment process relies on frequent feedback generated from faculty, students, staff and the institutional infrastructure, which is then carefully reflected upon for appropriate response. This system of obtaining feedback, followed by reflection and planning, and then taking action serves as the basis by which the BINT program determines whether it is successfully meeting its objectives. In particular, student feedback obtained through various means, including interactions with the Registrar's Office, faculty, and student-led organisations centred on computing, is essential. The Department also has ongoing reviews to ensure the alignment of the BINT program with industry needs relevant to Belize. In so doing, the quality of graduates has risen to such heights that employers actively seek AINT and BINT students because of their skills in computing administration, software development, and hardware and software systems deployment. Below are notable changes that have taken effect as a direct consequence of having conducted program reviews and internal assessments by faculty.

At an early stage of the program's development, the Department determined that students graduating from the program lacked practical experience. This lack of practical experience was because while the program offered many courses in computer science, it did not provide that many information technology courses and the proper facilities needed to conduct practical experience were either significantly deficient or non-existent. As a result of this determination, changes in program offerings included courses such as Basic PC Repair and practical-oriented networking and administration courses. In terms of facilities, there have been improvements, but still not at the desired level where for example, separate facilities for networking and security are available.

Early and subsequent reviews of the Bachelor degree program identified areas where the program lacked the breadth of the information technology used globally and the critical aspects of information technology practice in modern organisations. Subsequent modifications to the program sequence introduced courses in the subject areas of website design and implementation, web application development, Internet technologies, graphical user interfaces, and network security.

Observations stemming from conversations with stakeholders early on revealed that students graduating from the program did not possess the expected well-developed analytical, problem-solving and engineering skills required of a professional who engineers quality information technology systems. Adding Systems Analysis, Software Engineering, System Engineering, and Network Engineering courses into the program sequence addressed this deficiency.

Quantitative Assessment

Table 1 shows enrolment of the four major degree program implementations, by gender, from the years 1998 through 2017. The degree program implementations in chronological order are (1) CMP – pre-1998 to 2000, (2) ACSW – 1998 to 2009, (3) AINT – 2000 to present, and (4) BINT – 1999 to present. The table columns for each of the degree programs are defined as follows: "M" for male, "F" for female, "Total" for the total student enrolment, and "%F" indicates the degree of gender diversity. This indicator is a quotient of the number of females divided by the number of males. This quotient or percentage represents the proportionality of females to male enrolment, so a quotient of 100 indicates an equal number of males and females enrolled in the program. A more detailed study of diversity in the AINT and BINT programs is warranted but is outside the scope of this study.

Table 1. Enrolment by gender for the degree programs

	CMP				ACSW				AINT				BINT			
	M	F	Total	%F	M	F	Total	%F	M	F	Total	%F	M	F	Total	%F
1998	8	3	11	38	11	5	16	45								
1999	9	7	16	78	29	12	41	41					1	1	2	100
2000	5	8	13	160	54	57	111	106					7	2	9	29
2001					90	59	149	66	6	2	8	33	13	6	19	46
2002					81	32	113	40	10	6	16	60	20	6	26	30
2003					45	14	59	31	27	14	41	52	21	9	30	43
2004					25	9	34	36	65	23	88	35	30	14	44	47
2005					9	2	11	22	85	28	113	33	25	12	37	48
2006					5	0	5	0	91	26	117	29	30	13	43	43
2007									102	23	125	23	36	16	52	44
2008									125	26	151	21	38	15	53	39
2009									105	16	121	15	51	21	72	41
2010									98	16	114	16	47	15	62	32
2011									105	19	124	18	49	15	64	31
2012									92	25	117	27	45	14	59	31
2013									117	46	163	39	51	13	64	25
2014									109	28	137	26	43	14	57	33
2015									119	25	144	21	37	10	47	27
2016									116	22	138	19	38	5	43	13
2017									134	23	157	17	43	10	53	23
Total	22	18	40	81.8	349	190	539	54.4	1506	368	1874	24.4	625	211	836	33.8

For the four major degree program implementations, Figure 3 shows the enrolment trends for the years 1998 to 2017. Enrolment in the AINT program has been consistently increasing over the years, with significant peaks in 2008 and 2013. The BINT program also had a consistent increase until 2013 but then experienced a steady decline until 2017, when it again recorded a rise in numbers. The BINT program recorded its highest enrolment number in 2009. Note that the AINT program consistently recorded a significantly higher number of enrolled students over the enrolment exhibited by the BINT program.

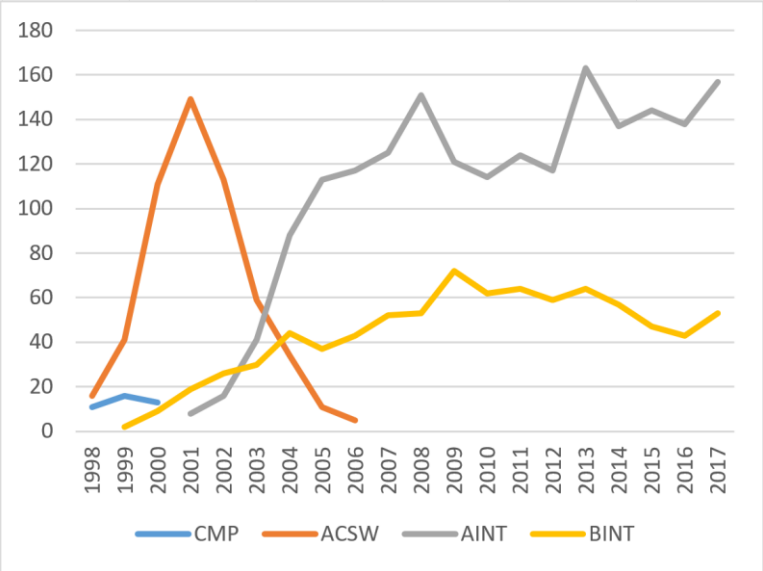

Figure 3. Total enrolment trends from 1998 to 2017

Figure 4 shows the number of students that graduated from 2000 to 2017 from the ACSW, AINT, and BINT programs. Since introducing the ACSW program, there has been a steady increase in graduates, with 376 students graduated. There were significant peaks in 2006, 2011, and 2016. Note that there were no graduates for 1998 and 1999 because the two-year ACSW program had just launched in 1998. The ACSW program accounted for 17% of the graduates, while the AINT and BINT programs accounted for 39% and 44%, respectively. This 5% difference favouring the BINT program does not hold when comparing the total Associate versus total Bachelor degree program graduates. The Associates then accounts for 56% of the total graduates, increasing 8% over the Bachelors.

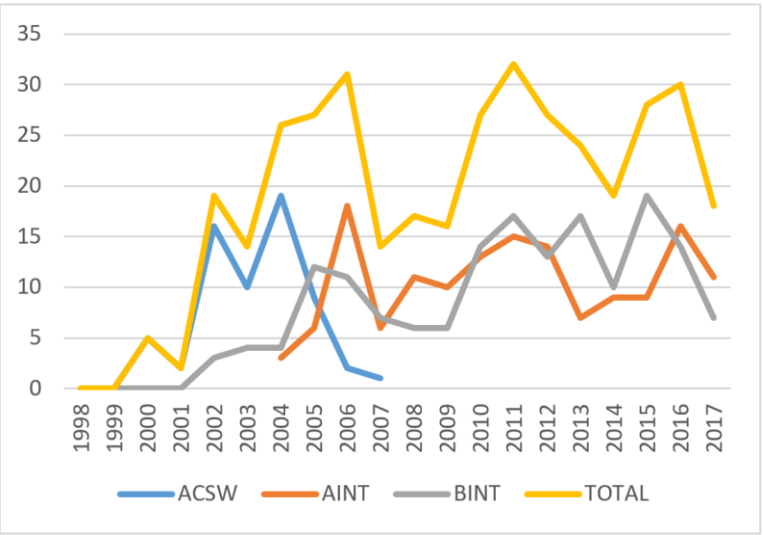

Figure 4. Graduates from 1998 to 2017

Figure 5 displays the relative gender ratios for the program implementations of CMP, ACSW, AINT, and BINT. The charts represent the sum enrolment for males and females from 1998 to 2017 obtained from Table 1. In the earlier CMP and ACWS programs, there were significantly higher percentages of female students than the subsequent AINT and BINT programs – CMP was 81.8%, ACWS was 54.4% compared to AINT's 24.4% and BINT's 33.8%. AINT peaked in 2002 at 60%, and BINT peaked in 2005 at 48%. Both programs experienced a steady decline in female enrolment after peaking. After 2003 the BINT consistently had more females enrolled than the AINT program except for 2013 and 2016.

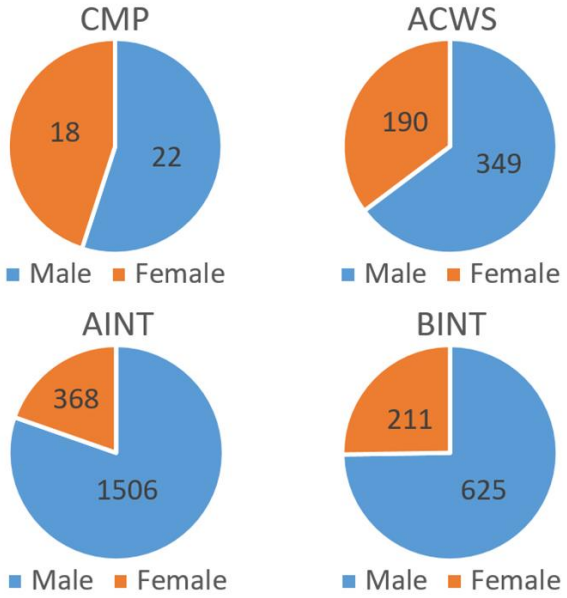

Figure 5. Gender ratios for the programs

Program Successes

Throughout the years, the Department has systematically undertaken efforts to improve the programs it offers. Such improvements have led to the inclusion and removal of courses and enhancements to existing courses to ensure that delivered content is viable and relevant. Taking such measures has been instrumental in developing a sustainable and academically mature program, as shown in Figure 3. Furthermore, the program basis is a well-balanced academic foundation underpinned by an ever-evolving, solid undergraduate computer science/ information technology curriculum. The inclusion of math, computer science/information technology electives also serves to better prepare students for advanced studies or immediate entrance into the workforce. (Kapoor & Gardner-McCune, 2018).

The Department launched a comprehensive initiative to solicit input from its key stakeholders to assess the efficacy of its programs and the calibre of its graduates. This initiative proved successful on two fronts. First, it allowed the program to realign itself with workforce demands, emphasising the needs of Belize. Second, it forged a new relationship between the Department and its business stakeholders based on the mutual benefit resulting from a successful program. An unintended consequence of this partnership has been the increase in opportunities for students to undergo experiential learning and subsequent permanent placement in jobs after that.

There has also been a significant jump in the overall retention rate of students. As the program evolves, its importance to the growth and development of the country has also become more pronounced. The demand for IT graduates has grown significantly over the years, a fact that has not gone unnoticed. The general population has become more aware that technology-related skills are now premium and provide the best opportunity for securing good-paying jobs. Also significant is that the percentage of females enrolled in the BINT program is comparable to other computer science degree programs globally (Computer Science.org, 2021).

Students who have completed the degree are qualified to work in a broad array of technology occupations. These occupations include computer programmers, computer technicians, network technicians, web admins, web developers, web designers, systems analysts, system administrators, database administrators, and network administrators (University of Belize, 2016). There is a high demand for AINT and BINT students by industry. Many students are offered employment during their respective capstone work experience and internship at the AINT and BINT levels.

Program Challenges

Lack of adequately developed infrastructure for specialised learning laboratories used for hands-on experience for non-theoretical subjects such as networking and cybersecurity. Such facilities are essential for delivering content that involves physical activities such as installation, configuration, and experimentation involving hardware components and digital infrastructure. A deficiency of qualified and experienced lecturers and tenure-track faculty to cover the span of offered courses, particularly in advanced areas of Information Technology / Computer Science.

While the BINT female enrolment may be comparable with other programs globally, the reality is that the gender imbalance is significant. This lack of diversity in computing programs is globally recognised and has been the topic of intense discussion and research (Gagnon et al., 2019). Therefore, the program must explore and identify how more females may be encouraged to study computing.

There are limited research opportunities for all students and collaboration opportunities between senior students and their counterparts from other faculties on joint initiatives that would benefit from interdisciplinary research that relies on shared knowledge.

Program Comparison

Since the regularisation of the Bachelor of Science in Information Technology in 2001, the Department determined that it was necessary to offer both the Associate and Bachelor degree programs. The basis of this determination was the needs analysis of students wishing to pursue a career in computing, and the stated requirements of the Information Technology Industry and other stakeholders, for two distinct levels of computing professionals. Like many two-plus-two programs, students find that the program is cost-effective and flexible, and it provides options for early entry into the workforce. It is essential to highlight that, unlike most two-plus-two programs, the AINT and BINT are provided at the same institution, making the transition from the associate program to the bachelor program easy and translating into program curricula that are solid, synergetic, and synchronised with each other (Mott & Lehrer, 2013).

Unlike some degree programs where the choice between an Associate degree and a Bachelor degree can significantly impact employment prospects (Peters & Belkin, 2014), an Associate of Science in Information Technology degree does not reduce employment opportunities in the field of computing. It may, at times, provide quicker access to the job market than the Bachelor of Science in Information Technology degree (Carnevale et al., 2020). This fact is primarily because information technology is one of the primary industry drivers. As a result, both Associate and Bachelor degree graduates from the field of computing are in high demand (Camp et al., 2017). As a result, placement and employment rates are high (over 90%) for graduates of both degree programs since they typically service distinct tiers based on industry needs. This level of employment for the program's students is in line with global trends. The growth rate for computing occupations is typically higher than the average growth rate of all other occupations (Fayer et al., 2017).

The rising costs of tuition and unemployment rates can make the prospect of investing in an Associate degree or Bachelor degree feel like a risky gamble (Abel & Deitz, 2014). However, based on the relationship Information Technology has with Industry (Martynov et al., 2019), for prospective students of the Associate of Science in Information Technology degree or a Bachelor of Science in Information Technology, the difficulty usually associated with the decision making process is not as substantial. Much of the concern is alleviated because the chances of obtaining placement or work prospects are about identical for both the Associate and Bachelor of Science in Information Technology degrees. Again, this is consistent with other programs globally.

In Belize, the University of Belize is one of two tertiary institutions with a degree program in Computer Science/ Information Technology. Given that the scope of this study focuses on a two-decade progress report on the BINT program, it would prove beneficial to undergo, in the future, a review of other computing programs offered in the country of Belize.

The BINT program, as it currently stands, does not support a hybrid curriculum (Benvenuti et al., 2018) at the Bachelor level. Instead, it focuses primarily on developing students that have achieved a discipline-specific foundation who, upon graduating, will have the required competency to embark on any number of specialisations. Upon completing the BINT, degree students pursue higher education online or enrol in foreign institutions to pursue Master of Science and Doctoral levels degrees in application design, information systems, and security. As the BINT program continues to advance and change, the development of advanced level degree programs is the next step in its natural evolution (Rude et al., 2018).

DISCUSSION AND CONCLUSION

The desired outcomes for its graduates and the skill acquisition of those graduates after four years heavily influence creating a new program. Where possible, the BINT program has aligned with the needs of students and industry stakeholders (Mardis et al., 2018), but even so, inevitably, tradeoffs are unavoidable. Unfortunately, course offerings have no perfect configuration that ensures the right balance of interdisciplinary information technology credits versus professional core credits. There is also the challenge of whether to focus exclusively on software or hardware. Considering all these factors, we have chosen a path that emphasises computer science/ information technology fundamentals that provide a clear direction for computing through foundational courses in software development and hardware deployment. The results of this approach have produced graduates that possess a solid foundation centred on computing technologies. This approach ensures that upon degree completion, students will have at their disposal a wide range of career choices from which to choose. These include Computer Programmer, Computer Technician, Network Technician, Web Master, Web Designer, Systems Analyst, System Administrator, Database Administrator, and Network Administrator.

Unlike many other fields of study where program content can be essentially static, program content is dynamic in computing because of the constantly evolving technology and emerging theories that shape and drive the discipline (Stewart, (2014). As a result, the Department is continually reviewing the program sequences of the Associate degree and Bachelor degree programs to ensure that they provide the best possible foundations for student success in computing. These reviews include comparing and evaluating the pros and cons of having a purely Computer Science track versus an Information Technology track. Also under consideration is embedding certification content (e.g. CompTIA, Cisco, Microsoft, etc.) into the sequence. The inclusion of certifications can improve both the marketing of the program and the employment of its alumni (Carnevale et al., 2020).

In recent years, several individuals and organisations, local and international, interested in establishing some form of Information Technology (IT) business have approached the Department. They have, on numerous occasions, cited Belize's geographic location, language and diversity as an ideal combination. However, these individuals state, and quite accurately so, that the country lacks technically skilled persons. The number of IT graduates alone is a crucial factor. For the last ten years, on average, about 28 students graduated per year (University of Belize, 2021), of which over 90% had guaranteed employment simply because they were filling existing occupation voids in industry. This average is a far cry from what a company wanting to make a significant investment will require in terms of necessary technical human resources. They can hardly rely on a trickle of graduates when their demands for skilled individuals is so high and ever-increasing. So, these companies have no recourse but to move elsewhere, despite any inclination of wanting to do business in Belize. Unfortunately, each time we lose such opportunities, we are preventing employment and the growth and development of a critical sector of society - a sector that has the potential to propel Belize forward and help move it into an era of prominence.

We don't have to look hard to see the positive effects investing in information technology has on a country. Singapore (Gunasilan et al., 2021), India (Surana & Sagar, 2020), and the Phillippines (Albert et al., 2018) are great examples. For example, an examination of Singapore's education system reveals that its strength lies in the fact that students of all intellectual abilities have access to quality education but notably its concentration on science, technology, engineering, and mathematics (STEM) (Yiannouka, 2015). Emphasis on STE education and the efficient and effective utilisation of frontier technologies have positively impacted the economies of these countries.

Therefore, the University of Belize and the Government of Belize must think long term. Immediate financial returns should not be the driving force. Instead, like Singapore, they must find ways of providing quality educational access to the masses, particularly in computer science and information technology, which can radically transform Belize. The returns on human investment are far greater than any other investment. The BINT program has been contributing, is contributing, and has the immense potential to contribute even more to the future development of Belize.

Ethics and Consent: Ethics committee approval is not required as it does not involve clinical research on humans and does not contain retrospective studies in accordance with the Law on Protection of Personal Data.

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Research Paper

Virtual Dissection Table: A Supplemental Learning Aid for a Physical Therapy Anatomy Course

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ABSTRACT
While cadaver dissection and prosection are deemed quintessential methods for studying anatomy, these methods are attenuated by the flat, 2-D structures incorporated into didactic segments of the anatomy courses that minimize students' ability to comprehend anatomy, leading to constraints in the teaching and learning experience. Several tools, such as 3-D virtual anatomy apps and anatomical models, enhance teaching and students' understanding of gross human anatomy. The Anatomage, a virtual anatomy dissection table (VDT), is a compelling technological development with dissection capabilities and a prosection of the human body and its segments. This study intends to explore incorporating a VDT into a physical therapy anatomy course as an enhanced anatomical learning technique. The methods encompass the inclusion of the VDT as an extra dissection table within the cadaver lab setting. Each group of scholars was required to locate the anatomical configurations and dissections assigned to the topic on the VDT. The anatomy course included four examinations covering the entire human body. The results suggest advancements in knowledge retention following the incorporation of VDT in the cadaver dissection portion of the course. Therefore, we ascertained that the VDT is an exemplary tool to adopt in anatomy courses to aid in the comprehension of complex anatomical structures. Integrating VDT is paramount to the assimilation and application of human anatomy in students' future health careers.

INTRODUCTION

Gross anatomy is one of the core courses in numerous health-related programs, such as physical and occupational therapy (www.twu.edu). The conventional methods for instructing gross anatomy are lectures with adjunct textbooks (Hammond, Taylor, & McMenamin, 2003) and cadaver dissections and prosections (Houser & Kondrashov, 2018). Two-dimensional (2-D) screen projections are among the styles most resorted to during the didactic segment of anatomy courses. However, although 2D screen projections are the most applied strategy in nearly every anatomy course, they have limitations associated with the teaching and learning experience (TLE). These screen projections, such as PowerPoint presentations, inflict numerous constraints on scholar comprehension, including difficulties in learning depth perception, understanding anatomical orientations among nearby structures, and clinical applications (Berkowitz et al., 2014).

The limitations generated by 2-D instructional methods in the lecture portion of anatomy courses often produce gaps or discrepancies between scholars' knowledge and comprehension, and the areas covered during lectures and cadaver laboratories (Chakraborty & Cooperstein, 2018). As previously noted, gross anatomy is a paramount course in nearly all health-related programs, which often pair the course with successive clinical experiences as another significant component of such curricula. As scholars advance to more analytic-oriented courses requiring a strong understanding of anatomy, such as kinesiology and clinical environments, the critical issue of students' disconnection between anatomy comprehension and application resulting from 2-D learning becomes critical, as the repercussions materialize in these settings and can become problematic.

To help close the divide between the didactic and cadaver laboratory sections of anatomy courses, many educators have adopted adjunct teaching-learning tools in both sections, such as software applications (apps) with three-dimensional (3-D) aspects (Chakraborty & Cooperstein, 2018), which are utilized in efforts to alleviate issues of discrepancies in student's comprehension by building more tailored and holistic views and perspectives during both segments of gross anatomy courses. The active interaction with some of these supplemental technologies is valuable in strengthening students' understanding of human anatomy and overall scores in anatomy-based courses (Sugand, Abrahms, & Khurana, 2010).

Virtual reality, models, and 3-D anatomy apps are among the adjunct devices designed to promote the interpretation of depth perception and the association of deeper and more complex arrangements within the human body (Iwanaga et al., 2020; Rosario, 2021; Rosario et al., 2019). While augmented virtual reality (AR) has been reported as a valuable supplement for human anatomy guidance, 3-D virtual anatomy applications are just as thorough and beneficial as other approaches used to strengthen the understanding of anatomy (Iwanaga et al., 2020), and their successes and advantages in anatomy courses have been reported by

many researchers (Chakraborty & Cooperstein, 2018; Houser & Kondrashov, 2018; Rosario, 2021). Both the 3-D app and AR techniques have been established as successful in targeting the perceived benefits of student participants in more specialized and advanced programs, along with reinforcing their comprehension of anatomy (Bairamian, Liu, & Eftekhar, 2019; Bork, 2019; Duncan-Vaidya & Stevenson, 2020; Ha & Choi, 2019). Therefore, incorporating augmented reality (AR), 3-D apps (Uruthiralingam & Rea, 2020), and virtual dissection tables (VDT) (Bork, 2019) as adjunct tools to cadaver dissection are favorable and have proven to furnish numerous advantages and enhancements to the TLE of those in anatomy courses.

Scholars often prefer to step outside of the traditional lecture scenario to strengthen their understanding of the course material by using some of the accessories mentioned above (Chakraborty & Cooperstein, 2018), which increases excitement among learners, which successively helps and enhances the TLE of anatomy courses (Berkowitz et al., 2014). The impact of 3-D anatomy apps and VDT as adjuncts to undergraduate human cadaver anatomy outreach activities has been previously explained, along with the usefulness of these technologies for the comprehension of anatomy, which further encourages pupils to pursue graduate studies (Mathis M., González-Solá, & Rosario, 2020). The effectiveness of incorporating 3-D anatomy apps into lectures was also established to improve course grades and boost the perceived benefits of such tools on the TLE (Rosario, 2021).

In addition to the clear disadvantages of learning anatomy from flat 2-D resources, scholars often exhibit a passive learning posture as a result of using these resources, such as simply listening and waiting for the professor to show them the material rather than seeking a more hands-on approach (Minhas, Ghosh, & Swanzy, 2012). The VDT is a valuable instrument that allows the user to manipulate various anatomical structures and navigate across different architectural arrangements (Ward, 2018; Brucoli, et al., 2020 & Brucoli, et al.,2018) while illustrating real human anatomy details and heightening TLE, even in earlier stages, such as among undergraduate scholars (Rosario et al., 2019). We recognize that the VDT can provide students with a smooth transition from the didactic portion of anatomy courses to the cadaver laboratory portion by enhancing 3-D perspectives, as it has been previously successful in similar scenarios (Afsharpour et al., 2018).

The addition of adjunct tools through a multimodal approach to the lecture and laboratory portion of courses had several immediate benefits that promote the TLE (Houser & Kondrashov 2018). Subsequently, prospective healthcare professionals need to be provided with anatomy education of the utmost quality to enact proficiency in various clinical scenarios (Schofeild, 2017). The human cadaver laboratory is the best opportunity to implement such education. Therefore, upon taking all that has been mentioned above into consideration, this study delves into exploring and reporting the effectiveness of supplementing the Anatomage VDT into a graduate anatomy course for physical therapy students on the TLE.

METHOD

Participants

A total of 216 first-year physical therapy graduate students enrolled at Texas Woman's University (TWU) during the fall semester from 2016 to 2019. The first cohort of 108 pupils (54 scholars per year) was enrolled in the anatomy course during the fall of 2016 and 2017, before the addition of the anatomage VDT. During Spring 2018, the VDT was obtained and subsequently incorporated into the anatomy course for the Fall of 2018 and 2019 laboratories. Therefore, the second cohort of 108 students (an additional 54 per year) was enrolled in the anatomy course using the VDT.

Human cadaver Laboratory

The School of Physical Therapy at Texas Woman's University has a human cadaver laboratory coordinated by a trained anatomist. The human cadaver laboratory has ten tanks, each of which contains one cadaver for a total of ten human specimens, which were obtained from the University of Texas Southwestern Medical Center's Willed Body Program.

Equipment

Virtual Dissection Table Anatomage, a life-size table that allows for the virtual dissection of fully segmented cadavers, features a full-length interactive touch screen that depicts "real-life virtual human cadavers" (Anatomage, 2019). The Anatomage includes options to dissect either the entire body, specific regional anatomy, or targeted organs while performing interactive segmentation and isolation of all body components, including those deemed most complex, all of which can be fully annotated. The anatomage VDT was added to the cadaver lab layout, as shown in Figure 1, during the Fall 2018 semester. During cadaver dissection, scholars were requested to reserve 15 minutes of their allocated laboratory time for using the VDT to study the structures and dissect the areas associated with that day's topic. After all tank members rotated, examined, and participated in the dissection, students then went to the VDT to locate and study the structures from that day and any other areas they needed to inspect further.

Anatomy Unit Tests

Per course requirements, all students underwent four unit tests, each of which was worth 100 points. The information in the first unit was composed of the back and upper extremities, the second unit covered the lower extremity regions, the content of the third unit consisted of the body cavities (thoracic, abdominal, and pelvic), and the fourth unit comprised the head and neck regions.

Data Analysis

The information used in this inquiry was collected from the four-unit test scores of all student participants and was then organized into an Excel spreadsheet where descriptive statistics and averages were analyzed using SPSS version 25. The benefits of using the VDT as a supplement for the lab's dissection portion were evaluated by comparing scholars' test scores before (Fall 2016-2017) and after (Fall 2018-2019) the addition of VDT to the anatomy course. A one-way ANOVA was conducted to compare both groups, and a p-value of 0.05, was considered significant for this inquiry.

RESULTS

Table 1 illustrates the student and gender distributions before and after the VDT was introduced to cadaver dissection.

Table 1. Participants

Characteristics	**Pre VDT n=108**	**VDT n=108**
Gender	Male= 29; Female = 79	Male= 23; Female = 85

Table 2 shows the grade comparisons between the two groups. After incorporating the VDT, there was a slight increase in grades; however, this increase was not statistically significant.

Table 2. Grades comparisons

Characteristics	**Pre VDT n=107**	**VDT n=107**	**P value**
Course Grade	169.1+/-15.0	170.9+/- 12.7	0.35*

*Anova analysis was performed with a P value of 0.05 as significant.

DISCUSSION

Anatomy professors often encounter difficulties in helping scholars comprehend the complexity of human anatomy. Coincidingly, a few challenges students face are ascribed to discerning the relationships between the various arrangements presented, along with distorted depth perception, resulting from the use of TLE-hindering 2-D study accessories, such as presentation projections and textbooks. The primary concern with these strains in health-related programs is that scholars will ultimately work with people in clinical environments rather than with an image on a computer screen or in a book, making it crucial to address the alleviation of these issues (Smith et al., 2013). In an attempt to help students promptly discern problematic anatomical concepts, relationships, and depths, this report focused on the impact of adding a VDT to the TLE in an anatomy course, which revealed several conclusions worth sharing.

As previously stated, cadaver dissection is a unique and unparalleled experience that is paramount to many health-related programs (Ghosh, 2015). However, anatomy supplements, such as the VDT used in this study, are vital in aiding students' comprehension, reducing the gap created by didactic lectures, and minimizing the time needed to connect concepts learned in lectures with the structures dissected and observed in the anatomy lab (Krause et al. 2015; Custer, & Michael, 2015).

Among the scholars who utilized the VDT, the slight increase in their test scores compared to the scholars who were not exposed to the table illustrates the benefits of the VDT as a supplemental tool. We deduce that, while they are not statistically significant, higher test scores are essential to consider. The VDT allowed the pupils to experience gross anatomy in a more in-depth way, including aspects that are not always visible in physical cadavers. We conclude that this is what led to the higher test scores, delineating that the VDT provides students with greater knowledge and a more thorough understanding of the human body (Ward, Wertz, & Mickelsen, 2018). Similar to other reports, we can infer that by incorporating a 3-D perspective in combination with the instructor requiring pupils to interact with the VDT during the cadaver dissection period, enhancements in understanding complex regions in the anatomy course are present (Peterson & Mlynarczyk, 2016). We recommend integrating VDT into other clinical classes that require a strong background in anatomy, such as kinesiology and musculoskeletal courses. However, we suggest providing this opportunity to scholars when they have the advantage of physically manipulating the virtual structure, thereby allowing them to be active learners during the activity, as proposed by Chakraborty & Cooperstein (2018).

One of the main concepts worth highlighting in the current study is the methodology and logistics in integrating the VDT into the anatomy course without hindering the TLE in cadaver dissection. As depicted in Figure 1, the VDT was incorporated as an additional cadaver tank in the laboratory layout, allowing students to rotate when needed without any restrictions. Nevertheless, to ensure that each student had experience working with and manipulating structures on the VDT, they were required to reserve time to work with the VDT during each cadaver lab interaction.

The cadaver dissection experience logistics were designed so that each group of students was assigned to one cadaver tank; this lab portion of the anatomy course consisted of 3 h of dissection followed by an hour of prosection, twice weekly. After the first hour of dissection, rotations for each tank group with the VDT began, as students were required to use the table for 15 minutes each lab session to interact with the dissection region and structures covered that day. The tanks were rotated every 15 min to allow each student to utilize the VDT in every lab session, which potentially allowed for the full and comprehensive view of anatomical structures that are not always explicitly observable in cadavers (Figures 1 and 2). Finally, after each group of students completed their allotted time with the VDT, they were encouraged to return to the VDT for further clarification, as needed.

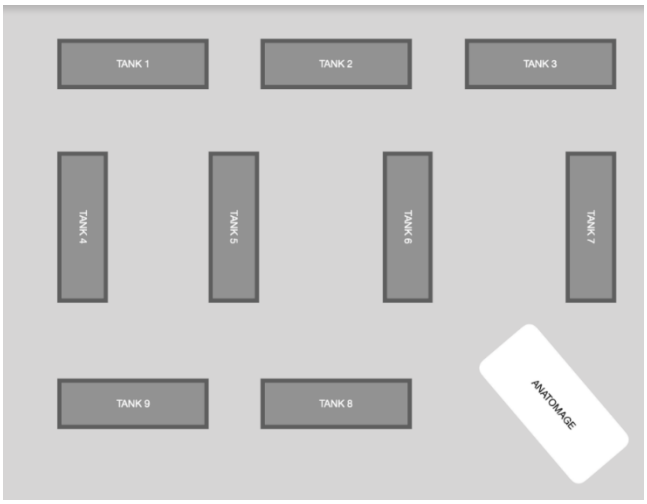

Figure 1. Cadaver Lab Setup with the addition of the anatomage

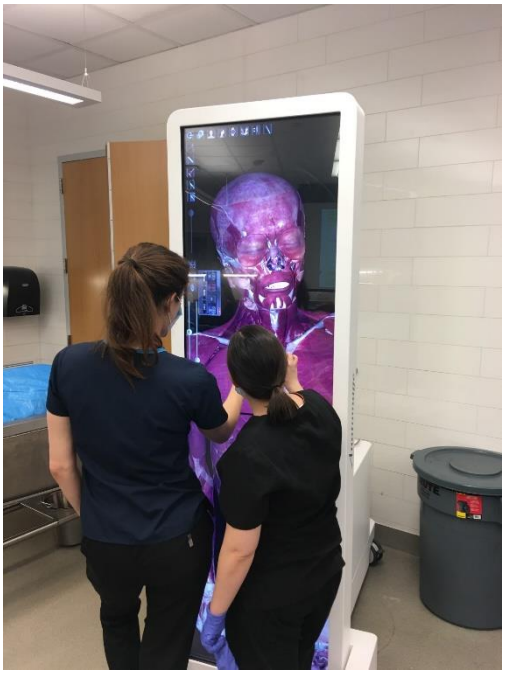

Figure 2. TWU DPT Students Using the Anatomage in Gross Anatomy PT6015

While the successful integration of this particular VDT model has been previously reported, they involved programs that differ from those in this study (Afsharpour et al., 2018; Ward, Wertz, & Mickelsen, 2018). As we knew the potential of the VDT and the quality of its specimens and images, we were confident that this cadaver lab setting and protocol would provide additional opportunities for students to review gross anatomy related to the regions being explored in the lab while boosting their anatomy comprehension and grades. Additionally, requiring students to be more actively involved in their learning by manipulating the virtual cadaver and analyzing different structures enabled them to discern the structural and functional anatomical relationships and how these configurations and areas fit together while influencing movement (Brucoli et al., 2020 & Darras et al., 2020).

Following the incorporation of this 3-D technology into the lecture and lab, there has been a noticeable increase in excitement and motivation concerning learning human anatomy, which can be attributed to the VDT providing students with the "full picture" in a concise manner, as previously reported in similar settings (Berkowitz et al., 2014). As a result, deliberations on adding the VDT to

other courses and outreach activities are underway. Further, this report was composed of only physical therapy students and the respective gross anatomy course; considerations will be made for interdisciplinary collaborations by focusing on the necessity of students' needs.

CONCLUSION

Since its incorporation into the cadaver laboratory at Texas Woman's University in the Fall of 2018 semester, the Anatomage virtual dissection table has proven to be a substantial adjunct to the gross anatomy course for physical therapy students. As cadavers often have inconsistencies, integrating the VDT into the TWU gross anatomy course allowed future doctors of physical therapy to thoroughly examine, study, and comprehend each anatomical structure and relationship unambiguously.

Regardless of the many advantages presented by supplemental tools in anatomy courses, such as that reported in this study, it is essential to point out that they are not a substitute for human cadaver dissection and should be used as adjuncts to enhance the TLE. Nevertheless, the VDT has made remarkable impacts as a teaching tool for both institutional and non-institutional students (Mathis, Gonzalez, & Rosario, 2020) at Texas Woman's University's School of Physical Therapy in Dallas.

Given that this investigation used VDT solely in an anatomy course, along with observing only a modest increase in grades, our findings and data cannot be generalized or transposed to differential courses. However, as the results of this study demonstrate students' grades to be steadily higher than in decline, it can be concluded that the VDT should be included in human anatomy courses within graduate programs in order to support the TLE.

Additional examinations should focus on employing the VDT among students who do not typically reap the benefits of experiencing education from observing, dissecting, prosecting, or studying cadavers, such as those pursuing undergraduate degrees, occupational therapy scholars, and students from other universities, which would further allow for a broader network of collaborators.

As per the discoveries of this inquiry, we propose incorporating a VDT into every anatomy-related course, regardless of the program's specifications or degree pupils are enrolled in. Likewise, since graduates tend to adopt a more passive learning approach, we encourage reserving time within the curriculum during which students would be required to maneuver the VDT, such as through small group assignments to complete appointed tasks. We further recognize that to learn anatomy successfully and all of the components it embodies over a shorter period of time, scholars must not simply watch and heed to their instructor within teaching and lab scenarios in a passive manner, but must also be proactive in engaging with the VDT. Since the VDT is expensive, we advocate including a supplemental 3-D application to anatomy courses, comparable to that of Rosario (2021) investigated; having a 3-D anatomy-based application available both inside and outside of class for scholars to examine and manipulate anatomical structures will only further expand upon their understanding and minimize the inevitable gap between lectures and laboratories.

As a final remark, we expect and aim to enhance the understanding of surface anatomy and underlying tissues among our physical therapy students in an effort to improve their palpation skills and ability to tailor future interventions per patients' needs effectively. Therefore, we recommend combining the use of a VDT with traditional instruction methods as an adjunct tool within other physical therapy graduate courses, such as kinesiology and musculoskeletal courses, to improve pupils' detailed human anatomy comprehension and clinical skills of prospective doctors of physical therapy.

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Ethics and Consent: The author utilized the ARECCI tool to stipulate and justify that this examination is categorized under the Program Quality Improvement, for which the ARECCI tool is instructed as a replacement for an institutional review board. This report can be retrieved at this URL:

http://www.aihealthsolutions.ca/arecci/screening/453976/8b87ac3c83723ce66cad073476cfc24d

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The Role of Multimedia in Concept Learning from the Parents' Perspective

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ABSTRACT
During the period of the pandemic in particular, children who are not able to leave their homes have been spending more time using multimedia devices. This research was carried out in order to determine the role of multimedia in preschool children's concept learning, as expressed by their parents. For this purpose, the research was designed qualitatively, and the case study model was used. The study's working group consisted of 21 parents living in seven different geographical regions of Turkey. The parents were determined using the maximum variation sampling method. A semi-structured interview form was used as a data collection tool in the research. The content analysis technique was used to analyze the data obtained in the research. As a result of the research, it was determined that the multimedia devices that children spent most time on were televisions, smartphones and tablets. Children preferred to use multimedia mostly for fun and games. The vast majority of parents thought that adult supervision was needed when children spent time using multimedia devices. In the research, the benefit of multimedia use that the parents most emphasized was concept learning. According to the parents, their children learned many basic concepts through accessing multimedia content. Parents also expressed their opinion that the multimedia content and apps contributing most to the children's concept learning were animated cartoons, YouTube and digital games. As a result of the research, it can be said that technological devices that offer children multimedia content positively affect children's learning of basic concepts.

INTRODUCTION

The preschool period is a time of rapid development in all areas of an individual's life (Bozkurt Yükçü, İzoğlu Tok & Bencik Kangal, 2019; Oruç, Tecim & Özyürek, 2011; Sapsağlam, 2018; Türkkent, 2012; Uzunboylu & Gündoğdu, 2018). This period is thus critical for the individual's development (Aydoğan, 2019; Özkılıç Kabul, 2019; Özyürek, 2018; Kol, 2014). Cognition is one of the areas which develops most rapidly during this period. Progress made in cognitive development has the power to positively affect all other areas of development (Ergül, 2007). Concept learning is an important dimension of cognitive development; in fact it forms the basis of cognitive development (Avşalak, 2008; Ergül, 2007; Hayran, 2010).

Concepts can be defined as those mental tools required for the skill of thinking. They provide individuals with an understanding of the physical and social world in which we live, as well as enabling meaningful communication with the environment (Çamlıbel Çakmak, 2012; Hayran, 2010; Senemoğlu, 2018). Groups of concepts emerge as a result of considering people, objects, events, and thoughts according to their similar characteristics (Kaptan, 1998; Senemoğlu, 2018). Concepts are also the most basic units of the learning process (Coşkun & Köroğlu, 2016). Individuals begin to learn concepts from the moment they are born and use these concepts in their daily lives (Manocha & Narang, 2004).

Children start learning concepts at around 12-24 months of age and rapid development is observed in children's concept-forming skills from their 48th month (Çamlıbel Çakmak, 2018; Üstün & Akman, 2003). Children therefore learn the basic concepts in the pre-school period (Bütün Ayhan & Aral, 2007; Çamlıbel Çakmak, 2012; Kol, 2014; Kurt, 2014). The concepts children learn in the preschool period support not only their cognitive development but affect all the children's developmental areas in a positive way (Ergül, 2007). In addition, the concepts that children learn before they start primary school are the basis for their learning during their time at school (Uğurtay Üstünel, 2007). Children's concept learning should thus be supported before they start their formal education (Konca, 2014).

While children are learning concepts in the preschool period, the type of communication they establish with their physical and social environment becomes more prominent (Ulus, 2005). In this context, how children relate to technological devices plays an important role in the concept learning process, especially in the 21st century where technology is dominant. According to Şimşek İşliyen and İşliyen (2018), children's communication with technological devices begins before they are born. Children may, for example, listen to lullabies played on their mothers' smartphones while they are still in the womb. The relationship between children and technological devices continues to develop from the moment they enter the world (Şimşek İşliyen & İşliyen, 2018). Preschool

children are introduced to technological devices at a very young age (Ateş & Durmuşoğlu Saltalı, 2019; Emir, 2011; Ergüney, 2017; Holloway, Green & Stevenson, 2015; İnci & Kandır; 2017; Konca, 2014; Özkılıç Kabul, 2019; Özyürek, 2018).

Today, with the widespread usage of technology and the internet, the time individuals spend with technological devices such as computers, tablets or smartphones has increased (Özkan, 2017). The frequent use of these devices by parents has made it easier for the children to access them (Kılıçkaya, Yıldırım, Çelik & Uyanık Balat, 2018). In fact, smartphones, which they are usually within easy reach, have now become toys for children (Park & Park, 2014). The age at which technological devices are first used (Gündoğdu et al., 2016; Özkan, 2017; Preradović, Unić & Boras, 2014; Rideout & Hamel, 2006; Yengil, Döner Güner & Topakkaya, 2019), and the age when internet usage begins (Kenanoğlu & Kahyaoğlu, 2011), have decreased to the preschool years. In the preschool period, television is one of the most common technological devices in children's daily lives (Yengil, Döner Güner & Topakkaya, 2019). Television comes into children's lives at an early age (Rideout & Hamel, 2006). They become active viewers from the age of three (Gündüz Kalan, 2010). Television is even seen today by some families as an extra "caregiver" (Akıncı, 2013; Dorey et al., 2009; Gündüz Kalan, 2010). Traditional fairy tales and stories have been replaced by animated cartoons that are broadcast on television (Aktaş, 2019; Canbekli, 2019).

One of the common features of technological devices such as computers, smartphones, tablets or televisions is that they create environments that appeal to more than one sensory organ. According to Akın (2015), these environments, taken together constitute the world of multimedia. In other worlds multimedia is the sum of those environments which stimulate an individual's sense of sight, hearing and touch, in which information is presented in more than one specific medium (Yalçınkaya, 2017). Multimedia as a whole thus presents information to individuals informs which they can both see and hear (Coşkun, 2015).

Multimedia is widely used in educational technology. In combination with other methods, the usage of multimedia in the teaching process contributes positively to students ' learning (Nusir, Alsmadi, Al-Kabi & Sharadgah 2013). Learning materials prepared using multimedia can be presented in various forms, whether visual or verbal (Mayer, 1999). The main elements of multimedia are text, video, audio, graphics and animation (Shilpa & Sunita, 2013). Multimedia that uses elements such as sounds, images and videos provides more realistic learning environments for children (Jones & Liu, 1997). Learning media enriched with these or other elements, such as animation, positively affects the concretization and learning of knowledge (R. Bulut, 2018), and also makes learning environments more enjoyable for the learners (R. Bulut, 2018; Yıldız, 2009). It can be said that multimedia, which affects the learning process positively, also has a positive influence on concept learning. According to Beydoğan and Hayran (2015), the most effective learning environments for concept learning are multiple learning environments. Multimedia contributes positively to students' ability to concretize and reinforce concepts by visualizing them (Çoruk, 2015). Given the difficulties that preschool children experience in concretizing and interpreting concepts, a range of visual, auditory and other elements should be used (Gülmez, 2019).

In the current age, preschool children are a generation growing up with devices and platforms such as computers, the internet, smartphones, social media apps, video games and YouTube (Preradović et al., 2014). These children thus frequently encounter multiple different environments through the technological devices that they use. The main purpose of this study was to determine the role played in concept learning by the multimedia that preschool children most frequently encounter. When the body of the literature is examined, studies can be found on the role of multimedia (Çakıroğlu & Taşkın, 2016; Kaya, 2005), computer-aided education (Alabay, 2006; Çeliköz & Kol, 2016; Demir & Kabadayı, 2008; Kacar, 2007), cartoons (Bayır &Günşen, 2017; Coşkun & Köroğlu, 2016; Çıkrıkçı, 1999; Koçak, 2016), computer games (Çankaya, 2012; Çoruh, 2004), and YouTube (Gülmez, 2019) in pre-school children's concept learning. When Çamlıbel Çakmak (2018) examined postgraduate theses on concepts in Turkey's preschool education between 1990 and 2016, she found that quantitative research methods were used in the vast majority of the studies, while qualitative research methods were used in only 5% of the studies. Similarly, in Öngöz, Aydın and Aksoy's (2016) study examining research conducted on multimedia in the field of Educational Sciences in Turkey, it was found that the proportion of qualitative studies was quite low. It is therefore expected that this qualitatively designed study will also contribute to the literature on this topic.

The most valid information about the relationship of preschool children with multimedia and how they use these environments is obtained from their parents, who are their first educators. Therefore, this study consulted with parents to find out their thoughts and opinions. There are many studies in the literature about the opinions of parents of preschool children. These studies have tried to determine the situation of preschool children's use of technological devices that offer them multimedia, in line with the opinions of their parents (Ateş & Durmuşoğlu Saltalı, 2019; Gündoğdu et al., 2016; Kılıçkaya et al., 2018; Kılınç, 2015; Kızıltaş & Ertör, 2018; Konca, 2014; Kulakçı Altıntaş, 2018; Özkan, 2017; Özyürek, 2018; Sezgin & Tonguç, 2016; Topan & Kuzlu Ayyıldız, 2018; Yılmaz Genç & Fidan, 2017). This study focuses on the role of the multimedia that preschool children frequently encounter and use in their daily lives in the process of concept learning and their parents' views on this were sought. This aspect of the study is also considered valuable in terms of how it contributes to the literature.

METHOD

Research Design

Since this study aimed to determine parents' views on the role of multimedia in preschool children's concept learning, it was designed as a case study, which is one of the qualitative research designs. A case study is a research method in which an event or phenomenon that cannot be controlled by the researcher is examined in depth. It is a research method seeking an answer to a 'how' question

(Yıldırım & Şimşek, 2018). In this direction, the attempt was made to find out how multimedia plays a role in the concept learning of preschool children, and the parents' thoughts and opinions on this topic.

Study Group

The study group consisted of 21 parents living in seven different geographical regions of Turkey who had preschool children (36-60 months). The parents whose opinions were sought were determined using the maximum variation sampling method, which is one of the purposeful sampling methods. This method that provides variation among individuals by selecting individuals with different characteristics (Glesne, 2012). In this study, the variation among the parents who made up the study group was achieved in terms of the geographical region in which the parents lived and the level of education that the parents had. In this regard, the study group consisted of parents who had different level of education (Elementary School, Secondary School, High School, Bachelor's degree, Postgraduate) and who were living in seven different geographical regions of Turkey (Black Sea, Marmara, Aegean, Mediterranean, South-eastern Anatolia, Eastern Anatolia and Central Anatolia). Within the scope of the research, the demographic information of the parents regarding the variables of gender, geographical region, education level, number of children, gender of the preschool child and age of their child are given in Table 1.

Table 1. Demographic information of parents

Variable	Group	Frequency
Gender	Male	9
	Female	12
Number of Children	1	7
	2	8
	3	6
Geographical region	Mediterranean	3
	Aegean	3
	Black Sea	3
	Marmara	3
	Central Anatolia	3
	Eastern Anatolia	3
	South-eastern Anatolia	3
Education Level	Elementary school	2
	Secondary school	4
	High school	3
	Bachelor's degree	10
	Postgraduate	2
Gender of the Child	Male	9
	Female	12
Age of the Child	36-48 months	12
	48-60 months	9

Data Collection Tool

A semi-structured interview form was developed in the study to determine the parents' views about the role of multimedia in preschool children's concept learning. A draft interview form consisting of open-ended questions was initially prepared. In order to determine the content validity of the draft interview form, the opinions of five experts from the preschool teaching departments of various universities were consulted. After the expert opinions had been received, the necessary corrections were made and pretesting stage of the draft interview form was begun. At this stage, a pretesting implementation was performed with three parents in order to test the comprehensibility of the questions in the draft interview form. The parents stated that the questions in the draft form were clear and understandable. The interview form, which was finalized after the pretesting implementation, consisted of 10 questions. An application to conduct the study was then submitted to the Ethics Committee of Kırşehir Ahi Evran University. After receiving legal permission from the committee (decree dated 27.08.2020 and numbered 2020/3), the study was begun.

Data Collection

The semi-structured interviews were carried out through phone calls between the researcher and the parents. Notes were taken to record the data during the interview. A voice recorder was also used in order to avoid data loss during the note-taking. Before starting the interview, permission to use the voice recorder was obtained from the parents.

Data Analysis

For the data analysis, the content analysis method, which is widely used in qualitative research, was used. In accordance with this method, the interviews recorded on the voice recorder were first transcribed and converted into written form in a computer environment. Codes were created from this written form of the interview data, and themes were generated by bringing similar codes together. A frequency value was calculated for each code determined within the scope of the research. The interviews with parents were also interpreted on the basis of these determined codes and themes. In addition, the data analysis process was supported by using direct quotations.

In order to determine the reliability of the content analysis process, the data obtained from the interview form was analyzed by another researcher and the percentage of concordance between both researchers was calculated. In calculating the concordance percentage, the formula (Number of consensus/Consensus + Number of dissensus) proposed by Miles and Huberman (1994) was used. As a result of the calculation using this formula, the concordance percentage between both researchers was determined as .91. This concordance percentage showed that the content analysis conducted within the scope of the research was reliable.

FINDINGS

Multimedia Devices Which Children Used

The frequency distribution of the multimedia devices which children spent their time using is given in Table2.

Table 2. Frequency distribution of the multimedia devices which children used

Theme	Code	F
Multimedia device used	Television	14
	Smartphone	14
	Tablet	7

When Table 2 is examined, it is seen that, according to the parents, the media devices on which the children spent the most time were television and smartphones. When the parents' views were examined, it was determined that they considered spending time on these was normal for all children in today's world. Regarding this situation, one parent (P21) responded that, *"Ours also spends time on television and the smartphone like every child".* Again, Table 2 shows that another device on which the children spent time was the tablet. This finding shows that some of the children spent time with tablets in addition to the television and smartphones. Regarding this situation, one parent (P6) stated that, *"My child uses all three media devices: the television, smartphone and tablet".*

Time Children Spent in Multimedia Environments

The frequency distribution of the time that children spent on multimedia content is given in Table 3.

Table 3. The frequency distribution of the time that children spent on multimedia content

Theme	Code	F
Duration of the time spent	Less than half an hour	6
	30 minutes - 1 hour	5
	1 hour - 2 hours	5
	2 hours - 3 hours	4
	3 hours and more	1

When Table 3 is examined, it seems that some of the children spent less time engaging with multimedia content, while others spent more time. When the views of the parents were analyzed, it was determined that the parents of those children who spent less time on multimedia restricted their usage and set time limits. One parent (P8) expressed their opinion on this situation thus: *"I check the time and I say that whatever you are watching or whatever activity you are doing, the time period [to do it] is over. Look, after what you're watching is over, we're done".* The parents of children who spent more time in multimedia environments associated this situation with the COVID-19 pandemic. For example, one parent (P3) stated that, *"As a mother, I limited my first two children's time using multimedia devices more, but at that time, there was an environment where the children could play outside. But with my third child, putting a time limit on media use is very difficult. We are at home and we can go to only certain places due to the pandemic. I can't limit it. Normally I am a restrictive mother, but now I have had to increase one hour of use to four hours".* Another parent (P16) said, *"He started spending more time on it because of the pandemic. His media use is around two hours a day. Unfortunately, I can't limit it to anymore".*

Reasons Why the Children Preferred Multimedia Content

The frequency distribution regarding the reasons why the children preferred multimedia content is given in Table 4.

Table 4. Frequency distribution of the reasons why the children preferred multimedia content

Theme	Code	F
Reasons for preference	Fun	13
	Playing games	9
	Training/Education	5
	Communication	1

When Table 4 is examined, the main reason children preferred multimedia content was for fun. When the parents' views were analyzed, it was determined that most of the parents had the same opinion that the media content entertained the children and therefore the children preferred these environments. One of the parents (P21) said, *"Those fast-changing colorful images are pleasing to the children. Therefore, they are having fun".* Another parent (P15) expressed this situation as, *"There are children dancing and singing and having fun on multimedia; my child watches them".* Some of the parents, consulted as to their opinions, stated that their children preferred multimedia devices for playing games due to their young ages. For example, one of the parents (P8) stated that, *"After all, this age group is at the age for playing. In other words, the only thing they need to do is playing and having fun from the games they play".* In addition, some parents stated that their children preferred multimedia because of their interest in learning new things. As an example of this, one of the parents (P6) said that, *"There are some channels that teach Spanish, German, English, Russian in a simple way. My child spends time on multimedia for learning those kinds of things. She's spending time in there like this not because of our guidance, but because of her own curiosity".*

Parents' and Children's Feelings about Multimedia Devices/Content

The frequency distribution of the parents' and children's feelings about multimedia is given in Table 5.

Table 5. Frequency distribution regarding the feelings of parents and children about multimedia

Theme	Code	f	
		Parents	Children
Feeling	Pleasure	11	19
	Displeasure	10	2

When Table 5 is examined, it is seen that there was a difference between the parents and children's feelings about multimedia devices/content. When the parents' views were analyzed, the majority of them stated that their children liked multimedia. According to the parents, their children enjoyed spending time in these environments. Regarding this situation, one of the parents (P20) said, *"He likes it so much. If I let him use multimedia, he uses it forever".* When the parents' own feelings about multimedia environments were examined, it was determined that some parents liked them, while some of them did not like. Some of the parents who liked multimedia environments stated that the reason why they liked multimedia was that their children had fun with it. For example, one parent (P3) stated that, *"When my child is happy, I am too."* Another reason why parents were satisfied with multimedia environments was that they could take the time for themselves when their children spent time on multimedia devices. Regarding this situation, one of the parents (P12) stated that, *"When the boy takes the smartphone in his hands, as parents we can rest for at least 30 minutes."* Those parents who were not satisfied with multimedia environments wanted their children to spend more time in real environments where they could engage in social relationships, rather than using technological devices. Regarding this situation, one of the parents (P15) said, *"I am not satisfied with multimedia environments. Why not? Because I want my child to communicate with people and play with other children more."*

Need for Adult Supervision of Multimedia Devices/Content

The frequency distribution regarding the need for adult supervision of multimedia use is given in Table 6:

Table 6. Frequency distribution regarding the need for adult supervision of multimedia use

Theme	Code	F
Adult supervision	Necessary in terms of content	16
	Necessary in terms of time	2
	Necessary in terms of device usage	2
	No need for adult supervision	2

When Table 6 is examined, it is seen that the majority of parents thought that adult supervision was needed when their children spent time in multimedia environments. In particular, they thought that supervision was needed because children are likely to

encounter harmful content in multimedia environments. For example, one of the parents (P9) stated that, *"Ads sometimes appear on the phone. Even if my child watches something else, she may come across harmful ads, and at this point it may be necessary to supervise her."* Another parent (P12) said, *"There is a really need to supervise them. That is to say, sometimes YouTube can suggest videos to the children according to the number of views. The videos it suggests contain harmful content for them. Therefore, parental supervision is absolutely vital."* Some of the parents added that adult supervision is needed in terms of controlling the time spent, in addition to the content watched. For example, one parent(P13) said, *"They need our supervision, in terms of content and duration. We try to choose appropriate content for their ages and we try to limit the time they spend using multimedia devices."* Again, some parents stated that their children needed support to use technological devices. For example, one parent (P8) stated that, *"Of course, like any child, my children may need my help to use technological devices."*

Harm to Children from Multimedia Use

The frequency distribution regarding the harm to children from multimedia use is given in Table 7.

Table 7. Frequency distribution of the harm to children from multimedia use

Theme	Code	f
Harms	Imitating negative behaviors	16
	Visual disorders	4
	Concentration problems	3
	Anger problems	3
	Dependent personality	3
	Absence of perception	3
	Sleeping problems	2
	Attention deficit disorder	2
	Inaction	1
	Wasting of time	1
	Introversion	1
	Inappetence	1
	Constipation	1
	Difficulty distinguishing reality from virtuality	1

When Table 7 is examined, it seems that the parents believed that multimedia use may cause various forms of harm to children. The harm most emphasized by the parents was that the children may imitate the negative behaviors they have seen on multimedia devices. When the views of the parents were examined, it was determined that the children may role-model many of the negative behaviors, such as violence and fighting, that they have encountered in multimedia environments. One of the parents (P9) stated that, *"When they see violent behaviors in cartoons and games, they try out these actions with their siblings and friends."* Another parent (P12) said, *"There are such harmful videos that I think they should be controlled by the state. When something happens that the child doesn't like, he screams, shouts, hits his friends. When he watches these things, he immediately puts it into practice. In other words, when he feels bad, he immediately starts hitting someone, and when his friend does not give him his toy, he starts shouting."* Also, some parents stated that children may develop visual disorders when they are exposed to multimedia environments too often. For example, one of the parents (P7) said, *"Setting everything else aside, even the damage which the smartphone causes to the child's eye is enough to say multimedia is harmful."* Furthermore, some of the parents stated that the multiple stimuli in multimedia environments had negative effects on children's concentration. One of the parents (P13) commented that, *"He is bombarded by stimuli from everywhere. He has trouble concentrating on one thing."*

Benefits of Multimedia for Children

The frequency distribution regarding the benefits of multimedia use for children is given in Table 8:

Table 8. Frequency distribution of benefits of multimedia use for children

Theme	Code	f
Benefit	Concept learning	20
	Foreign language learning	9
	Verbal skills	8
	Development of intelligence	6
	Values education	5
	Social progress	3
	Personality development	3
	Religious education	2
	Learning their role in the family	1

When Table 8 is examined, it is seen that almost all the parents had the opinion that multimedia use supports the children's process of concept learning. According to them, multimedia environments enable their children to understand concepts more easily by affecting more than one sense organ. With respect to this, one of the parents (P16) said, *"My child can't understand some concepts through my own teaching methods or my words, but when he watches them in multimedia environments, he catches on to them faster. I can accept that multimedia content is useful when considered from this point of view. For instance, the shapes are more colorful in multimedia. He may not understand a circle when I draw it on a sheet of paper at home, but when I show it to him on the screen, he grasps it faster because there are more options."* Some parents stated that multimedia environments contributed to their children's foreign language learning. According to these parents, their children learned the meaning and pronunciation of a number of words in foreign languages through multimedia use. For example, one of the parents (P6) stated, *"My child learned the numbers and the letters both in English and German."* Some of the parents considered that one of the benefits of multimedia use was in their children's verbal skills. According to these parents, words and sentences learned in multimedia environments influenced the children's verbal skills in their native language positively. Related to this, one of the parents (P21) said, *"So I can say that multimedia use affects my child's language development positively. My child forms the sentences and words she hears in multimedia environments and tries to use them in her own way. In fact, this situation surprises us when she says a different sentence at an unexpected moment."*

Concepts Learned in Multimedia Environments

The frequency distribution of the concepts the children learned from multimedia environments is given in Table 9:

Table 9. Frequency distribution of the concepts the children learned from multimedia environments

Theme	Code	F
Concepts learned	Number	17
	Color	15
	Geometric figures	8
	Antonyms	6
	Location/Position-in-Space	5
	Animal	4
	Sense	1
	Earthquake	1
	Death	1
	Family	1
	Plant	1
	Transportation	1
	Fruit	1

When Table 9 is analyzed, it is seen that the children had learnt many basic concepts from their multimedia use. According to the parents, the children were able to learn basic concepts such as numbers and colors before they started school. Regarding this situation, one of the parents (P5) stated that, *"Thanks to using multimedia, my child learned the colors, numbers, and then the names of animals even before he went to the school."* Another parent (P9) added that, *"My child learned the number and colors particularly well by using multimedia."* Some of the parents stated that multimedia use was also effective in learning the concepts of geometric figures, antonyms, and location/position-in-space. For instance, one of the parents (P16) stated that, *"My child learned such concepts as big/small and long/short through multimedia content".* Another parent (P18) said that, *"Although my child is so young, he learned concepts like behind/in front, above/below, on/off." When the views of the parents were examined, it was determined that one of the parents considered that multimedia use was even effective for learning abstract concepts such as "death".* This parent (P4) explained this by saying, *"My child started to realize what killing or death is. For example, he learned that a fish cannot survive outside of water."*

Multimedia's Contribution to Concept Learning by Type

The frequency distribution of the type of multimedia that contributes to the children's concept learning is given in Table 10:

Table 10. Frequency distribution of the type of multimedia contributing to concept learning

Theme	Code	F
Multimedia contributing to concept learning	Animated cartoon	14
	YouTube	13
	Digital game	6

When Table 10 is examined, it is seen that animated cartoons supported the children's concept learning the most. According to the parents, the children also used concepts that they have learnt from cartoon films in their daily lives. Regarding this situation, one parent (P20) said, *"Watching cartoons and learning a lot of concepts. Let me give you an example: when my child saw a crack in the concrete on the ground, he said, 'Mom, there may have been an earthquake here'. And then he continued, 'I think there was an earthquake here' and I asked why he thought that. He replied, 'Because when an earthquake occurs, the concrete may crack and*

collapse.'" According to the parents, one of the forms of multimedia that supported concept learning in their children was YouTube. The parents thought that many of the concepts that they had difficulty teaching were easier for children to learn thanks to YouTube. Regarding this situation, one parent (P4) said, *"My child uses YouTube most. Thanks to this app, he has learnt the shapes very well. For example, when we tried to teach shapes to our child, he did not want to learn from us because he was stubborn. Thanks to these educational videos on YouTube, our child learned the shapes on his own."* According to the parents, another type of multimedia that contributes to their children's concept learning is digital games. The parents believed that their children learned many concepts while playing multimedia games. For example, one parent (P14) said, *"We downloaded a game program to the smartphone. The shapes, numbers, and colors are taught in this program. For example, when he gets bored, he wants to play a game and opens that program. In this way, he learned a lot of shapes."*

DISCUSSION, CONCLUSION and RECOMMENDATIONS

This research found that technological devices that offer multimedia content to preschool children have now become part of their lives. Television, smartphones and tablets, in particular, constitute the multimedia environments in which children now spend their time. Given today's technological conditions, this situation can be considered quite natural, because these technological devices are now very easy to access. The study conducted by Kabali et al. (2015) with parents confirms this view. In that study it was determined that most of the parents with children aged between six months and four years old had a television, smartphone and tablet in their homes. Similar findings were obtained in the studies conducted by Kulakçı Altıntaş (2018) and Topan and Kuzlu Ayyıldız (2018), and it was determined that televisions, smartphones and tablets constituted the first three technological devices which preschool children spend time using. It can thus be said that today's technological devices play a major part in children's lives from a very young age. In a study conducted by Linebarger and Walker (2005), parents stated that their children became interested in watching television for the first time when they were nine months old. In the study conducted by Gündoğdu et al. (2016), some parents stated that their children learned to use a smartphone or tablet even before they could talk.

Within the scope of the study, it was determined that the duration of time the children spent using multimedia devices varied. While this period was less than 30 minutes for some children for others it was three hours or more. Similar findings have been obtained in other studies found in the literature. In the study conducted by A. Bulut (2018), it was determined that the time children spent using technological devices varied between 30 minutes and four hours. Again, in the study conducted by Ergüney (2017), it was determined that preschool children used the internet for one to four hours. It can be said that parental attitudes play an important role in varying the duration of time children spend with technological devices. As a matter of fact, in the present study, it was determined that the parents of the children who spent less time in multimedia environments had set specific time limits for them. Another reason for the variability in the duration of time spent using multimedia devices may be associated with the amount of time the parents themselves spend in this way. The study by Carson and Jannsen (2012) also supports this view: they determined that there was a positive relationship between the time children spent in front of a screen and the time spent by their parents in front of a screen. Again, Kılıçkaya et al. (2018), it was found that there was a direct relationship between the duration of mothers' smartphone usage and the amount of time their children spent on the tablet and smartphone. In addition, in the present study, it was determined that some parents thought that the pandemic had led to an increase in the time children spent viewing multimedia content. The parents stated that their children stayed at home due to the pandemic and did not have the opportunity to play outside, and that this situation increased their time spent in multimedia environments. The study by Kızıltaş and Ertör (2018) also supports this opinion: they determined that children prefer to play games outside rather than playing games on smartphones.

The present study found that the main reason why the children preferred multimedia content was that they found it to be fun. It can be suggested that the primary cause of this situation is that multimedia content includes elements that entertain children, such as animation, images, and music. A similar finding was obtained in the study conducted by Altun (2019) and it was determined that children generally spent time on the internet for fun. In the current research, another reason why children liked multimedia content was for gaming. It is quite natural for preschool children to make choices like this as a result of their young age. Similar findings have been obtained in many studies in the literature. In the study conducted by Ateş and Durmuşoğlu Saltalı (2019), it was concluded that children used digital technologies mostly for games and entertainment. In the studies conducted by Özkan (2017), Özyürek (2018), and Yılmaz Genç and Fidan (2017), it was determined that most of the children used computer technologies for games. Again, in the study conducted by Sezgin and Tonguç (2016), it was found that most of the parents gave their mobile devices to their children so that they could play games.

The vast majority of the parents whose opinions were received as part of the present study stated that their children enjoyed spending time viewing multimedia content. Given that children used multimedia for fun and games, it was to be expected that they enjoyed spending time in these environments. A similar finding was obtained in the study by Lepicnik and Samec (2013), which most of the parents stated that their children were interested in technological devices and liked to use them. In the present study, when the opinions of the parents about this situation were examined, some parents stated that they themselves liked that their children spent time in multimedia environments. One of the most important reasons for this feeling was that when the children spend time using multimedia devices, the parents may have the opportunity to take time for themselves. The study conducted by Kabali et al. (2015) also supports this view: most of the parents stated that they gave technological devices to their children when the parents had to carry out various household tasks. Dorey et al.'s (2009) study found that parents saw one of the benefits of television as being that it kept their children busy while the parents dealt with household chores such as cooking or cleaning. In other words, parents like their children spending time in multimedia environments because multimedia devices keep the children occupied. In the study conducted by Ateş and Durmuşoğlu Saltalı (2019), it was determined that parents see digital technologies as devices which can

entertain children, and that the parents themselves guide their children in using digital technologies. Again, in the study conducted by Kızıltaş and Ertör (2018), it was determined that the parents perceived smartphones to be ideal devices to keep children engaged.

Another notable finding of the study was that the majority of parents thought that their children need adult supervision while spending time in multimedia environments. According to Park and Park (2014), children need adult supervision because children's self-control is very poor. According to Güngör (2014), preschool children's use of computers and television helps them in many ways, as long as there is adult supervision. The majority of the parents whose opinions were sought in the present study thought that such monitoring was needed, especially in terms of content. They believed that their children were likely to encounter harmful contents in multimedia environments. In the study conducted by A. Bulut (2018), parents expressed a similar opinion and stated that children were at risk of encountering dangerous content while using technological devices. Again, in the study conducted by Yılmaz Genç and Fidan (2017), parents stated that they were worried about the possibility of their children encountering harmful content while using tablets. Parents can monitor content by either determining the content to be watched by the children or by watching the content with their children. Studies in the literature show that adults often engage in such behavior to assess content. In a study with mothers by Banko, İlhan and Şallı (2017), most of the mothers stated that they let their children watch television in a controlled manner by setting a time limit and choosing which program to watch. In the study conducted by Koçak and Göktaş (2020), parents stated that they watched animated films together with their children in order to guard them from any harmful effects that may be present. In the study conducted by Gündüz Kalan (2010), it was found that parents actively chose which programs their children watched. In the study conducted by Konca (2019), it was determined that children were guided by their parents during digital activities. In the study conducted by Jinqiu and Xiaoming (2004), it was determined that most of the parents encouraged their children to watch specific programs.

In the present study, the parents stated that multimedia has many potential sources for harm for children. The most common source of harm was that the child may imitate the negative behaviors they have seen. In the study conducted by Rideout and Hamel (2006), most of the parents stated that their children tended to imitate the behaviors they had seen on television. In the study conducted by A. Bulut (2018), the parents stated that their children admired imaginary characters and tried to imitate them. According to Can (1995), children are most influenced by the behavior of cartoon characters and the words they use. Animated cartoons with violent content, which can be very visually engaging, affect preschool children greatly. According to Güleken Katfar (2019), children are not aware of the negative side of violence and imitate these behaviors because they find them funny and entertaining. In the study conducted by Türkkent (2012), mothers and preschool teachers shared a common opinion regarding this situation. They believed that children often imitated the characters in violent cartoons and engaged win these behaviors with their friends. In addition, the parents in the present study also noted that multimedia has many other negative effects such as causing visual disorders, sleeping problems, anger problems, dependent personalities, and attention deficit disorder. Studies conducted in the literature have also found similar harmful effects. They show that technological devices have negative impacts, including visual disorders (Altınkılıç, 2014; Ateş & Durmuşoğlu Saltalı, 2019), dependent personality (Ateş & Durmuşoğlu Saltalı, 2019; Park & Park, 2014; Yalçın & Erden, 2018; Yılmaz Genç & Fidan, 2017) sleeping problems (Altınkılıç, 2014), anger problems, attention deficit problems (A. Bulut, 2018) and a lack of physical activity (Ateş & Durmuşoğlu Saltalı, 2019; A. Bulut, 2018).

In the research, the parents expressed the opinion that multimedia is beneficial for children in many ways. According to the parents, multimedia content positively influences children's foreign language learning. The study conducted by Od (2013) also supports this view. In his study, Od (2013) determined that the use of animated cartoons in foreign language teaching at an early age positively affected children's listening and speaking skills, and that using multimedia devices increased children's motivation to learn a foreign language. A study conducted by Silverman and Hines (2009) found that multimedia-supported teaching positively affected children's general English vocabulary. In the study conducted by Duisembekova (2014), it was determined that the songs that children watched on YouTube contributed to the children's vocabulary learning. The parents also expressed the opinion that multimedia contributes positively to children's native language speaking skills. A similar finding was obtained in the study conducted by A. Bulut (2018), in which parents stated that the use of technology helped preschool children to construct complex, grammatically correct sentences and enriched the children's vocabulary. In the study by Özkılıç Kabul (2019), it was determined that the language development levels of children who used smartphones were higher than of those who did not. According to the research, multimedia content supports children's native and foreign language learning in a positive way. According to Jinqiu and Xiaoming (2004), children learn the language seen on the screen more easily when they watch television. In the present study, the parents also stated that multimedia contributes positively to values education, too. The study conducted by Hamarat, Işıtan, Özcan and Karaşahin (2015) also supports this. In their study, they examined the two cartoons terms of the values they presented, and it was determined that both social and individual values were involved in both cartoons. In the study conducted by Öztürk Samur, Durak Demirhan, Soydan and Önkol (2014), preschool teachers stated that they believed a cartoon that children had watched to be positive in terms of values education.

In the current research, the benefit of multimedia usage most emphasized was concept learning. The parents believed that their children learned many basic concepts through multimedia. A similar finding was obtained in the study by Kurt (2014), in a study that examined the opinions of children, parents and teachers about a children's channel. It was determined that the teachers, children and parents agreed that the channel positively influenced the process of concept learning. In the present study, it was determined that the parents believed that the children learned numbers and colors more easily in multimedia environments. A similar finding was obtained in the study by Yalçın and Erden (2018), in which the parents stated that their children learned the concepts of colors and numbers through multimedia. Many experimental studies conducted in the literature have observed that multimedia (Çakıroğlu & Taşkın, 2016; Kaya, 2005) or computer-aided instruction offering multimedia (Alabay, 2006; Çeliköz & Kol, 2016; Demir & Kabadayı, 2008; Kacar, 2007; Kesicioğlu, 2011) positively affected the concept learning of preschool children.

In the present study, the parents' view was that animated films were most important in terms of the multimedia content that best supported concept learning in children. According to Dalacosta et al. (2009), animated films are multimedia content which help children to concretize abstract concepts. Cartoons should thus not be considered solely as entertainment. Children are also able to enrich their vocabulary thanks to watching cartoons (Soumya, Eljo & Anitha, 2014). Studies by Coşkun and Köroğlu (2016) and Fırat (2019) examining cartoons in terms of concept teaching also support this view. Both these studies showed that animated cartoons contribute to concept teaching. Again, Öztürk Samur et al. (2014) stated that preschool teachers found a cartoon that children had watched to be positive in terms of concept teaching. In the present study, the parents stated that another multimedia application that contributes to children's concept learning was YouTube. According to Kaynak (2020), YouTube is now watched more than any individual television channel. YouTube has many channels that appeal to children and attract their attention (Ergün Özdel, 2019). Kabali et al. (2015), in his study with parents, determined that YouTube is popular even among children aged 1-2 years. According to Gülmez (2019), YouTube enables preschool children to concretize concepts because it engages many different sense organs. In the present study, another form of multimedia that parents thought contributed to concept learning was digital gaming. Toran et al. (2016), in a study conducted with mothers on children's use of digital games, found that the children were generally introduced to digital games around the age of three, although the earliest age was about one-and-a-half years old, according to some of the mothers. In the studies conducted by Çankaya (2012) and Çoruh (2004), it was determined that computer games positively influenced concept learning in preschool children.

As a result of the current research, it can be said that technological devices that offer children multimedia content have a positive effect on children's learning of basic concepts. According to Grubb (2000), introducing children to technological devices in the early stages of concept acquisition will enrich their learning environments, which will contribute to how children acquire concepts. In the study conducted by Li and Atkins (2004), it was determined that children who had access to a computer learned concepts better. In the study conducted by Oluwadare (2015), it was determined that using information and communication technologies in the preschool period contributed to children's understanding of concepts related to numbers and natural sciences. Multimedia content thus enables children to learn basic concepts at an early age. According to Bracken and Schaughnessy (2003), the earlier children learn basic concepts, the sooner they will understand their environment, adapt to the environment and communicate effectively. In addition, children's learning the basic concepts at an early age will form the basis of their future schooling. As a matter of fact, in the study conducted by Östergren and Traff (2013), it was determined that knowledge of numbers acquired in the early childhood period positively influenced first-grade arithmetic skills'.

Parents should be advised to encourage children to use technological devices not only for entertainment and games, but also for educational purposes, especially during the current period when children are forced to remain at home due to the pandemic. In this regard, it is suggested that parents consider technological devices not only as tools that can distract and engage children, but as multimedia device that provide children with learning environments. This study examined the role of multimedia in the concept learning process on the basis of parents' views. Further studies could be carried out including observations of the actual time children spend in multimedia environments.

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Review Paper

Postgraduate Theses on Digital Literacy in Turkey: A Content Analysis Study

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ABSTRACT
The purpose of this research is to reveal the research trends of postgraduate theses published in the field of digital literacy published in Turkey between 2015 and 2020. In this context, a total of 34 postgraduate theses on digital literacy published between 2015 and 2020 in the database of YÖK (Higher Education Institution) National Thesis Centre were examined. In the examination of the theses, the publication classification form including year, level, language, department, research method, research design, sample, the determination method of the sample, number of sample, data collection tool, data analysis techniques, research topic, and research results were used. According to the results of the research, it was determined that the number of studies published in the field of digital literacy increased until 2019 and decreased in 2020. It was also determined that these theses are generally carried out at the master's level and mostly regarding the department of Computer and Instructional Technology Education. Another finding was that common methods and designs used in these studies are the quantitative research method and descriptive and relational research design. Considering the sample in the theses, it was determined that pre-service teachers and university students constitute the sample and that the convenience sampling method is used. The topics were mainly about the examination of digital literacy level based on various variables and the highest digital literacy levels of secondary and high school students were found to be the highest in the results obtained.

INTRODUCTION

In today's globalized world, the individual's ability to compete with other individuals and survive depends on understanding the changing and transforming the world and gaining the basic required knowledge and skills as soon as possible. Particularly in the 21st century, rapid technological developments have made it a necessity for individuals to acquire new skills. One of these skills is digital literacy (List, 2019). The concept of digital literacy was coined by Gilster. According to Gilster (1997), digital literacy is the ability to use, analyse and evaluate digital resources, tools, and services appropriately and apply them to lifelong learning processes. Today, the concept of digital literacy has become related to many fields, from education to health sciences, law, banking, commerce, and media, depending on the developments in the internet and mobile applications (McDougall, Readman & Wilkinson, 2018).
Digital literacy is a key concept in reaching the information society and constitutes one of the most important elements of digital citizenship, together with digital access, digital commerce, digital communication, digital ethics, digital law, digital rights and responsibilities, digital health, and digital security. Digital citizenship is defined as individuals who use digital tools correctly, respect ethical rules and personal rights on digital platforms, and use these tools safely and responsibly (Çubuk & Bayzan, 2013).
Digital literacy, on the other hand, is to interpret and evaluate the information presented in digital environments with a critical perspective (Mossberger, Tolbert., & McNeal, 2007) or to reach the right information in digital environments, to be aware of producing the right information and sharing the right information, and to use technology in learning and teaching processes (Çubuk & Bayzan, 2013). Accordingly, digital literacy is sometimes defined as the technical use of information and communication technologies while also being defined as the ability to produce information. However, the widespread use of the internet and the proliferation of personal and mobile devices have further increased the effective use of digital resources and the importance of digital literacy. Digital literacy is to perform the action of literacy using digital tools for the individual (Maden, Maden & Banaz, 2018). It requires having functional and digital skills while accessing information (Polizzi, 2020). It also covers the basic knowledge and skills that will enable the individual to be safe in online environments (Yalçınkaya & Cibaroğlu, 2019). For this reason, digitally literate individuals should have higher-order thinking skills such as research, questioning, critical thinking, and problem-solving.

Eshet Alkalai (2004) defines digital literacy as the ability to survive in the digital age while Ng (2012) defines it as the ability to adapt to emerging new and modern technologies. Martin (2005), on the other hand, refers to digital literacy as the awareness, attitude, and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse, and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process. However, it is stated in the literature that digital literacy is an umbrella literacy that includes information literacy, computer literacy, media literacy,

communication literacy, visual literacy, and technology literacy (Covello, 2010). Furthermore, skills considered to be essential for digital literacy are to be technology-focused, goal-directed, digital reading focused and reflecting critical use (List, Brante & Klee, 2020). Four components of digital literacy are technical skills, information usage, communication, and creation (Moon & Bai, 2020). Accordingly, technical skills to use digital tools, ability to access information while solving problems, ability to interpret, analyse and evaluate information, to connect with other individuals in online environments, communication and ability to produce information in digital environments constitute the components of creating digital literacy. Besides, there are 8 components of digital literacy including creativity, critical thinking and evaluation, cultural and social understanding, collaboration, the ability to find and select information, effective communication, e-safety, and functional skills (Payton & Hangue, 2010). Therefore, digital literacy is a fairly broad multi-dimensional concept that includes technical and cognitive behaviors on one side and social and affective behaviors on the other.

Although digital literacy is a relatively newly defined concept, it is one of the most researched topics due to its content, scope, related disciplines, and expectations in the individual and society. However, considering the studies conducted in Turkey on digital literacy, Dönmez (2019) examined the relationship between awareness of information security and digital literacy in high school students, concluding that there is a positive and significant relationship between students' awareness of information security and digital literacy. Kaya (2020) examined the relationship between digital literacy and digital citizenship in his study on secondary school students, reporting that there is a positive and significant relationship between them because of the research. Kul (2020) analysed the relationship between digital literacy levels of university students and internet addiction, reporting that there is a positive significant relationship between students' digital literacy and internet usage time. In their study on digital transformation and digital literacy in Turkey, Karabacak & Sezgin (2019) reported that there is a digital transformation in the field of education in Turkey and there is a need for projects to increase digital literacy competence for the relevant transformation to take place quickly. Kozan & Bulut Özek (2019), on the other hand, investigated pre-service computer and instructional technologies education teachers' sensitivities towards digital literacy and cyberbullying, concluding that the pre-service teachers' sensitivity towards digital literacy and cyberbullying was at a high level. In their study on the digital literacy level of pre-service science teachers, Üstündağ, Güneş & Bahçıvan (2017) found that the digital literacy of pre-service science teachers was at a good level. Finally, Yıldız (2020) analysed the views of academics on digital literacy, reporting that academics are familiar with the concept of digital literacy and ready to participate in training programs to be provided by relevant institutions and organizations. On the other hand, Onursoy (2018) conducted a study on the digital literacy levels of university students and reported that university students' use of digital tools and spending more time in digital environments does not mean that they use digital technologies wisely and that there is no relationship between critical perspective and digital skills. Bayrakçı (2020), Hamutoğlu, Canan, Kaya & Gür (2017), and Aydemir, Sakız & Doğan (2019) developed scales and rubrics to measure the digital literacy skills of university students, pre-service teachers, and primary school students.

Significance of the Study

There has been a recent increase in academic studies published on the digital literacy subject. This is also the case for postgraduate theses. Postgraduate theses are among the most important information production and dissemination tools of Higher Education institutions (Universities). In addition, postgraduate theses are reports of a series of academic activities for scientific research and applications and contribute to the realization of various purposes such as producing information and spreading, raising qualified human resources, and offering solutions to social problems. Postgraduate theses are also the concrete outputs of educational activities at the highest level as an indicator of the scientific quality of the Master's and doctoral programs in higher education institutions. Therefore, it is important to examine the postgraduate theses published in Turkey in terms of the research subject, research method, sample, data collection tools, data analysis techniques and to reveal the impact value of the information, the publication of the produced information, the general view specific to the subject, and the current trend.

When the literature is examined, it is seen that there are many studies that focus on postgraduate theses in different disciplines in Turkey (Bıkmaz, Aksoy & Altınyüzük, 2013; Daşdemir, 2018; Gökmen et al.2017; Karadağ, 2010; Yavuz & Yavuz, 2017). On the other hand, it is striking that there are no content analysis studies examining the research processes specific to the digital literacy subject in Turkey. In this context, it is reported that such content analysis studies play an important role in the dissemination of information, guiding future research, and shaping new policies, new practices and public perception specific to the subject (Suri & Clarke, 2009; Çalık & Sözbilir, 2014). It is known that content analysis is the synthesis and interpretation of studies on a specific subject with a critical point of view or systematic studies that evaluate the results and tendencies of studies on a particular subject (Çalık & Sözbilir, 2014). Accordingly, the examination of the postgraduate theses published by the universities in Turkey in terms of the research subject, research method, and the results obtained will contribute to the dissemination of information about digital literacy and revealing the needs and deficiencies in the field. It will also guide researchers who are doing and will do research on digital literacy. Apart from this, it is thought to be important in terms of providing the opportunity to do a comparison of these theses with the theses published abroad on digital literacy.

Objective

The objective of this study is to reveal the research trends of postgraduate theses published in the field of digital literacy published in Turkey during the period of 2015-2020. In this context, answers were sought for a total of twelve research questions, three of which were related to the demographic characteristics of the postgraduate theses, eight of which were related to the research subject and method, and one of which was related to the research result. These are as follows:

1. How is the distribution of postgraduate theses by years?
2. How is the distribution of postgraduate theses according to research types?
3. How is the distribution of postgraduate theses according to the department?
4. How is the distribution of postgraduate theses according to the research subject?
5. Which methods were used (qualitative, quantitative, and mixed)?
6. Which research designs were used?
7. Who constitutes the sample?
8. Which methods were used to determine the sample?
9. What is the number of the sample?
10. Which data collection tools were used?
11. Which data analysis techniques were used?
12. What are the results?

METHOD

Research Model

This research was designed according to the content analysis method, which is one of the qualitative research methods in terms of the process it follows. Content analysis is a scientific method that collects similar data within the framework of certain concepts and themes and examines them objectively and systematically (Krippendorff, 2018; Yıldırım & Şimşek, 2013). From this point of view, the term content analysis was used as a research method rather than a data analysis technique. In addition, the content analysis method was applied in the study because it was aimed at presenting the current situation descriptively in terms of the research subject, method, and results of postgraduate theses on digital literacy in Turkey.

Population and Sample

The population of this research consists of postgraduate theses on the digital literacy subject in the database of the Higher Education Institution (YÖK) National Thesis Centre. The research sample was determined according to the purposeful sampling method depending on the subject area. Purposeful sampling is used to select and analyse events, situations, or facts based on certain characteristics (Büyüköztürk et al., 2012). There is no postgraduate thesis on the subject of digital literacy published before 2015 in the database of the Higher Education Council (YÖK) National Thesis Centre. In this framework, the sample consists of 34 postgraduate theses, 30 of which are master's theses and 4 doctoral theses published between 2015 and 2020 with open access.

Data Collection Tools

In the study, the "Publication classification form" developed by Sözbilir, Kutu & Yaşar (2012) was used to evaluate the theses related to digital literacy. However, depending on the purpose of the research, some changes were made in the publication classification form by the researchers to facilitate the classification of the information about the theses. Accordingly, the digital literacy publication classification form (DLPF) includes the publication year, type, department, research subject, method, research design, sample determination method, number of samples, data collection tool, data analysis, and results obtained in the research.

Data Collection Process

Within the scope of the research, the steps in Figure 1 were followed sequentially in the process of collecting data on postgraduate theses.

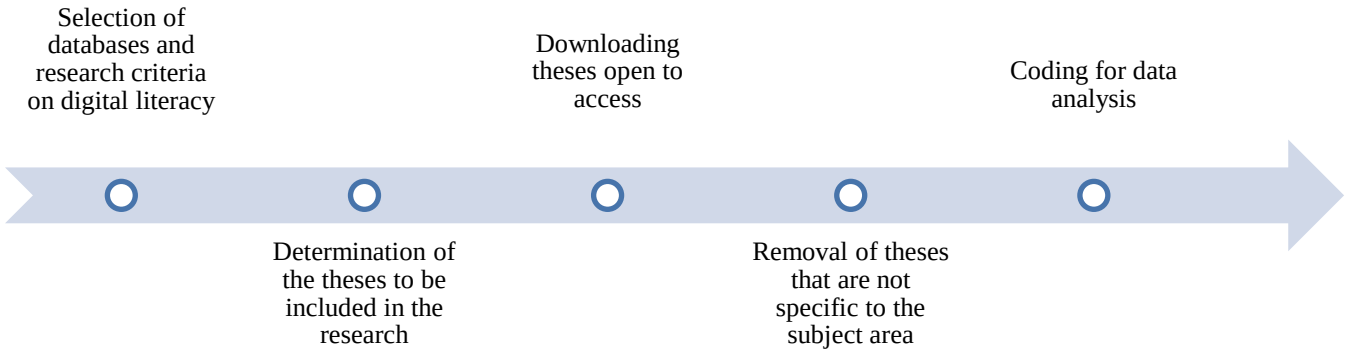

Figure 1. Data collection process

In the first step of the data collection process of the research, the keywords to be searched in the database of the YÖK National Thesis Centre were determined. For this, a literature review was made, and it was observed that the keywords "digital literacy" and "numerical literacy" are generally used in the same sense. In this context, these keywords were searched separately in the database of the YÖK National Thesis Centre and related theses that are open to access were obtained. Firstly, 72 results were obtained, including 53 Master's and 19 doctoral theses. With the subsequent preliminary examination, 23 Master's and 15 doctoral theses that

are not specific to the subject area of digital literacy (digital citizenship, financial literacy, digital applications, digital intelligence, digital data security, etc.) 34 theses were included in the scope of the research. Then, the data collection process was completed by transferring the data obtained according to the digital literacy publication classification form created by the researchers to the computer environment.

Data Analysis

The categorical analysis technique was used in the analysis of the collected data. Four steps were followed in the categorical analysis technique. In the first step, the theses were saved in the computer in two folders as master's and doctoral theses. Starting from the master's theses, each one was given a code according to the thesis number order given by the National Thesis Centre. These codes were used in the analysis and presentation of the findings. In the second step, an Excel worksheet was created to enter the data to be obtained for each heading in the data collection tool. The serial numbers of the analysed theses were written in the rows in the Excel worksheet, and the headings for the research problems were written in the columns. In the third step, the theses were examined in detail according to the headings for each research problem and the tables were filled. In the fourth step, the data were arranged in a meaningful way and reported after frequency and percentage calculations were made. The findings were presented to the reader with percentages and frequencies using graphics. In addition, the procedures to ensure the validity and reliability of the study were (i) to explain the data collection and analysis processes in detail, (ii) to create the encoding key named publication classification form, and (iii) to get assistance from an independent encoder.

FINDINGS

This section includes the findings related to postgraduate theses on digital literacy in Turkey published between 2015 and 2020.

Findings Related to the Demographic Characteristics of Digital Literacy Theses

Type of theses

It was observed that most of the postgraduate theses published in the field of digital literacy are master's degree theses. Accordingly, 30 (88%) of the theses published between 2015 and 2020 are master's theses, while 4 (12%) are doctoral theses.

Distribution by Years

The distribution of postgraduate theses on digital literacy by years is presented in Figure 2.

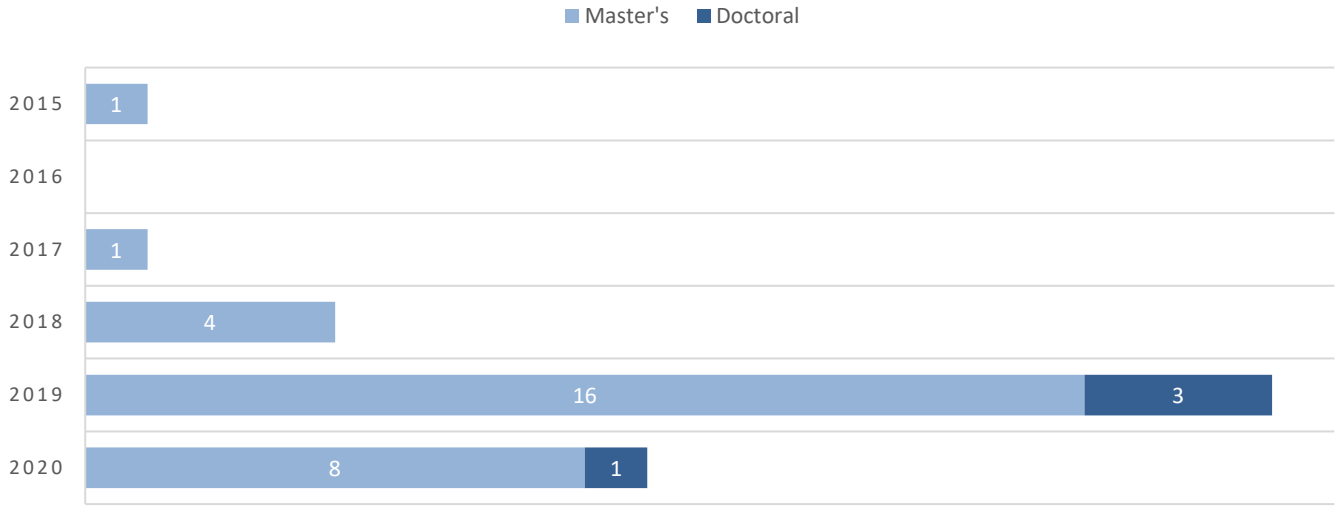

Figure 2. Distribution of postgraduate theses on digital literacy by years

Figure 2 reveals that postgraduate theses on digital literacy were mostly published in 2019 between 2015 and 2020. Accordingly, 19 theses, 16 of which are master's and 3 of which are doctoral, were published in 2019. Within the scope of the research, it was determined that the years with the least number of studies were 2015 and 2017; however, no graduate thesis was published in 2016 on digital literacy. It was also observed that the number of theses on digital literacy, which has been increasing since 2015, decreased after 2019.

Distribution According to Original Language

The distribution of the postgraduate theses on digital literacy according to the original languages in which they were written is presented in Figure 3.

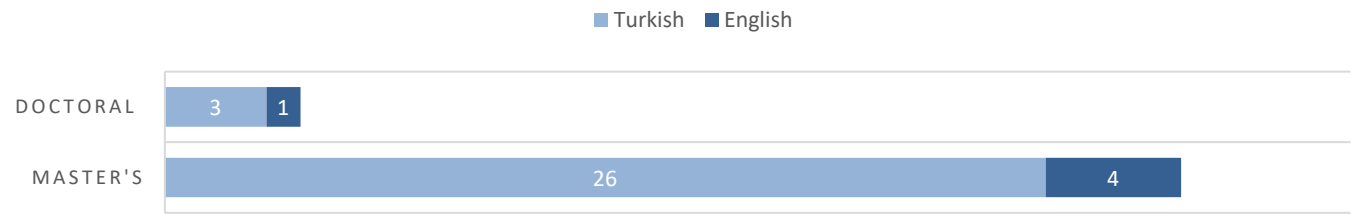

Figure 3. Distribution of the postgraduate theses on digital literacy according to the original languages in which they were written**.**

According to Figure 3, a total of 29 (85%) publications were published in Turkish, 26 at the Master's level and 3 at the doctoral level, on the subject of digital literacy, while a total of 5 (15%) publications, 4 at the Master's level and 1 at the doctoral level, were published in English.

Distribution According to the Department

The distribution of postgraduate theses on digital literacy according to departments is presented in Figure 4.

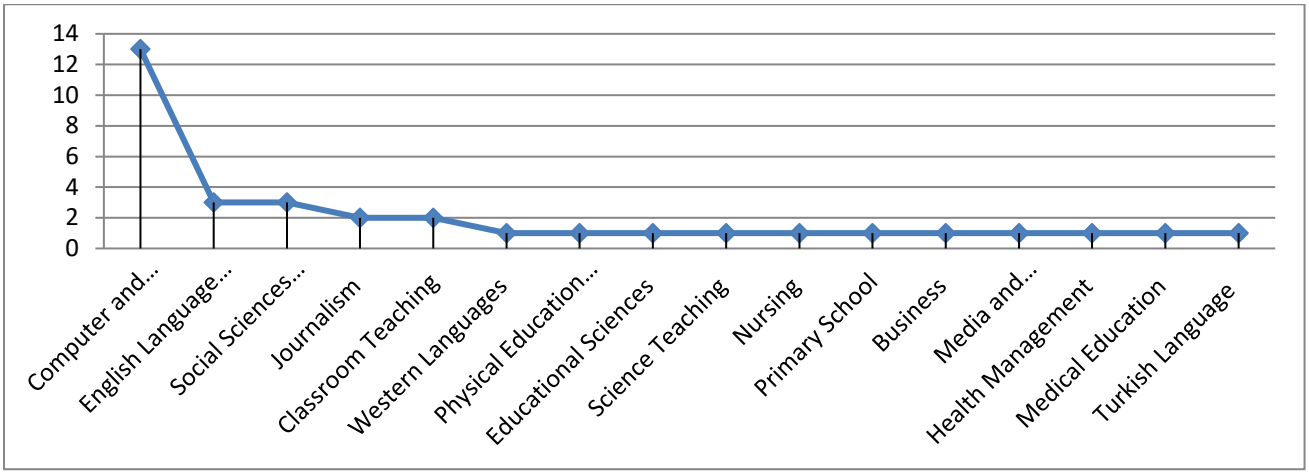

Figure 4. Distribution of postgraduate theses on digital literacy according to departments

Figure 4 reveals that postgraduate these on digital literacy were published mainly in the Department of Computer and Instructional Technologies (f=13) followed by the departments of English Language Teaching (f=3), Social Sciences Teaching (f=3), Classroom Teaching (f=2), and Journalism (f=2). Besides, at least one postgraduate thesis was published in 11 different departments (Western Languages, Physical Education, Educational Sciences, Science Teaching, Nursing, Primary School, Business, Media and Communication, Health Management, Medical Education, and Turkish Language).

Distribution According to Research Subjects

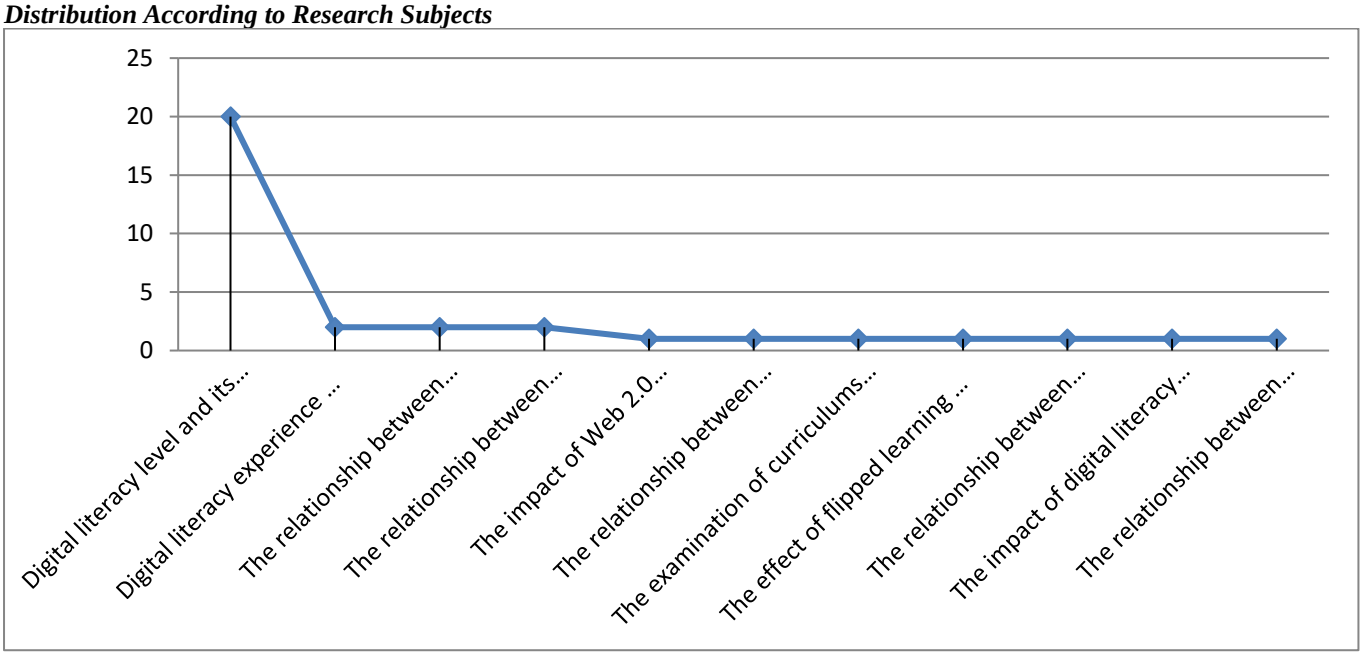

Figure 5. Research subjects of postgraduate theses on digital literacy

As can be seen in Figure 2, the common research subject on digital literacy is digital literacy level and its examination in the context of various variables (f = 20) followed by the digital literacy experience and its reflection on daily life (f = 2), the relationship between digital literacy and health literacy (f = 2), and the relationship between digital literacy and lifelong learning dispositions (f = 2). Besides, there are also some publications on information security (1), digital citizenship (f = 1), financial literacy (f = 1), awareness of online privacy (f = 1), and the impact of flipped learning (f = 1) and web 2.0 applications (f = 1) on digital literacy.

Findings Regarding the Method of Theses on Digital Literacy

Distribution According to the Research Method

Findings regarding the research method of graduate theses on digital literacy are presented in Figure 6.

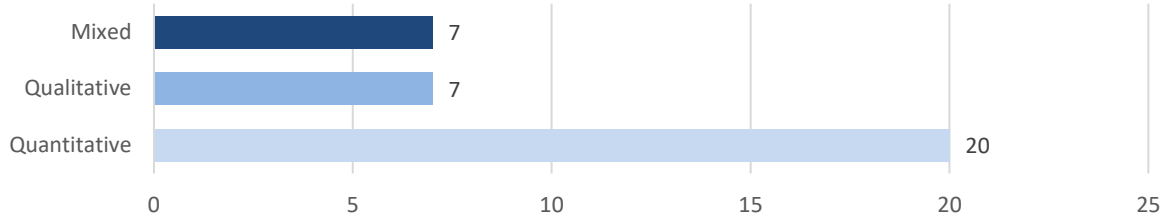

Figure 6. Distribution of graduate theses on digital literacy according to research methods

Figure 6 reveals that quantitative research methods (f = 20) were mainly used in theses on digital literacy, followed by qualitative (f = 7) and mixed research methods (f = 7), respectively. In the study, it was also determined that quantitative research methods were used more than the sum of qualitative and mixed research methods.

Research Design

The findings regarding the research designs used in the postgraduate theses on digital literacy are presented in Figure 7.

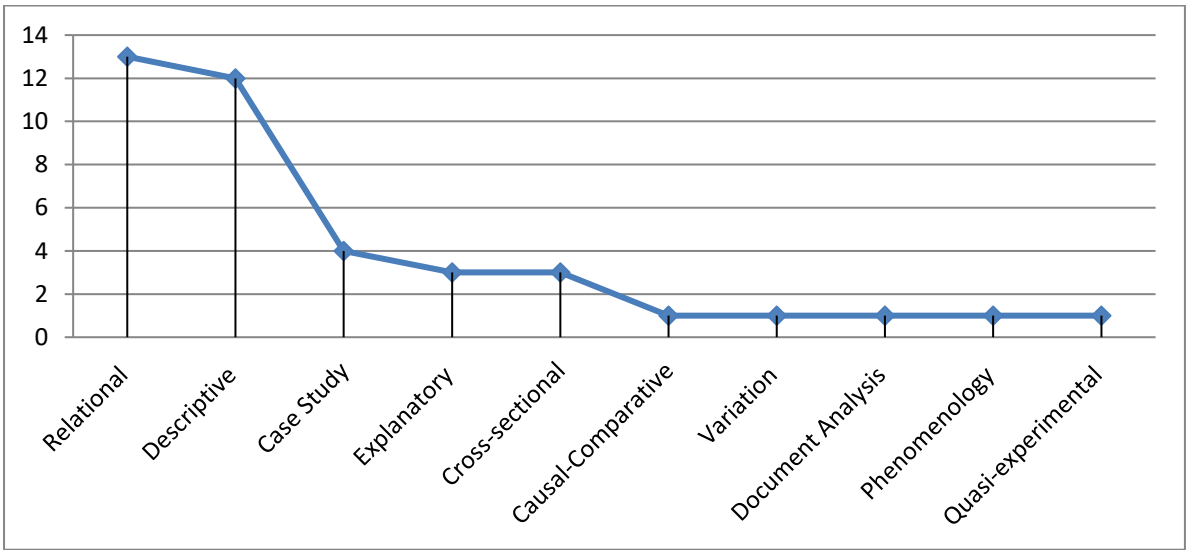

Figure 7. Research designs used in the postgraduate theses on digital literacy

Figure 7 reveals that most common research designs were relational (f=13) and descriptive (f=12) research designs followed by case study (f=12), explanatory (f=3) and cross-sectional (f=3) research designs. The least common ones were causal-comparative (f=1), variation (f=1), document analysis (f=1), phenomenology (f=1) and quasi-experimental (f=1) research designs.

Research Sample

Findings regarding the sample distribution of postgraduate theses on digital literacy are presented in Figure 8.

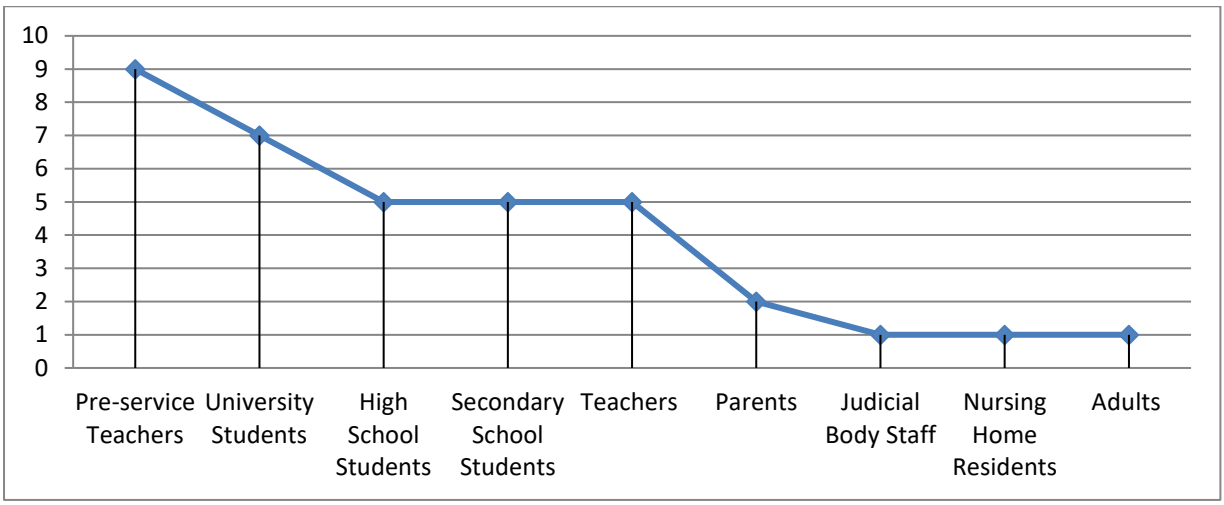

Figure 8. Sample groups used in postgraduate theses on digital literacy

Figure 8 reveals that sample groups in postgraduate theses on digital literacy are comprised of mainly pre-service teachers (f=9) and university students (f=7) followed by high school students (f=5), secondary school students (f=5), teachers (f=5), parents (f=2), judicial body staff (f=1), nursing home residents (f=1) and adults (f=1). Besides, some theses consist of more than one sample group.

Sampling

Findings regarding sampling methods used in postgraduate theses on digital literacy are presented in Figure 9.

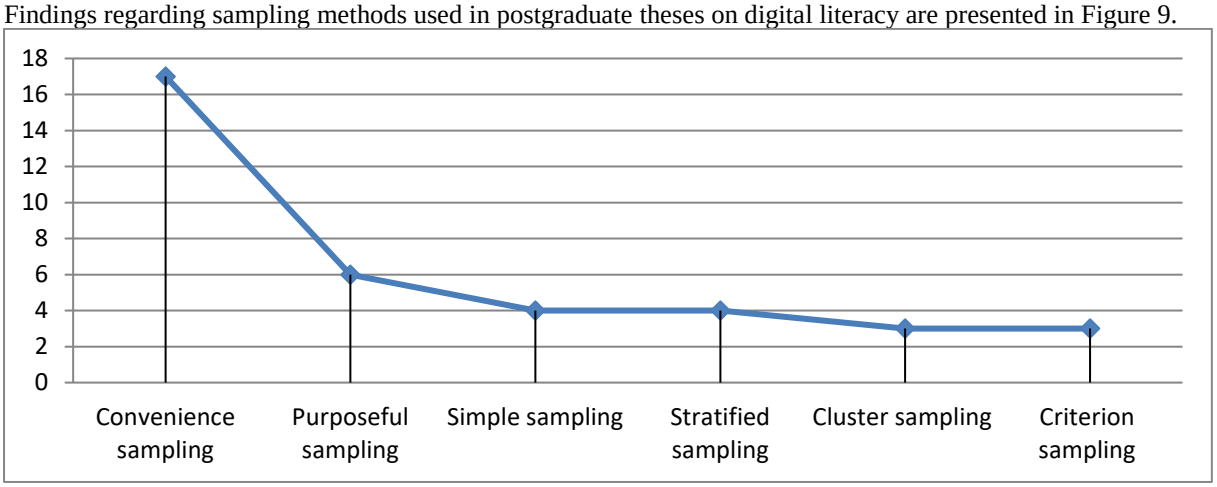

Figure 9. Sampling methods used in postgraduate theses on digital literacy

Figure 9 reveals that the most common sampling methods used in postgraduate theses on digital literacy are convenience sampling (f=17) followed by purposeful sampling (f=6), simple sampling (f=4), and stratified sampling (f=4). The least preferred ones are cluster sampling (f=3) and criterion sampling (f=3).

The Number of Samples

Findings regarding the number of samples used in graduate theses on digital literacy are presented in Figure 10.

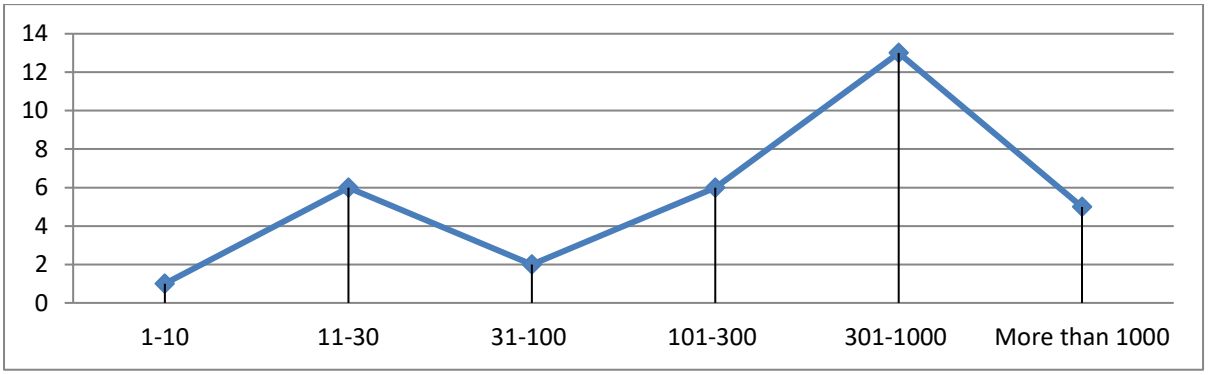

Figure 10. The number of samples used in graduate theses on digital literacy

Figure 10 reveals that the number of samples ranges mostly between 301 and 1000 (f=13) followed by the range of 11-30 (f=6) and 101-300 (f=6). The least preferred number of samples is 1-10 (f=1).

Data Collection Tools
Findings regarding the data collection tools used in graduate theses on digital literacy are presented in Figure11.

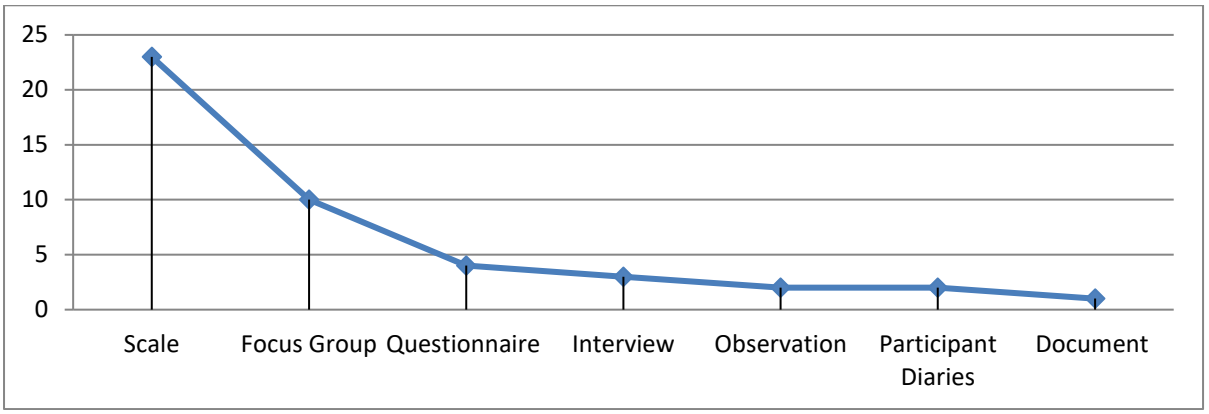

Figure 11. Distribution according to the data collection tools used in graduate theses on digital literacy

Figure 11 reveals that the most commonly used tools are scale (f = 23) and focus group (f = 10) followed by questionnaire (f = 4), interview (f = 3), observation (f = 2), participant diaries (f = 2), and document review (f = 1), respectively.

Data Analysis Techniques
Findings regarding data analysis techniques used in postgraduate theses on digital literacy are presented in Figure 12.

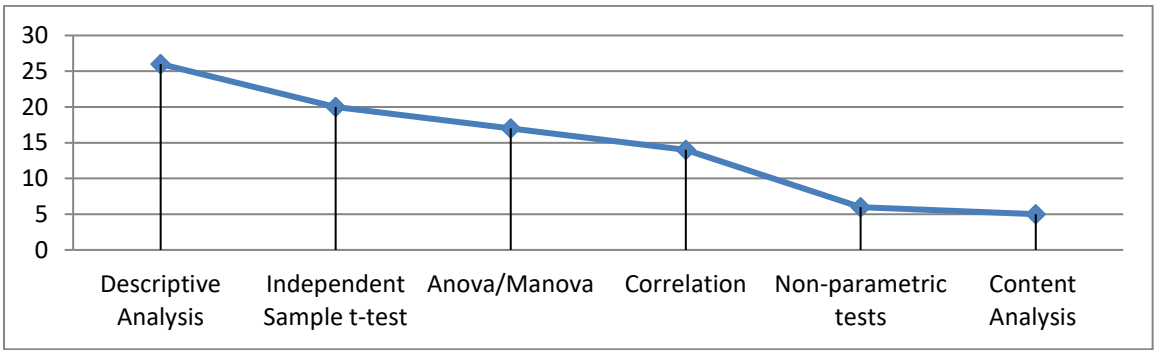

Figure 12. Data analysis techniques used in postgraduate theses on digital literacy

Figure 12 reveals that the most commonly used technique is the descriptive analysis (f=26) followed by independent sample t-test (f=20), Anova/Manova (f=17), correlation (f=14), non-parametric tests (f=6), and content analysis (f=5).

Research Results of Postgraduate Theses
Findings regarding the research results of postgraduate theses on digital literacy are presented in Table 1.

Table 1. Research results of postgraduate theses on digital literacy

Research Results	Frequency (f)
It was concluded that the digital literacy levels of pre-service teachers were high.	5
It was concluded that the digital literacy levels of male students were higher than female students.	5
It was concluded that secondary and high school students had high digital literacy levels.	4
It was concluded that the digital literacy levels of parents and teachers were higher than students.	3
It was concluded that teachers' digital literacy levels were high.	3
It was concluded that there was a positive correlation between health literacy and digital literacy levels.	2
It was concluded that there was a positive relationship between lifelong learning disposition and digital literacy.	2
It was concluded that the digital storytelling workshop increased the digital literacy levels of the elderly.	1
It was concluded that the flipped learning method positively affected the digital literacy level.	1
It was concluded that Web 2.0 applications had no effect on digital literacy.	1
It was concluded that the use of target-based scenarios positively affected the digital literacy level.	1
It was concluded that there was a positive significant relationship between awareness of information security and digital literacy levels.	1
It was concluded that the digital literacy levels of the staff working in the judicial bodies were high.	1

It was concluded that there was a significant positive relationship between digital citizenship and digital literacy level.	1
It was concluded that the digital literacy level did not have a significant effect on financial literacy.	1
It was concluded that there was a positive significant relationship between online privacy awareness and digital literacy level.	1
It was concluded that the reflection of the digital literacy lesson experiences of the pre-service teachers on daily life was not at a sufficient level.	1
Total	**33**

Table 1 reveals that as a result of the research in postgraduate theses, digital literacy levels of pre-service teachers are high and digital literacy of male students is higher than female students; the digital literacy levels of secondary and high school students are high and the digital literacy levels of parents and teachers are higher than students; there is a positive significant relationship between digital literacy and information security, financial literacy, digital citizenship, lifelong learning, and online privacy, and; the reflection of the digital literacy lesson experiences of the pre-service teachers on daily life is not at a sufficient level.

DISCUSSION and CONCLUSION

Given the demographic characteristics of the postgraduate theses on digital literacy published in Turkey, it was determined that the majority of the theses (82%) were at the Master's level and the number of theses made at the doctoral level was relatively low (12%). This is probably because there are more programs that provide education at a Master's level than programs that provide education at a doctoral level in Higher Education Institutions in Turkey. However, it can be implied that reasons such as the length of the doctoral programs, the harsh conditions for admission to the doctoral programs, and the limited number of admitted students can also explain the scarcity of postgraduate these at the doctoral level. Şimsek et al. (2009) and Gökmen et al. (2017) reported that the number of theses at the Master's level is much higher than the theses at the doctoral level, which confirms our research results.
It was determined that there was an increase in the number of theses published in the digital literacy subject area from 2015 to 2019, whereas there was a decrease in 2020. A potential reason for this result is the increased interest of researchers in the field of digital literacy in Turkey, as in the whole world. The decrease in 2020 may arise from the difficulty of research opportunities due to the Covid-19 pandemic process that has been affecting the whole world. Most of the theses published on digital literacy were published in Turkish (85%), whereas the number of theses published in English was very limited (15%). Postgraduate programs run under Higher Education Institutions in Turkey generally are in Turkish. This may increase the international recognition of postgraduate theses published in Turkey along with more citations or higher numbers of publications to be published in journals scanned in international indexes (such as SCI, SSCI, ESCI, ERIC, AHCI). It was also determined that one-third (38%) of the theses published on digital literacy in Turkey were conducted in the Department of Computer and Instructional Technologies. This is not surprising though as topics of digital literacy (*such as accessing information in digital environments, producing and sharing information, using technology in learning and teaching processes, exhibiting ethical behaviors on digital platforms*) are included in Computer and Instructional Technology Education curricula and researched further at the graduate level. Given the subject contents of the postgraduate theses on digital literacy published in Turkey, it was determined that the focal point was the digital literacy level and the examination of digital literacy in terms of various variables. This is due to the increase in access to digital media (*applications such as e-commerce, e-government, e-health, and e-school*) and the development of regulations on the development of digital literacy in social life in Turkey in recent years, depending on the level of digital literacy in different samples and their various variables. Karabacak & Sezgin (2020) also reported that depending on the developments in the world, studies on the level of digital literacy and the areas of use of new technologies, especially educational sciences, have increased in Turkey.

When the postgraduate theses published on digital literacy in the study were examined in terms of methods, it was determined that the quantitative research method was used the most (59%) and the qualitative and mixed research methods were used less frequently (21%). In this case, it can be said that research on digital literacy is done with these methods for reasons such as reaching different and multiple samples, time, cost, and easier generalization of the results obtained. Similarly, it was reported that quantitative research methods are used more in other studies on postgraduate theses published in Turkey (Gökmen et al.2017; Erdem, 2018). The less frequent use of qualitative and mixed research methods by researchers may be due to reasons such as the participant role of the researchers, the need for a holistic approach, difficulties in revealing their perceptions in the sample, flexibility in research designs, and an inductive perspective. This situation makes it difficult to reveal the reasons that cannot be measured by quantitative research in-depth, as stated by Sandelowski (1986) in postgraduate theses on digital literacy in Turkey. Therefore, researchers should be encouraged to use more qualitative and mixed research methods to publish more detailed postgraduate theses on digital literacy. Furthermore, Şimşek & et al. (2008) reported that students should be provided with more information on how to conduct and report mixed research in graduate programs. Gökmen et al., (2017) put forward that giving courses for mixed-method research at the graduate level would be beneficial for the quality of graduate theses.

In the study, it was determined that descriptive and relational survey designs, which are among non-experimental quantitative research designs, were mostly used in postgraduate theses on digital literacy published in Turkey, whereas causal-comparative designs, variation, document analysis, phenomenology, and experimental research were used less frequently. The research design is a very important step in presenting the theses and gives the researchers an idea about how to answer the research problem, how to collect the data, and how to evaluate and analyse the data. Accordingly, descriptive, and relational survey designs in theses on digital literacy are used as validity and reliability studies of such studies are easier and a situation should be explained as is or the

relationship levels between variables should be revealed. On the other hand, the less commonly used research designs such as causal-comparative designs, variation, document analysis, phenomenology, and experimental research may stem from the difficulty of validity and reliability studies of such studies. This overlaps with the results of studies conducted by Varışoğlu, Şahin & Göktaş (2013). It was also observed that there are not enough studies via experimental, quasi-experimental or weak designs to test the factors that may be effective in the development of digital literacy skills.

Considering the sample of postgraduate theses on digital literacy, it was found that researchers mostly focused on university students and pre-service teachers while they also focused on high school and secondary school students and teachers, respectively. Convenience sampling and appropriate sampling methods were mainly used in theses with a sample ranging between 301 and 1000. Accordingly, such a result may stem from the fact that students studying at higher education institutions are given technology-based courses and spend more time in digital environments. Studies were conducted on different sample groups (*such as judicial body staff, parents, elderly people, and adults*). This is also probably because the subject of digital literacy is a multidimensional concept and contains a subject of research in many different disciplines from health sciences, media and communication, educational sciences to journalism. The use of convenience and appropriate sampling methods in theses on digital literacy is believed to stem from the requests and needs for fast, easy, and comfortable data collection. Similar results were obtained in the study by Selçuk et al (2014) who focused on the articles published in the field of educational sciences. This result overlaps with the result of our research.

The analysis of the data collection tools of postgraduate theses on digital literacy revealed that scales were mostly used. It can be implied that as scales are more easily responded to and scored in measuring different variables or as the variables to be measured are easier to analyse mathematically, scales are preferred. This result overlaps with the result of the study conducted by Gökmen et al. (2017) on distance education. It was concluded in the relevant study that documents were the least frequently used tools in postgraduate theses. This may be due to the inadequacy of studies such as concept analysis, meta-analysis, systematic review, or collective evaluation in digital literacy theses. Another result of the study is that the descriptive analysis method (frequency, percentage tables, arithmetic mean, standard deviation) is mostly used in the analysis of digital literacy data. This is followed by independent sample t-test, Anova/Manova and correlation analysis method, respectively. It is believed to be an expected result due to the use of research designs such as descriptive and relational surveys in theses on digital literacy, which are conducted via description, estimation, or comparison. Şimşek et al. (2009) support the result in their study on educational technologies. The least frequently used data analysis method in the research was determined to be content analysis. This may be due to the less commonly used qualitative and mixed-method research in theses. Data analysis techniques such as regression analysis, structural equation model, and multi-factor Anova are not preferred as a result of this study. Gökmen et al. (2017) reported that researchers do not sufficiently draw upon advanced data analysis techniques (*such as Regression, Structural Equation Model, Manova*).
Finally, it was revealed that secondary and high school students, pre-service teachers, teachers, and parents have a high level of digital literacy. There was a positive and significant relationship between health literacy, financial literacy, digital citizenship, lifelong learning, awareness of information security, and online privacy awareness and digital literacy level. Also, lipped learning, Web 2.0 applications, digital storytelling and target-based scenario applications positively affect digital literacy.

RECOMMENDATIONS

As a result of the research, it was determined that the postgraduate theses about digital literacy published in Turkey between 2015 and 2020 were mainly published at the Master's degree level, in Turkish, and mostly in the department of Computer and Instructional Technology. In addition, it was determined that the theses focused on the digital literacy level, quantitative research methods were preferred, and studies were carried out on pre-service teachers and university students. In this respect,

1. It is recommended that higher education institutions may focus on doctoral theses that will provide the competence to conduct independent research about digital literacy, contribute to scientific developments, examine, interpret, and analyse the problems with a deep perspective, and to produce information.
2. It may be beneficial to increase the number of postgraduate theses in English other than Turkish in order to increase the scientific quality of graduate theses, the possibility of publication in journals scanned in international indexes, recognition, and the number of citations.
3. Digital literacy is a multidimensional research field related to different disciplines and universities may be encouraged to carry out theses specific to this subject area in different departments (for example, by providing project support to digital literacy theses).
4. In addition to non-experimental relational and descriptive survey methods, emphasis can be placed on concept analysis, meta-analysis, theory building, case study, explanatory or exploratory mixed research methods for more detailed, explanatory, and in-depth graduate theses related to digital literacy.
5. Alternative data collection tools such as open-ended survey questions, focus group interviews, participant or non-participant observations, diagnostic tests, and portfolios can be used as a data collection tool in graduate theses on digital literacy.
6. Beyond revealing the digital literacy levels of the sample of the digital literacy theses, there should be more focus on the studies aimed at determining the teaching approaches that will increase its competence in daily life.

As a result, this research will contribute to the quality of researchers' work by offering them some suggestions in their studies on digital literacy in terms of method and research results. Also, revealing the general trend in the theses related to the digital literacy

subject area will guide researchers who will conduct research on this subject. In this context, the research is limited to the theses available in the national thesis database of YÖK published as open access between 2015 and 2020 in Turkey on digital literacy.

Ethics and Consent: Ethics committee approval is not required as it does not involve clinical research on humans and does not contain retrospective studies in accordance with the Law on Protection of Personal Data.

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Review Paper

Review of Trends in Peer Instruction: Bibliometric Mapping Analysis and Systematic Review

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ABSTRACT

This research aims to reveal the trend in peer instruction that many researchers around the world have been working on for over 20 years. In this context, 58 papers published in journals indexed in SSCI were examined in terms of different variables (e.g., research methods, courses, and response technologies). The bibliometric results showed that the most used keyword and the most used word in the abstract sections of the studies was peer instruction. Systematic review results revealed that the continent and country with the most studies among 17 countries in four continents is North America and the USA, respectively. Moreover, the majority of studies were published in 2016. It was also found that studies are generally carried out with numerical courses such as physics, chemistry, and computer science. Other findings provided from the researches were discussed in detail, and various suggestions were made for teachers and researchers in line with the findings obtained from the study.

INTRODUCTION

Peer instruction (PI) is a student-centered active learning approach developed by the physics education research group (Eric Mazur and his colleagues) at Harvard University in the 1990s (Brown, 2020; Liao et al., 2019; Wang & Murota, 2016; Zhang, Ding, & Mazur, 2017). Mazur stated that it is very difficult to maintain students' attention throughout the whole course, especially in large classes, and that ensuring student interaction and focusing students' attention on the underlying concepts during the course are the main objectives of the PI method (Mazur, 1997). Although there are differences in studies by different researchers (e.g., Kalman et al., 2010; Michinov et al., 2015; Zingaro & Porter, 2014), Mazur (1997) described the process of the classic PI model as "1) Question posed, 2) Students given time to think, 3) Students record individual answers (optional), 4) Students convince their neighbors (peer instruction), 5) Students record revised answers (optional), 6) Feedback to teacher: Tally of answers, and 7) Explanation of correct answer". In other words, it can be said that a classic sequence for PI starts with posing the question and continues with the first individual voting, see the answers, peer discussion, and second individual voting. Furthermore, students may be asked to write explanations about their answers and report their confidence level (e.g., Chou & Lin, 2015; Tullis & Goldstone, 2020). The results of the study conducted by Dancy and Henderson (2010) with the 722 physics faculty showed that the most widely known and the most highly used strategy was PI and, nearly half of all the participants reporting that they used PI also indicated that they did not use it in a way that is consistent with the classic PI sequence.

In the PI process, a blackboard, a projector, or oral form can be posed questions to students (Chou & Lin, 2015). Clickers (e.g., Pearson, 2019), flashcards (e.g., Gok, 2015), and phones, tablets, or laptops (e.g., Zou & Xie, 2019), etc. can be used to get students' responses, depending on the learning environment and the purpose of the study. Watkins and Mazur (2010, pp. 41) stated that "the quality of student discussion and learning in a PI classroom depends on the quality of the ConcepTests". Moreover, the effectiveness of the ConcepTests (conceptual multiple-choice questions) requires students to think about the higher-level concepts in the questions and not be able to solve the questions simply by recalling something. Although multiple-choice questions are commonly used in the PI, open-ended questions (e.g., Wang & Murota, 2016), short-answer (also referred to as free-text questions) questions (e.g., Pearson, 2017), and true/false (two possible answers) questions (e.g., Perez et al., 2010) can also be used.

When the literature is examined, it is seen that such as using isomorphic questions (e.g., Porter, et al., 2011; Zingaro & Porter, 2014), discussion partner assignment, and using accountability scoring mechanisms (Chou & Lin, 2015), the effect of not showing /showing the bar graph of students' first voting before the discussion (e.g., Perez et al., 2010), live responses versus responses only available after the poll had closed (Pearson, 2019), and giving students points for participation regardless of whether their answers are correct (Hubbard & Couch, 2018), etc. many innovative approaches can be applied to support students' learning, active participation, academic engagement, motivation, etc. in the PI process. Furthermore, the PI method, which is becoming widespread with each passing day, is also used in many different courses related to biology (e.g., Hubbard & Couch, 2018), chemistry (e.g., Yıldırım &

Canpolat, 2019), computer science (e.g., Adawi et al., 2016), economics (e.g., Ghosh & Renna, 2009), mathematics (e.g., Olpak et al., 2018), medical science (e.g., Versteeg et al., 2019), and science (e.g., Jones et al., 2012), etc. from different disciplines. Moreover, in the study conducted by Henderson (2019), it was stated that PI is one of the most popular research-based instructional practices in STEM education. However, to date, no study has examined the recent trends in PI. In this context, unlike previous research (e.g. Balta et al., 2017; Vickrey et al., 2015), this research aimed to reveal the trends in PI. For this purpose, answers to the following questions were sought:

- What were the most frequently used keywords in the reviewed articles?
- What were the most frequently used words in the abstract sections of in the reviewed articles?
- Where, when, and by whom were the reviewed articles published?
- What was the geographical distribution of the reviewed articles?
- What was the distribution of the reviewed articles according to the research methods used?
- What was the distribution of the reviewed articles according to the course studied?
- What types of participants were selected in the reviewed articles?
- What types of response technologies were selected in the reviewed articles?

METHOD

Selection of Studies

In studies aiming to reveal trends in a specific research area, many different criteria can be taken into account in the selection of relevant studies (e.g., Akçayır & Akçayır, 2018; Kim & Gurvitch, 2020). In this context, the following search criteria were applied in the advanced search section of the Web of Science (WOS) Core Collection database on February 8th, 2021 (TI = "peer instruction" or AK = "peer instruction" or AB = "peer instruction", Language: English, Document Types: Article or Review, Timespan: 1997-2020, Indexes: SSCI). Thus, a total of 101 papers with the words Peer Instruction, Peer instruction or peer instruction, etc. in the title/keywords/abstract, written in English and published in journals indexed SSCI between 1997-2020 were found. However, the full text of 8 of these papers could not be accessed and downloaded. The full text of the remaining 93 studies was downloaded to a computer in electronic format. The downloaded papers were examined in detail by considering the criteria specified in Table 1 in terms of their suitability for this study. As seen in Figure 1, 58 articles related to the purpose of the present study were obtained as a result of the examination made by the researchers.

Table 1. Article selection criteria

Inclusion Criteria	Exclusion Criteria
Peer instruction is the primary content focus	Research in different contexts despite meeting the search criteria
Papers should be listed in WOS, indexed in SSCI, and written in English	Studies that were editorials and article reviews

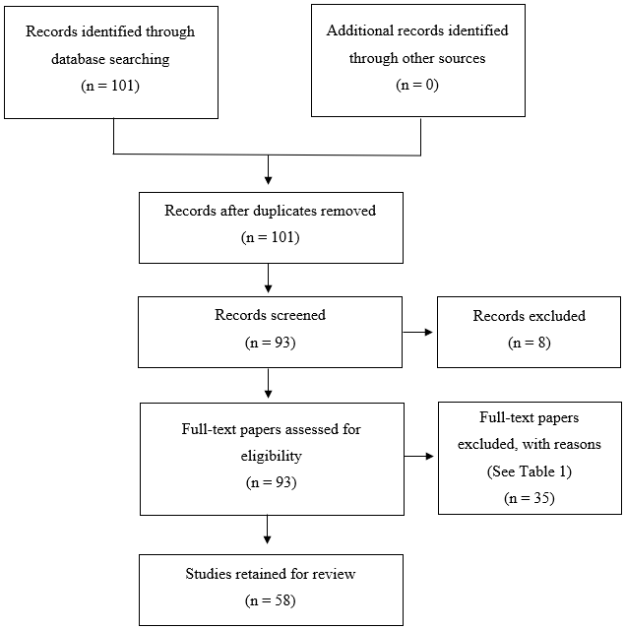

Figure 1. Search strategy

The search results completed in the advanced search section of WOS were refined to show 58 papers to be studied within the scope of the research, on the date of February 8th of 2021. The bibliometric information for these 58 papers was downloaded by selecting the 'full record and cited references' option and saved as a tab-delimited (Win) text file. The text file obtained from WOS was

transformed to a Microsoft Excel format. Considering the BMA to be made using the VOSviewer software tool, several identifiers of the articles (e.g., Year Published, Author Keywords, and Abstract) were carefully examined and necessary manual corrections applied. The data in the Microsoft Excel file were transferred back to a tab-delimited (Win) text file for BMA using the VOSviewer. Besides, the citation reports related to 58 studies were downloaded as a Microsoft Excel file. Furthermore, the Microsoft Excel files for 'citation reports' and 'full record and cited references' were combined into a single Microsoft Excel file, and the final dataset was obtained (58 records).

Data Analysis

In the current study, the publication classification form (PCF) similar to previous studies (e.g., Akçayır & Akçayır, 2016; Crompton & Burke, 2018) was used by researchers after some arrangements were applied. In addition to the dataset, column headings in the PCF were added, and the relevant fields were filled in for each paper by the researchers. The data obtained from the PCF were analyzed using descriptive statistics, and the VOSviewer was used for the analysis of the most used keywords and the most used words in abstract sections of the reviewed papers.

RESULTS

Most Frequently Used Keywords

Since 23 (39.66%) out of 58 papers did not have keywords, these analyzes were made according to the data in the studies where keywords entries were made. As seen in Figure 2, the results showed that the most used keywords are peer instruction (f=27), collaborative learning (f=7), clickers (f=6), active learning (f=5), and higher education (f=5), respectively.

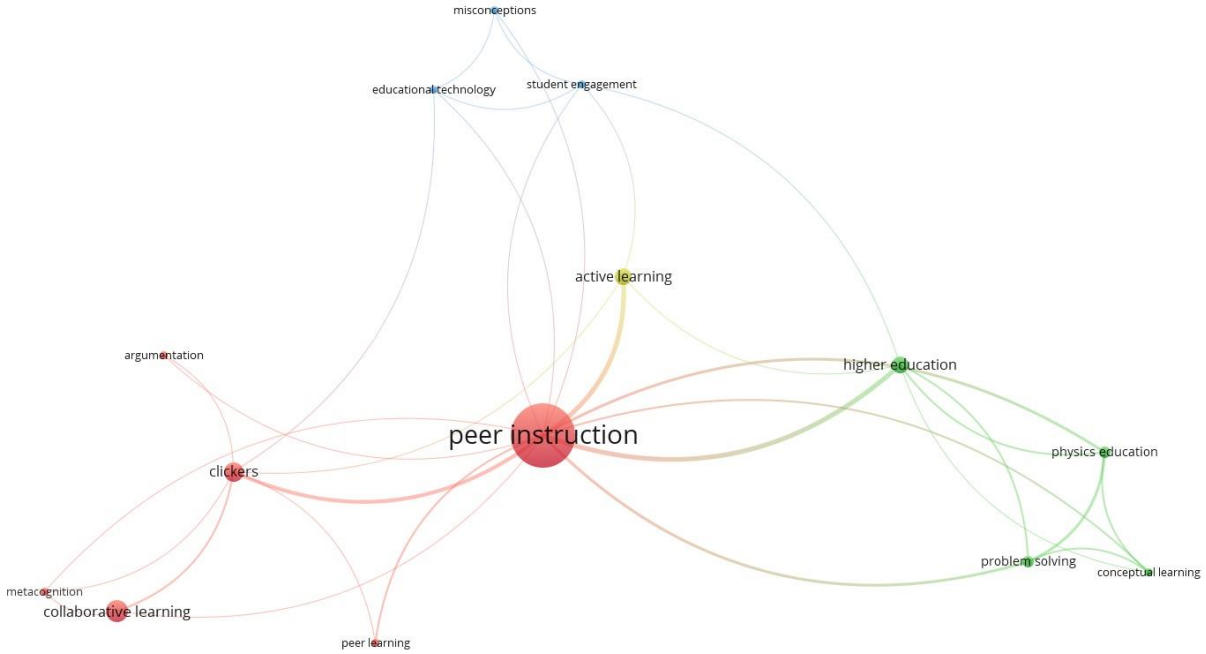

Figure 2. The most used keywords

Most Used Words in Abstract Sections

As seen in Figure 3, the results showed that the most used words in the abstract sections of the reviewed papers are peer instruction (f=50), question (f=31), group (f=24), effect (f=16), and instructor (f=15), respectively.

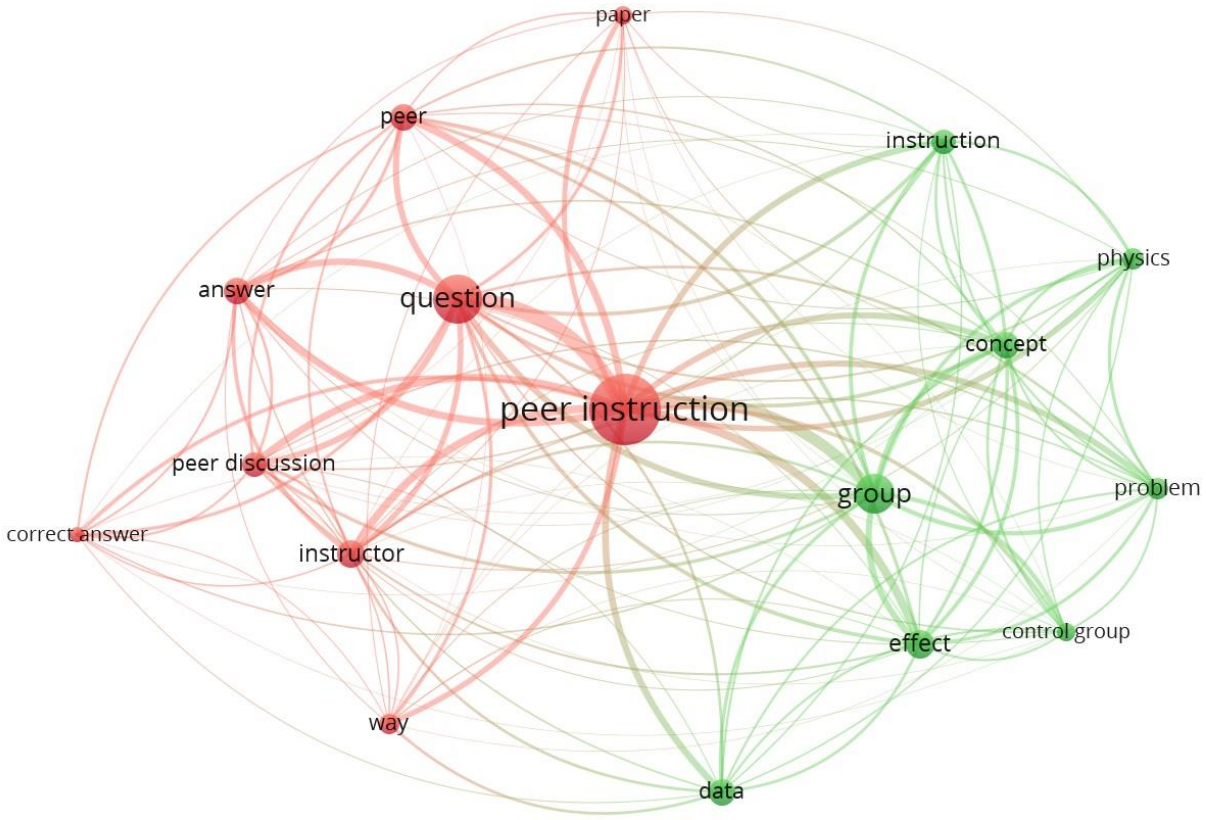

Figure 3. The most used words in abstract sections

Authors and Publication Years

58 articles reviewed within the scope of this research were produced by 125 authors from 17 countries. Besides the results also revealed that 104 authors took part in one article, 17 authors in two articles, one author in three articles, two authors in four articles, and one author in five articles. According to Table 2, the highest number of articles were published in 2016 (*n*=9), and most of the published articles were conducted by two (*n*=16) or three (*n*=16) authors. Although searches have been made since 1997, no articles that meet the criteria have been published 1997-2003, and there has been uninterrupted publication since 2009.

Table 2. The distribution of articles in terms of publication years and number of authors

Publication year	Number of authors						Total
	1	2	3	4	5	6	
2003		1					1
2009		2	1				3
2010	1	1	2			1	5
2011	1	1					2
2012	1	1	1				3
2013	1						1
2014	1	1		1	2		5
2015	1	1	1	1	3		7
2016		1	6	2			9
2017	2		2	1			5
2018	2	3	1				6
2019	2	3	1	1		1	8
2020	1	1	1				3
Total	13	16	16	6	5	2	58

Journals

The 58 papers reviewed in this study were published in 32 journals in total, only one article was published in 22 of these journals. Furthermore, two papers in four journals, three papers in four journals, and eight papers in two journals were published. The journals

with the highest number of articles published were Physical Review Physics Education Research (8 documents) and Physical Review Special Topics - Physics Education Research (8 documents).

Geographical Distribution

Geographically, the studies were conducted in 17 countries on four continents (see Figure 4). In meta-analysis or literature review studies conducted by more than one researcher, the country of the first author was classified as the country where the study was conducted. Similarly, if the country in which the study was conducted was not clearly stated, the country of the first author was used. Finally, Turkey and Kazakhstan, even though the territory in both Asia and Europe, studies in these countries are classified as Asia. The continent with the highest number of studies in North America (*n*=25), followed by Asia (*n*=17), Europe (*n*=15), and South America (*n*=1). Also, among the countries, the USA was the country with the highest number of studies (*n*=20), followed by Turkey (*n*=7), the UK (*n*=6), and France (*n*=5).

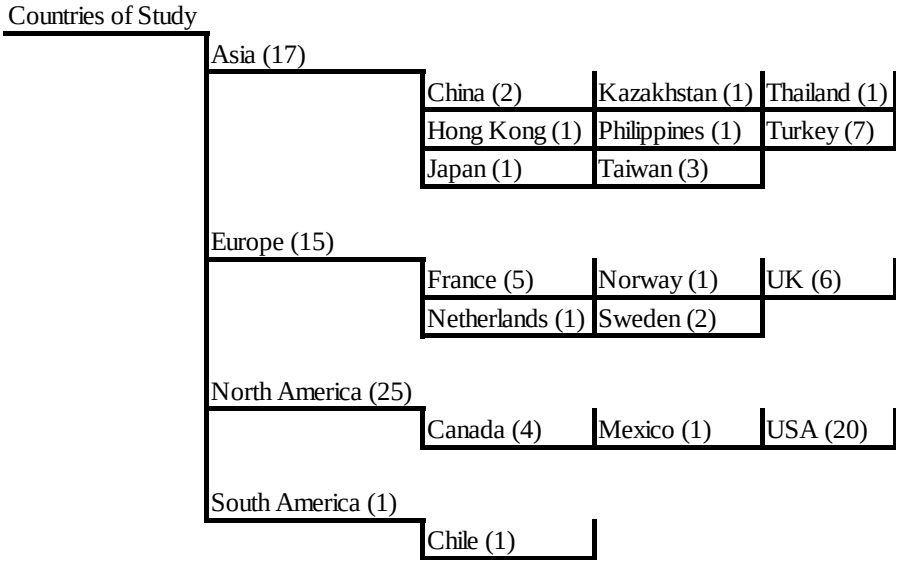

Figure 4. Geographical distribution

Research Method

As seen in Table 3, quantitative research methods (*n*=32) were the most common research method, followed by mixed-method studies (*n*=15), qualitative studies (*n*=8), and other research methods (literature review, meta-analysis, or theoretical studies) studies (*n*=3).

Course

In the reviewed papers; it is seen that (see Table 3) studies are generally carried out with numerical courses such as physics (*n*=30), chemistry (*n*=7), and computer science (*n*=5). While creating the frequencies as seen in Table 3 for the reviewed papers; if more than one course in the same discipline (e.g., Liao et al., 2019) was carried out in a study, the frequency of the relevant discipline was increased by one. However, if more than one course from different disciplines was studied in a study (e.g., Aricò & Lancaster, 2018), the frequency of all related disciplines was increased by one. The course in which the research was conducted was classified as 'Not specified' if it was unspecified or undetermined. Finally, in some studies (Hung, 2017; Zou & Xie, 2019), the courses classified as 'Languages' (English writing course, and learning English as a foreign language) are related to English.

Type of Participant

Participants in the studies were classified similarly to earlier review studies (e.g., Akçayır & Akçayır, 2016). However, since it is not possible to make a type of participants classification (e.g., unspecified or undetermined) for some papers (e.g., Knight & Brame, 2018), 'Not specified' has been added to the options. Moreover, for studies with more than one type of participant (e.g., Nitta, 2010), the 'Mixed' option was added. As seen in Table 3, the majority of the participants were higher education students (77.59%) in the reviewed articles.

Response Technology

In the current study, the technology used in the question and answer process of PI was called response technology. When the literature is examined, it is seen that the technologies used for this purpose are named in different ways in different studies. For example, different terms such as electronic voting systems (e.g., Wood et al., 2016), electronic classroom response system (e.g., Turpen & Finkelstein, 2010), classroom response system (e.g., Zhang et al., 2017), or student response systems (e.g., Hung, 2017)

can be preferred instead of clickers. As indicated in Table 3, clickers (*n*=33) were the most common response technology in the reviewed papers.

Table 3. Research method, course, type of participant, and response technology

#	Number of articles
Research methods	
Quantitative	32
Qualitative	8
Mixed	15
Other	3
Course	
Biology	2
Chemistry	7
Computer science	5
Economics	3
Languages	2
Mathematics	2
Medical science	2
Not specified	3
Physics	30
Psychology	2
Science	1
Type of participant	
Faculty	3
Higher education	45
K-12	5
Mixed	2
Not specified	3
Response technology	
Clickers	33
Flashcards or hands-on	7
Not specified	7
Paper-pencil	5
Phones, tablets, or laptops, etc.	8

DISCUSSION

This study aimed to reveal recent trends in the PI using BMA and systematic review, and 58 studies were examined. The BMA results indicated that the most used keywords in the reviewed papers were: peer instruction, collaborative learning, clickers, active learning, and higher education. These results showed that the reviewed studies are based on the PI and its key points. Furthermore, it can be said that these results are consistent with the other findings of the current study. Because the findings of the present research showed that clickers are the most common response technologies and the majority of the participants were higher education students. Moreover, considering that PI is an active learning approach that supports collaborative learning (Balta et al., 2017; Michinov et al., 2015), it can be said that this also supports the findings on keywords. Besides, the most used words in the studies' abstract sections were peer instruction, question, group, effect, and instructor which also support these findings.

Considering the number of authors of the reviewed studies, since all but 13 (22.41%) include more than one author, this finding suggests a trend towards more collaborative work amongst researchers. Looking at the publication year of each article, it was seen that a total of 43 articles (74.14%) were published in the last 7 years (since 2014), and that interest in the PI has increased in recent years. This may be due to the fact that technologies that can be used in the PI method in parallel with the development of communication technologies are cheaper and easily accessible. For example, in the study conducted by Chien et al. (2015), it was stated that the use of clickers, which are frequently used in the question and answer process of PI, is increasingly widespread and it is estimated that millions of clickers are sold to schools around the world each year. Furthermore, the results showed that the most preferred journals were Physical Review Physics Education Research and Physical Review Special Topics - Physics Education Research. The publication of more articles in these journals related to physics education research may be due to the fact that PI is developed by the physics education research group (e.g., Zhang et al., 2017).

The results revealed that the North America continent has dominated the findings with the highest number of research. Moreover, the USA was the country with the highest number of articles. This may be because the PI method was first applied at a university in the USA (e.g., Brown, 2020). In addition, as indicated in **Hata! Başvuru kaynağı bulunamadı.**, the three countries (USA, UK, and Canada) where more than half of the reviewed studies (51.72%) were conducted are English-speaking countries. However, it should be taken into consideration that all of the papers included in this review were written in the English language and that studies published in journals, not SSCI-indexed or written in languages other than English may have been conducted. Although the results of the present study indicate that research on PI is predominantly concentrated in the USA, it seems that there is interest in PI in other countries (e.g., Turkey, the UK) as well. It also appears that interest in PI has increased in recent years and researchers often tend to work together. In this context, the researchers from different cultures, taking into account the various individual differences of the learners, can provide more in-depth knowledge about PI by conducting new studies.

The results showed that the most preferred research method among the research methods was the quantitative research method, and 68.97% of the reviewed articles were conducted using a single research method (quantitative or qualitative). This may be due to the fact that mixed-method studies are more expensive than the single-method approach in terms of time, money, and energy (e.g., Abowitz & Toole, 2010). However, mixed-method researches can also make it easier to answer more complex research questions, as it allows combining research styles that balance strengths and weaknesses (Abowitz & Toole, 2010; Johnson & Onwuegbuzie, 2004). Moreover, reviewed studies are generally carried out in numerical courses such as physics (e.g., Zu, Munsell, & Rebello, 2019), chemistry (e.g., Pearson, 2019), and computer science (e.g., Adawi et al., 2016), and that these findings are consistent with earlier studies (e.g., Balta et al., 2017). In the study conducted by Liao et al. (2019), in a way to support these findings, it was stated that the PI method was invented for introductory physics courses and then adopted for computer science. In this context, conducting new research using mixed-method design in courses in different disciplines in future research can contribute to the literature on the PI.

The results also showed that the majority of the studies' participants were higher education students, which is consistent with an earlier meta-analysis study conducted by Balta et al. (2017). This may be due to the development of the PI method through studies conducted at a higher education institution (e.g., Zhang et al., 2017), or from researchers' choice for convenience or purposeful sampling methods. Finally, it was determined that the majority of response technologies in the reviewed papers were clickers. Moreover, in a meta-analytic study conducted by Chien et al. (2016) on clickers, it has been stated that the educational potential of clickers is of great interest by researchers and educators in various disciplines, and it can be said that tens of thousands of courses around the world are being conducted with the addition of clickers. In this context, it is recommended to conduct new researches on the effective use of different response technologies with students at different educational levels in future studies.

LIMITATIONS

Whilst the present study reviewed papers written in the English language and published in SSCI-indexed journals in the WOS, future studies could review other document types (e.g., dissertations), indexes other than SSCI in the WOS (e.g., ESCI), indexed in different databases (e.g., ERIC), or written in other languages. Thus, the different datasets could be obtained and various trends related to the PI thereby revealed.

CONCLUSIONS

In the present study, 58 papers published in SSCI-indexed journals related to the PI were analyzed in terms of different variables. Although the history of the PI method dates back to the 1990s, there has been an increase in the number of studies conducted in recent years. In this context, this study revealed useful results and provided an up-to-date evaluation to help researchers gain a holistic understanding of the importance of the PI, and also to understand the current research gaps in the literature.

Ethics and Consent: Ethics committee approval is not required as it does not involve clinical researches on humans as well as it does not contain Retrospective studies in accordance with the Law on Protection of Personal Data.

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Research Paper

Students' Views Regarding Instruction during the Pandemic Process

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ABSTRACT

The aim of this study was to determine the views of secondary and high school students regarding the distance education activities carried out during the coronavirus disease 2019 (COVID-19) pandemic, the blended learning activities conducted afterwards, and the post-pandemic back-to-school process. The study consisted of 982 students and was conducted utilizing the descriptive survey method, one of the quantitative research methods. Data were collected using the "Scale of Evaluating Instruction in Pandemic Process". The findings indicated that most of the students used smartphones alone for distance education during the pandemic process and most of them participated in distance education only via live lessons. In addition, no significant difference was found between genders with regard to students' satisfaction with the distance education process and their expectations. On the other hand, most of the students did not receive sufficient psychological and academic support during this process. It was also noted that the students with internet access were more satisfied with the instruction activities in this process and that their access to the internet and technologies were higher than the students without internet access. Based on our findings, we recommend that students should be provided with academic and psychological support, security precautions should be tightened in schools to minimize the effects of the pandemic, and equal opportunities should be provided to students regarding hardware and internet support.

INTRODUCTION

During the coronavirus disease 2019 (COVID-19) pandemic, schools have remained closed and strict measures have been taken to maintain instruction during the pandemic in many countries. Additionally, numerous countries have decided to continue their educational activities through distance education. In line with the technological capabilities of the countries, distance education has continued with printed teaching materials, educational radio, and television broadcasts, and online and offline activities (Viner et al., 2020). In Turkey, effective as of March 16, 2020, nationwide distance education began to be implemented at all educational levels, and education activities were carried out in a similar way to the practices in the world. Most of these distance education activities were conducted using the system known as Eğitim Bilişim Ağı (EBA; meaning *Education Information Network*) and EBA TV. By making such a decision, the Turkish government aimed to minimize the negative effects of the pandemic as well as the learning loss by maintaining the educational and instruction processes (Aydın, 2020).

Although there are no large-scale studies on the effectiveness of these measures, it has been reported that students who are disadvantaged in various aspects are more affected by the adverse consequences of school closures and thus the dropout rates among such students may increase significantly (Bozkurt et al., 2020). In addition, it has also been emphasized that long-term closure of schools may cause disruption of essential school-based services such as immunization, school feeding, mental health, and psychosocial support (Brooks et al., 2020; Sahu, 2020) and that the lack of face-to-face communication may cause stress and anxiety (Cao et al., 2020; Kürtüncü & Kurt, 2020).

School closures pose unprecedented challenges to governments, teachers, students, and parents to ensure continuity of learning (Chang & Satako, 2020). Additionally, the unique and critical role played by schools make them a priority to stay open in order to ensure that students receive both academic education and support as well as critical services. While some of the schools are reopening for face-to-face education, others continue to operate with a blended teaching model consisting of face-to-face and distance (online) learning. According to UNESCO (2020), as of September 21, 2020, schools were fully reopened in 91 out of the 210 countries and partially reopened in 41 countries. Moreover, it was reported that schools were closed during the holidays in 26 countries and fully closed in the remaining 52 countries. In October and November, 2020, the number of countries with fully or partially open schools all over the world increased, while the number of countries where schools were closed decreased. In Turkey, make-up education initiated via distance education on August 31, 2020 and face-to-face education activities were started for kindergartens and first grades with a diluted and gradually eased education system on September 21, 2020. On October 12, 2020,

the number of classes performing face-to-face education was increased. Yet, parents were still concerned about whether it would be safe to send their children to school during the pandemic (Ben-Joseph, 2020). This concern primarily stemmed from the idea that a vaccine would not be available for many students in the following academic year. However, as is commonly known, maintenance of public health during the pandemic depends largely on the success of schools in following the COVID-19 treatment and prevention guidelines, though studies have shown that reopening schools for face-to-face education does not cause a significant increase in the transmission of the virus in the society (American Academy of Pediatrics, 2021).

To date, numerous studies have been conducted on the back-to-school process. Among these, the study conducted by UNICEF (2020) made recommendations to teachers, administrators, and parents regarding the safety of returning to school, measures to be taken by schools, possible solutions to compensate for the education lost during the lockdown periods, and the measures to be taken against students' resistance to return to school. Another study that was conducted by Bayındır (2021) aimed to determine teachers' perceptions of resilience after the pandemic and reported that teachers were mostly worried about contracting the disease during their back-to-school process and that they were expecting institutional solutions. Based on these findings, the author suggested that necessary support should be provided periodically to reduce the anxiety levels of teachers and to maintain their well-being. Another study suggested that there would be no problems for children returning to school, also noting that they would not be adversely affected by the disease since their infection status was remarkably low compared to adults. The authors also stated that children can return to school after all the necessary measures have been ensured (Munro & Faust, 2020). By contrast, in a study conducted with 355 participants, it was reported that all the stakeholders in the school experienced social and emotional problems in coping with emotions such as anxiety, anger, and uncertainty and it was also noted that the students had problems in focusing on their educational activities and in controlling themselves during the online education process (Bulut, Çakıcı, & Yazgan, 2020).

In line with the notions presented above, it can be asserted that during the process of reopening schools, the expectations of the community from politicians and school administrators include elimination of educational inequalities, minimization of individual and parental risks associated with returning to school, maximization of the educational potential in schools, and the prioritization of the benefits of returning to school for the psychological well-being of children (Woodland et al., 2020). In the schools reopened within the scope of the new norms, both the level of meeting these expectations and whether the measures taken are sufficient, whether they can be applied as desired, and the comparison of the distance education activities conducted in the spring term and the current blended learning activities are considered important issues in terms of helping the education policymakers (Can, 2020). To this end, the present study aimed to investigate the views of secondary and high school students towards the distance education activities (TV broadcasts, live lessons) carried out during the COVID-19 pandemic period, the blended learning (distance and face-to-face education) activities carried out afterwards, and the post-pandemic back-to-school process. For this purpose, answers to the following research questions were sought in the research:

RQ1. How and with which information tools do high and secondary school students participate in distance education?
RQ2. What are the views of secondary and high school students regarding the instruction conducted during the pandemic?
RQ3. Do students' views differ according to gender?
RQ4. Do students' views differ according to educational level?
RQ5. Do students' views differ according to the status of internet connectivity?
RQ6. Do students' views differ according to the mode of participation in distance education (e.g. TV broadcast, live lesson)?
RQ7. Is there a difference in student views with regard to the number of students simultaneously participating in distance education in the same house?
RQ8. Is there a difference in student views with regard to the student's city of residence?

METHOD

The research was conducted utilizing the descriptive survey method. Description is a quantitative research method used for describing and explaining a situation or phenomenon (Sönmez & Alacapınar, 2013). Survey, on the other hand, is a research design that is widely used in descriptive research and is carried out on large groups, in which the opinions and attitudes of individuals in the group are queried regarding an event or phenomenon and related events and phenomena are described (Karakaya, 2014). By choosing this method, it was aimed to determine the views of students on the distance and blended education activities (TV broadcast, live lesson) and the post-pandemic back-to-school process during the COVID-19 pandemic period.

Participants

The study included 982 students (234 secondary school students and 748 high school students) studying in the provinces of Giresun, Bayburt, Diyarbakır, and Elazığ, which were selected using the convenience sampling method. Convenience sampling is a sampling method in which individuals or groups that can easily be researched for the subject to be studied are preferred. The reason for choosing this method was that it allows the researchers to personally take part in the data collection process and to collect convenient data in a relatively shorter time (Sönmez & Alacapınar, 2013). Demographic characteristics of the participants are presented in Table 1.

Table 1. Demographic characteristics

	Secondary School		High School		
	Male (n)	**Female (n)**	**Male (n)**	**Female (n)**	**Total**
Diyarbakır	23	20	138	298	479
Bayburt	41	33	111	141	326
Giresun	59	54	0	0	113
Elâzığ	2	2	53	7	64
Total	**234**		**748**		**982**

Data Collection

Data were collected using the "Scale of Evaluating Instruction in Pandemic Process" developed by Tutal et al. (2021). The scale consisted of three parts: the first part probed participants' demographic characteristics, the second part consisted of five-point Likert-type items ("Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree"), and the third part involved four-point Likert-type items "Never, Rarely, Occasionally, Often, Always". The Exploratory Factor Analysis (EFA) indicated eight dimensions (Satisfaction, Precautions, Accessibility, Expectations, Evaluation, Support, EBA TV & Service desks, and Time) and 39 items. Additionally, the CFI, NFI, and NNFI scores in the Confirmatory Factor Analysis (CFA) were 0.95, 0.92, and 0.95, respectively. It was also revealed that the 8-factor structure determined in Exploratory Factor Analysis (EFA) was confirmed by CFA. On the other hand, the Cronbach's Alpha reliability coefficient was found to be 0.893 for the scale. Finally, the scale was administered to the participants by using "Google Forms".

Data Analysis

Data were analyzed by using both descriptive and predictive analyses. In the descriptive analysis, mean, standard deviation, frequency, and percentage were utilized. In the predictive analysis, since the data were not normally distributed according to the Kolmogorov-Smirnov Test, non-parametric tests including Mann Whitney U-Test and Kruskal Wallis H-Test were used. For the current study the Cronbach's Alpha reliability coefficient of the scale was found to be 0.93. A p value of <0.05 was considered significant in all sub-dimensions.

RESULTS

In this section, the findings are presented in sub-headings in accordance with the research questions.

Tools and Modes of Participation

The information technologies used by the students while participating in teaching activities during the pandemic process were examined and the results of the analysis were presented in Table 2.

Table 2. Information technologies used by students during the pandemic process

Information technologies	***f***	***%***
Smartphone only	513	52.2
TV only	147	15.0
Computer only	102	10.4
Tablet only	59	6.0
Computer + Smartphone	54	5.5
TV+ Smartphone	29	3.0
Tablet + Smartphone	20	2.0
TV + Computer + Tablet + Smartphone	20	2.0
TV + Computer + Smartphone	14	1.4
Computer + Tablet + Smartphone	12	1.2
TV + Tablet + Smartphone	5	0.5
Computer + Tablet	5	0.5
TV + Computer	2	0.2

As seen in Table 2, most of the students used smartphones only (52.2%), followed by television only (15%), and computer only (10.4%). In addition, some students used more than one tool, whereby the combination of computer + smartphone was the most commonly used method (5.5%).

Table 3 presents the modes participation utilized by the students for the distance education process conducted during the pandemic.

Table 3. Modes of participation in the distance education during pandemic

Participation type	*f*	%
Live lesson	635	65
TV broadcast	187	19
TV broadcast + Live lesson	160	16

As is clear in Table 3, most of the students (65%) participated in the distance education only through live lessons, while the remaining students utilized TV broadcast (19%) and a combination of TV broadcast and live lesson (16%).

Students' Views on Instruction during the Pandemic Process

The average scores obtained for each of eight dimensions (Satisfaction, Precautions, Accessibility, Expectations, Evaluation, Support, EBA TV & Service desks, and Time) are presented in Table 4.

Table 4. Means and standard deviations of students' views on instruction during the pandemic process
SD: Standard deviation

Dimensions	Items	$\bar{X}$	*sd*
Gladness	1. I think I learned the subjects that were processed in the distance education process.	2.49	1.21
	2. I am glad about the teaching of the lessons I take through distance education.	2.66	1.24
	3. I look forward to participating in distance live lessons.	2.76	1.27
	5. I can communicate healthily with my teachers in the distance education process.	3.15	1.27
	6. I can communicate healthily with my friends during the distance education process.	2.96	1.29
	7. I can express my thoughts effectively in live lectures conducted through distance education.	2.90	1.25
	8. The distance education process has positively influenced my thoughts about my learning process.	2.62	1.21
	9. The distance education process positively affected my thoughts about the learning environment (student-centered, individual learning, inquiry-based, collaborative, etc.).	2.72	1.16
	Overall	2.78	0.97
Precaution	16. At my school, safety precautions related to COVID-19 are adequate.	3.41	1.28
	35. The school administration monitors whether students comply with COVID-19 precautions.	3.79	1.32
	36. Teachers monitor whether students comply with COVID-19 precautions.	3.92	1.24
	37. Students at my school adhere to precautions related to COVID-19.	3.34	1.34
	38. Teachers at my school adhere to precautions related to COVID-19.	4.21	1.10
	39. Administrators at my school adhere to precautions related to COVID-19.	4.15	1.15
	Overall	3.80	1.02
Accessibility	4. I quickly use the technologies necessary for distance education.	3.17	1.36
	26.I participated in distance education activities during the pandemic through live lectures.	3.47	1.32
	32. I can easily access the internet connection required for distance education.	3.29	1.44
	33. I can easily access the technologies required for distance education (mobile phone, tablet, computer).	3.20	1.47
	Overall	3.28	1.16
Expectation	10. I would be happy to start face-to-face instruction.	3.79	1.35
	11. In the process of back- to-school, I feel a sufficient sense of commitment to the school.	3.62	1.24
	12. In the process of back- to-school, I feel a sufficient sense of commitment to my friends.	3.60	1.20
	13. After the process of back-to-school, I would like to continue my education in a hybrid model.	3.29	1.29
	15. I believe that schools will open fully to face to-face instruction.	3.13	1.38
	21. I can be more successful at school with blended learning.	3.37	1.26
	Overall	3.47	0.96
Evaluation	14. I had trouble getting used to face-to-face instruction during the process of back-to-school.	2.68	1.28
	17. My communication with the teacher in live lessons is more qualified than in face-to-face classes.	2.32	1.27
	18. In live lessons, the in-class discussion environment is more effective than in face-to-face classes.	2.39	1.24
	22. Distance education is more motivating than face-to-face instruction.	2.21	1.29
	27. I want courses to continue this year with distance education only.	2.49	1.60
	Overall	2.42	0.89
Support	28. I get psychological support from my family during the distance education process.	3.01	1.49
	29. I get academic support from my family during the distance education process.	2.96	1.45
	30. I get technological support from my teachers at school during the distance education process.	2.07	1.34

	31. I get psychological support from my teachers at school during the distance education process.	2.40	1.36
	Overall	2.61	1.07
EBA TV & Support Points	34. I utilize EBA support points.	2.21	1.31
	23.In the distance education process, EBA TV broadcasts contribute to my learning about the relevant subject.	2.60	1.23
	24. In the distance education process, EBA TV broadcasts are enough for me to learn the relevant subject.	2.12	1.08
	25. I participated in distance education activities during the pandemic from TV broadcasts.	2.28	1.13
	Overall	2.30	0.85
Time	19. I spend more time preparing for distance education courses than face-to-face courses.	2.82	1.20
	20. After distance education courses, the time I spend doing homework, repeating courses, research, etc., is more than face-to-face classes.	2.87	1.25
	Overall	2.85	1.08

As clearly seen in Table 4, the students' satisfaction was at a moderate level (range, 2.49-3.15) and students were not highly satisfied with the learning of the subjects covered (X=2.49) and with the teaching activities (X=2.66). About the COVID-19 precautions, students had above-average opinions (range, 3.41-4.21), whereby teachers (X=4.21) and administrators (X=4.15) were found to show greater compliance with the precautions compared to students (X=3.34). It was also determined that students' views regarding accessing and using the internet and necessary technologies for distance education and participating in live lessons during the pandemic process were at a moderate level (X=3.28). On the other hand, students had below-average opinions about receiving psychological and academic support from their families and teachers and benefiting from EBA Service Desks during the pandemic process. Accordingly, it can be asserted that students did not receive the support they expected during this process. In addition, it was determined that the students did not consider watching EBA live broadcasts sufficient to learn the subjects in the lessons and that the students did not spend more time for online activities such as pre-class preparation and post-class activities when compared to face-face instruction.

Comparison of Students' Views on Instruction during the Pandemic Process according to Gender

When students' views on instruction during the pandemic process were examined in terms of gender, a significant difference was found only in three sub-dimensions including Precautions, Expectations, and Evaluation (Table 5).

Table 5. Mann Whitney-U test results for the comparison of students' views on online instruction according to gender

Variables	**Group**	***N***	**Mean Rank**	**Sum of Ranks**	***U***	***Z***	***p***
Satisfaction	Female	555	486.14	269809.50	115519.50	-.675	.499
	Male	427	498.46	212843.50			
Precautions	Female	555	518.70	287876.50	103398.50	-3.374	.001
	Male	427	456.15	194776.50			
Accessibility	Female	555	487.01	270293.00	116003.00	-.566	.571
	Male	427	497.33	212360.00			
Expectations	Female	555	511.43	283842.00	107433.00	-2275	.012
	Male	427	497.33	198811.00			
Evaluation	Female	555	475.65	263984.00	109694.00	-2001	.045
	Male	427	512.11	218669.00			
Support	Female	555	489.24	217529.50	117239.50	-.285	.776
	Male	427	494.43	211123.50			
EBA TV & Service Desks	Female	555	489.67	217765.00	117475.00	-.232	.817
	Male	427	493.88	210888.00			
Time	Female	555	500.38	277710.50	113564.50	-1.132	.258
	Male	427	479.96	204942.50			

As revealed in Table 5, females had a significantly higher score (Mean rank=518.70) compared to males (Mean rank=456.15) in the dimension of Precautions [U=103398.50, $p<0.05$]. Similarly, in the dimension of Expectations, female students had a significantly higher score (Mean rank=511.43) compared to male students (Mean rank=497.33) [U=107433.00, $p<0.05$]. However, in the dimension of Evaluation, males had a significantly higher score (Mean rank=512.11) compared to females (Mean rank=475.65) [U=109694.00, $p<0.05$].

Comparison of Students' Views on Instruction during the Pandemic Process according to Educational Level

An analysis of students' views on teaching during the pandemic process with regard to educational level indicated a significant difference in all sub-dimensions except for Evaluation (Table 6).

Table 6. Mann Whitney-U test results for the comparison of students' views on online instruction according to educational level

Variables	Group	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*p*
Satisfaction	Secondary School	234	651.39	152425.50	50101.50	-9.88	.000
	High School	748	441.48	330227.50			
Precautions	Secondary School	234	603.45	141207.50	61319.50	-6.93	.000
	High School	748	456.48	341445.50			
Accessibility	Secondary School	234	663.87	155344.50	47182.50	-10.67	.000
	High School	748	437.58	327308.50			
Expectations	Secondary School	234	578.99	135482.50	67044.50	-5.41	.000
	High School	748	464.13	347170.50			
Evaluation	Secondary School	234	472.37	110534.50	83039.50	-1.18	.236
	High School	748	497.48	372118.50			
Support	Secondary School	234	616.95	144366.00	58161.00	-7.77	.000
	High School	748	452.26	338287.00			
EBA TV & Service Desks	Secondary School	234	602.52	140990.50	61536.50	-6.88	.000
	High School	748	456.77	341662.50			
Time	Secondary School	234	589.19	137868.00	64659.00	-6.10	.000
	High School	748	460.94	344785.00			

As shown in Table 6, a significant difference was found in favor of secondary school students in all sub-dimensions except for Evaluation (Satisfaction [U=50101.50, p<0.05], Precautions [U=61319.50, p<0.05], Accessibility [U=47182.50, p<0.05], Expectations [U=67044.50, p<0.05], Support [U=58161.00, p<0.05], EBA TV & Service Desks [U=61536.50, p<0.05], Time [U=64659.00, p<0.05]).

Comparison of Students' Views on Instruction during the Pandemic Process according to the Status of Internet Connectivity

In terms of the status of internet connectivity, a significant difference was found in the sub-dimensions of Satisfaction, Accessibility, Support, and Time (Table 7).

Table 7. Mann Whitney-U test results the comparison of students' views on online instruction according to the status of internet connectivity

Variables	Group	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*p*
Satisfaction	No internet access	296	383.26	113444.50	69488.50	-7.86	.000
	Have internet access	686	538.20	369208.50			
Precautions	No internet access	296	473.50	140156.00	96200.00	-1.309	.190
	Have internet access	686	499.27	342497.00			
Accessibility	No internet access	296	225.84	66848.50	22892.50	-19.32	.000
	Have internet access	686	606.13	415804.50			
Expectations	No internet access	296	480.74	142300.00	98344.00	-.782	.434
	Have internet access	686	496.14	340353.00			
Evaluation	No internet access	296	483.85	143220.00	99264.00	-.556	.578
	Have internet access	686	494.80	339433.00			
Support	No internet access	296	413.82	122491.50	78535.00	-5.65	.000
	Have internet access	686	525.02	360161.50			
	No internet access	296	473.81	140247.00	96291.00	-1.289	.197

EBA TV & Service Desks	Have internet access	686	499.13	342406.00			
Time	No internet access	296	438.57	129817.00	85861.00	-3.887	.000
	Have internet access	686	514.34	352836.00			

As noted in Table 7, students with internet access (Mean rank=538.20) had a significantly higher score than students without internet access (Mean rank=383.20) with regard to Satisfaction [U=69488.50, p<0.05]. Similarly, in terms of Accessibility, students with internet access (Mean rank=606.13) had a significantly higher score than students without internet (Mean rank=225.84) [U=22892.50, p<0.05]. Additionally, students with internet access (Mean rank=525.02) had a significantly higher score than students without internet access (Mean rank=413.82) with regard to Support [U=78535.00, p<0.05]. In the same manner, students with internet access (Mean rank=514.34) had a significantly higher score than students without internet access (Mean rank=438.57) with regard to Time [U= 85861.00, p<0.05].

Comparison of Students' Views on Instruction during the Pandemic Process according to the Mode of Participation

In terms of the mode of participation, a significant difference was found in all sub-dimensions except for Evaluation (Table 8).

Table 8. Kruskal Wallis-H test results the comparison of students' views on online instruction according to the mode of participation

Variables	**Group**	***N***	**Mean Rank**	X^2	***sd***	***p***	**Difference**
Satisfaction	TV	187	346.22	93.33	2	.000	3>2>1
	Live Lesson	635	496.86				
	TV+ Live Lesson	160	640.02				
Precautions	TV	187	461.68	22.19	2	.000	3>2>1
	Live Lesson	635	476.20				
	TV + Live Lesson	160	587.08				
Accessibility	TV	187	198.34	252.86	2	.000	3>2>1
	Live Lesson	635	549.15				
	TV + Live Lesson	160	605.33				
Expectations	TV	187	466.62	17.82	2	.000	3>2>1
	Live Lesson	635	477.17				
	TV + Live Lesson	160	577.47				
Evaluation	TV	187	481.69	0.28	2	.869	-
	Live Lesson	635	493.49				
	TV + Live Lesson	160	495.06				
Support	TV	187	394.41	41.06	2	.000	3>2>1
	Live Lesson	635	495.60				
	TV + Live Lesson	160	588.72				
EBA TV & Service Desks	TV	187	531.30	81.94	2	.000	3>1>2
	Live Lesson	635	437.91				
	TV + Live Lesson	160	657.67				
Time	TV	187	428.50	27.54	2	.000	3>2>1
	Live Lesson	635	486.43				
	TV + Live Lesson	160	585.24				

As seen in Table 8, students mostly participated in distance education only via live lesson (N=635), followed by TV only (N=187) and TV + live lesson (N=160). When the sub-dimensions of the scale were examined in terms of the way students participate in distance education, a significant difference was determined in favor of students who attended both TV and live lessons in all sub-dimensions (Satisfaction [X^2=93.33, p<0.05], Precautions [X^2=22.19, p<.05], Accessibility [X^2=252.86, p<.05], Expectations [X^2=17.82, p<.05], Support [X^2=41.06, p<0.05], EBA TV and Service Desks [X^2= 81.94, p<0.05], and Time [X^2=27.54, p<0.05]), except for Evaluation.

Comparison of Students' Views on Instruction during the Pandemic Process according to the Number of People Participating in Distance Education in the Same House

A significant difference was found in the dimensions of Satisfaction, Accessibility, and Time with regard to the number of people participating in distance education in the same house (actively using it as a teacher or student) apart from the student participating in the study (Table 9).

Table 9. Kruskal Wallis-H test results comparison of students' views on online instruction according to the number of people participating in distance education in the same house

Variables	Group	*N*	Mean Rank	X^2	*sd*	*p*	Difference
Satisfaction	Single Participant	231	535.44	9.461	2	.009	1>2>3
	Student + 1 Participant	330	495.31				
	Student + ≥ 2 Participants	421	464.41				
Precautions	Single Participant	231	500.27	1.752	2	.416	-
	Student + 1 Participant	330	474.70				
	Student + ≥ 2 Participants	421	499.86				
Accessibility	Single Participant	231	541.91	43.619	2	.000	2>1>3
	Student + 1 Participant	330	544.05				
	Student + ≥ 2 Participants	421	422.65				
Expectations	Single Participant	231	494.82	.296	2	.862	-
	Student + 1 Participant	330	484.59				
	Student + ≥ 2 Participants	421	495.10				
Evaluation	Single Participant	231	492.11	.021	2	.989	-
	Student + 1 Participant	330	489.66				
	Student + ≥ 2 Participants	421	492.60				
Support	Single Participant	231	510.10	3.076	2	.215	-
	Student + 1 Participant	330	501.29				
	Student + ≥ 2 Participants	421	473.62				
EBA TV & Service Desks	Single Participant	231	490.89	.971	2	.616	-
	Student + 1 Participant	330	503.15				
	Student + ≥ 2 Participants	421	482.71				
Time	Single Participant	231	498.61	7.367	2	.025	2>1>3
	Student + 1 Participant	330	520.25				
	Student + ≥ 2 Participants	421	465.06				

In statistical analysis, a significant difference was determined with regard to three sub-dimensions including Satisfaction (X^2=9.461, p<0.05), Accessibility (X^2=43.619, p<0.05] and Time [X^2=7.367]), p<0.05]). Accordingly, it can be asserted that students who attended distance education at home alone were more satisfied than students who had more than one user (e.g. sibling, parent) at home.

Comparison of Students' Views on Instruction during the Pandemic Process according to the City of Residence

When the views of students on instruction during the pandemic process were examined, a significant correlation was found between the cities of residence (Bayburt, Diyarbakır, Elazığ and Giresun) and the sub-dimensions except for Evaluation (Table 10).

Table 10. Statistical comparison of students' views according to the city of residence

	Satisfaction	Precautions	Accessibility	Expectations	Evaluation	Support	EBATV & Service Desks	Time
Chi-Square	98.668	38.952	225.269	18.056	6.538	63.574	22.520	36.692
df	3	3	3	3	3	3	3	3
Asymp. Sig.	.000	.000	.000	.000	.088	.000	.000	.000

a. Kruskal Wallis Test
b. Grouping Variable: City of Residence

As seen in Table 10, there were significant differences between the cities and all sub-dimensions except for Evaluation.

DISCUSSION AND CONCLUSION

In this study, it was aimed to determine the views of secondary and high school students on the distance education activities (TV broadcast, live lessons) carried out during the COVID-19 pandemic and the blended learning activities carried out during the post-pandemic back-to-school process. For this purpose, the "Scale of Evaluating Instruction in Pandemic Process" was applied to the students and the obtained data were analyzed in terms of different variables such as gender, educational level, status of internet connectivity, modes of participation, number of people participating in distance education in the same house, and the city of residence.

Within the scope of the study, it was revealed that most of the students participated in distance education using a single device, with the most widely used device being smartphone, followed by TV and computer, respectively. In contrast, the number of students using more than one device was relatively lower. This finding could be due to the fact that smartphones are both economically accessible and also available with most of the students and families (Kaysi, Yavuz, & Aydemir, 2021; Talan, 2021). These results are consistent with the results of studies conducted by Öz Ceviz et al. (2020), Pala (2018), Serçemeli and Kurnaz (2020), and YÖK (2020). In addition, in the study carried out by Altuntaş Yılmaz (2020), the device preferences of the students were examined according to gender and it was concluded that female students mostly used smartphones and male students, unlike in this study, mostly used computers to participate in distance education.

In the statistical analysis, it was revealed that the students had above-average opinions on the security precautions taken at school. Since the beginning of the pandemic process, the Turkish Ministry of National Education has notified school administrators about all the measures that need to be taken in schools and thus the efforts of school administrators and teachers to obtain the "Clean School Certificate" may be the reason for the positive opinions about security precautions. On the other hand, the students' satisfaction about the process, accessing and using the internet as well as information technologies for distance education, and participating in live lessons were at a moderate level. However, students had below-average opinions about receiving psychological and academic support and benefiting from EBA & Service Desks. Of note, while the support received from the families was above the average, the support received from the teachers was below the average. This finding emphasizes the active role of families in this process. Similarly, Başaran, Dogan, Karaoğlan, and Şahin (2020) also stated the students did not receive enough psychological and academic support during this process. Additionally, Türker and Dündar (2020) obtained similar findings for EBA live broadcasts. In the same study, it was determined that the students had below-average opinions regarding the use of EBA TV & Service Desks. Based on this finding, the authors recommended that both teachers and students should be encouraged to use EBA effectively and efficiently. However, the authors noted that the students did not consider EBA TV broadcasts to be sufficient for learning and that this may be one of the reasons why students mostly preferred smartphones to attend live lessons.

Factors such as psychological, demographic, or physical opportunities affect student satisfaction in distance education. Additionally, access to technological resources may be related to the socioeconomic status of families (Balaman & Hanbay-Tiryaki, 2021; Talan, 2021). The fact that Turkey, as in the whole world, was unprepared for this process (Demir & Özdaş, 2020) may be the reason for the items in which students had below-average opinions. Additionally, the lack of teacher-student interaction in face-to-face education can be shown as the reason for students' views about EBA TV (Karpenko, 2008). In a similar way to our study, the studies conducted by Eren, Korkmaz, Yıldırım, and Avcı (2021) and Qazi et al. (2020) indicated that the students were satisfied with the distance education method. However, Buluk and Eşitti (2020) stated that male students were more satisfied with the distance education process, while Karadağ and Yücel (2020) stated that students' satisfaction levels did not show a significant difference between genders. Similarly, the study conducted by Paechter, Maier, and Macher (2010) concluded that there was no significant difference between the two genders with regard to students' satisfaction levels and expectations. In a similar way to our study, it was revealed that female students had higher expectations than male students regarding the distance education conducted during the pandemic process and it was also noted that they considered the precautions to be sufficient and they were satisfied with the precautions taken at school. In a similar manner, the studies conducted by Adnan and Yaman (2017), Korkmaz et al. (2015), and

Kaynar, Kurnaz, Doğrukök, and Barışık (2020) reported that while the students' expectations from distance education did not differ between genders, the average score of male students was relatively higher than that of female students. These results are inconsistent with the results of our study.

It was observed that the satisfaction and expectations of the secondary school students regarding the instruction activities carried out in this process were higher than those of the high school students. In addition, it was also revealed that secondary school students had higher levels of accessing and using the internet and other technologies and getting support from different sources such as family and school than high school students. The study conducted by Eygü and Karaman (2013) indicated a significant difference between the ages of the students and their satisfaction with distance education. By contrast, the study by Terzi, Akalın, and Erdal (2020) found no significant difference between age and satisfaction, contrary to the results obtained in this study.

Our findings also indicated that students with internet access were more satisfied with the instruction activities in this process. Additionally, it was revealed that students with internet access received more support from different sources such as family and school and also the time they spent on the instruction was higher when compared to other students. These findings could be attributed to the fact that the level of technical support provided to the students is directly proportional to students' access to technology (Adnan & Yaman, 2017). In addition, the students that watched live lessons on EBA TV alone indicated that this method was their only choice, in which they could not participate actively and the teachers could not obtain feedback. By contrast, another study reported that even though the students who participated in distance education via EBA Live lessons received partial feedback, satisfactory results could not be obtained and thus both the students and teachers complained about the ineffectiveness of the lessons (Can, 2020). On the other hand, some other studies reported that the students in public schools had greater problems in accessing distance education compared to students in private schools and it was also noted that students who could easily access distance education and did not have connection problems had more positive views regarding distance education than those who had connection problems (Kaynar, Kurnaz, Doğrukök, & Barışık, 2020).

Since the transition to distance education during the pandemic period, online environments and TV broadcasts have been actively used in this process in many countries (Stojanovic, El-Khatib, Brandic, & Maalouf, 2020). In our study, students who participated in distance education using both TV and live lessons were more satisfied with the instructional activities, had higher expectations, had easier access to technology, and received more support compared to students who participated only by using TV or live lessons. One reason for this could be that the students who participated in distance education with TV alone had little or no interaction, could not participate in discussion and Q&A activities, and could not ask any questions to the teachers when compared to students both participating in live online lessons and watching TV broadcasts. Moreover, reasons such as the teacher's inability to establish eye contact and not being able to monitor the students continuously in distance education make it difficult for students to attain a high level of participation in the lesson (Gürer, Tekinarslan, & Yavuzalp, 2016). A study by Özdoğan and Berkant (2020) presented similar findings. Another study also noted that the students could not attend distance education courses due to the fact that the lessons on EBA TV were broadcasted at an early hour, the number of siblings attending distance education simultaneously was remarkably high, and there was only one television available in the house (Başaran, Dogan, Karaoğlan, & Şahin, 2020).

Our findings also showed that students who had no other family members (e.g. sibling, mother, father) participating in distance education at home apart from themselves were more satisfied with the teaching activities compared to other students. Meaningfully, the students had greater accessibility to the internet and technological devices and also spent more time for distance education compared to other students. Similarly, the study by Başaran, Doğan, Karaoğlan, and Şahin (2020) also noted that the high number of siblings participating in distance education simultaneously was one of the reasons for not participating in distance education, which was primarily caused by the insufficient number of devices for each family member. This finding, as noted by Özdoğan and Berkant (2020), Ramos-Morcillo et al. (2020), and Salman (2020), could be ascribed to the inequality of opportunities associated with the socioeconomic status of the people living in the regions where this study was conducted. Additionally, these studies also emphasized that students in rural areas are in a more disadvantaged position than students in urban areas.

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Research Paper

Assisting Higher Education Learners to Acquire Self-Regulated Writing Strategies during COVID-19

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ABSTRACT

Background: The abrupt transition to virtual language learning environments due to the Covid-19 pandemic has brought considerable challenges to educational practices. In the context of foreign/second language learning and teaching, it has become more difficult to ensure that learners have the necessary engagement and motivation levels along with sufficient support and guidance. As educators and researchers report, the adversities in today's online learning environments need to be challenged.
Purposes: The study is meant to contribute to language learning and teaching practices by sharing the results of the implementation of a self-supporting tool, namely, Self-Monitoring Chart for Effective Writing Strategies. The chart has been developed by the researchers for an online academic English writing course at higher education level to assist learners their writing improvement and to become self-regulated learners while maintaining their engagement in their writing tasks.
Methodology/Approach: The study was designed as a qualitative case study and the opinions of the participants on their experiences of using the chart were elicited using semi-structured interviews. The participants were students at English Language Teaching departments of two state universities (N=48). The qualitative data gathered was analyzed using systematic content analysis.
Findings and Discussion: The results indicate that the learners greatly benefited from using the SMC. In particular, they reported to have become aware of SRL writing strategies, to have learned how to implement them, to be more engaged and more motivated in writing tasks. The implications are meant to contribute to online language learning and teaching contexts.

INTRODUCTION

Covid-19 brought about considerable challenges to different stakeholders in education; namely, learners, teachers and administrators at universities. The main challenges include technology and infrastructure-related impediments, issues due to lack of motivation and desirable attitudes, and also problems stemming from inadequate and/or inefficient online learning and teaching approaches (e.g., Alea et al., 2020; Amemado, 2020; Aristovnik, et.al. 2020; Chen et al., 2020; Crawford et al., 2020; Drane et. al., 2020; Dwivedi et al., 2020; Toquero, 2020). According to recent studies, the observable outcomes of this abrupt transition have been quite overwhelming on the side of the teachers (Donitsa-Schmidt & Ramot, 2020; Mishra et al., 2020). They have not only felt the need for curricular, administrative and infrastructural support to teach online, but they also have experienced important problems related to using effective online teaching methods and techniques, supporting learners with the necessary resources for online learning, monitoring their progress, and adapting themselves to this new environment (Donitsa-Schmidt & Ramot, 2020; Mishra et al. 2020). In addition to lack of social interaction, sense of belonging to the school environment, and the technological difficulties, learners have experienced difficulties in receiving timely feedback from their teachers (Adnan & Anwar, 2020; Chen et al., 2020; Drane et. al., 2020; Popa et al., 2020).

In the context of foreign/second language (F/SL) learning and teaching, recent studies indicate that the challenges during online learning have superadded (Chen et al., 2020; Popa et al., 2020). Virtual language learning environments make it more difficult to ensure that learners have the necessary engagement and motivation levels along with sufficient support and guidance (Chen et al., 2020; Mishra et al. 2020; Popa et al., 2020). Language learning is not composed of acquiring the gradual knowledge included in educational programs, but rather, it is mainly considered to be skill development, which requires higher levels of learner engagement and self-regulated learning (Hu &Kuh, 2003; Mazer, 2013). In such a skill-building process, learners need to be motivated and engaged by being actively involved in the materials, tasks and activities that are both challenging and motivating while receiving timely and sufficient feedback on their progress (Fredericks et al., 2004; Gellin, 2003; Hu &Kuh, 2003; Mazer, 2013).
As for improving foreign language writing skills throughout online education, which is considered as one of the most challenging skills for learners (McCutchen, 2011; Wang, 2014), the process has been even more challenging. Research illustrates that language learners try hard to write in an effective or 'satisfactory' manner as the nature of the writing itself is multi-dimensional and learners are required to meet specific standards belonging to structural, lexical, discourse, and task features (Hidi&Boscolo, 2006; MacArthur, 2014; Wang, 2014).

In higher education contexts, writing in foreign language plays a substantial role in learners' personal, academic, professional, and social development as writing experiences enable learners to improve their language production skills, develop critical thinking skills, learn to communicate their ideas in F/SL contexts effectively, and to improve their knowledge on the content areas (Bruning & Horn, 2000). Therefore, the adversities in today's online learning environments need to be challenged. One way to assist learners to continue improving their writing skills is to enable them to become self-regulated learners and assist them to maintain their engagement in their writing tasks in online education. Reporting learner engagement as a strong predictor for achievement and long-term success, research highlights the importance of increasing learner engagement both for higher academic achievement and for life-long learning and satisfaction for life (Appleton, et al., 2006; Trowler&Trowler, 2010). Within this context, we postulate that learner engagement levels could be elevated by introducing to and equipping learners with SRL strategies as "self-regulated learners have the necessary cognitive, behavioral, affective, and social features to become active, independent, and constructive learners." (Seker, 2016; p.601). In this respect, a self-monitoring chart for effective writing strategies (SMC) has been developed by the researchers and tailored for an online academic English writing course at higher education level in order to equip learners with self-regulated learning strategies (SRL) and assist them to be productively engaged. The aim of the study is to find out the impacts of the implementation of SMC on learners' reported use of SRL strategies in their writing tasks. The specific research questions sought are:

1. Do students report using SRL strategies in their writing assignments with the help of SMC?
2. Do students report higher levels of engagement in their writing tasks with the help of SMC?
3. What are the opinions of higher education ELT learners on the SMC?

REVIEW OF LITERATURE

Learner Engagement

Engagement is defined as "positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufelli et al, 2002, p.74). Engagement can manifest itself in persistent affective and cognitive state, high levels of energy activation and involvement for tasks, high levels of concentration, persistence, and resilience against challenges (Llyod, 2014; Truta et al., 2018). In the field of educational psychology, on the other hand, learner engagement broadly refers to active involvement in learning and is viewed from cognitive, psychological, social, and behavioral dimensions (Finn& Zimmer, 2012; Fredricks et al., 2011). When engaged, learners have been reported to spend more time and energy on learning tasks (Hu &Kuh, 2003; Kuh, 2009); feel higher levels of enjoyment and attachment (Pike &Kuh, 2005); have higher self-esteem and satisfaction (Lam et al., 2012); develop practical competence and establish relationships with the newly learned materials and their own personal and academic lives (Gellin, 2003; Pike & Kuh, 2005); exhibit increased performance and productivity (Krause & Coates, 2008); and obtain higher grades and achievement rates (Klem& Connell, 2004; Rumberger&Rotermund, 2012).

Considering engagement as the interaction between the learner and the learning context, Fredricks and McColskey (2012) distinguish between the concept of motivation and of engagement. While motivation is the underlying reason(s) for an action or an effort, engagement is the behavioral, emotional, and cognitive manifestations of motivation. In other words, motivation is perceived as a psychological state that determines the learner's desire to do a task, engagement is more related to the actual actions and/or efforts taken towards the task. A motivated learner is expected to 'want to learn' whereas an engaged learner 'exhibits the efforts to learn". At this stage, if learners are able to regulate their learning efforts, they are more likely to accomplish deeper learning (Fredrickset al., 2004), which creates an opportunity to implement self-regulated learning strategies that lead to deeper learning (Pintrich & DeGroot, 1990).

Self-Regulated Learning and Its Role in Foreign Language Learning

In its broader sense, self-regulated learning refers to demonstrating control over learning actions (Fredricks, et al., 2011). For Pintrich (2004), self-regulated learning process is "an active and constructive process through which learners establish objectives, monitor, regulate and control their cognition, motivation and behaviour guided by their goals and the contextual features of the learning environment' (p. 453). When executed effectively, the use of self-regulated learning strategies have been reported to enhance learner autonomy and increase achievement by enabling learners to become active agents of their learning (Andrade & Evans, 2012; Beishuizen & Steffens, 2011).

In the context of foreign language learning, self-regulated learners are found to exhibit higher performance in language skills (i.e., speaking, writing, reading, etc.) and higher language achievement rates (Andrade & Evans, 2012; Gunning & Oxford, 2014; Ma & Oxford, 2014).

Foreign language learning requires continuous engagement and persistence in learning. However, learners' engagement could be facilitated and their learning experiences could be enhanced by equipping them with SRL language learning strategies. When self-regulated learners are engaged in learning, they are likely to set effective learning goals, create optimum learning environments, maintain necessary psychological states, search and compile sources efficiently, manage their time effectively, seek support from or collaborate with others, implement and orchestrate necessary cognitive strategies for deeper learning while monitoring and evaluating their learning processes continuously.

METHOD

The study was designed as a qualitative case study, which is defined as 'a research methodology that provides tools for researchers to study complex phenomena within their contexts' (Baxter & Jack, 2008, p. 544). The opinions of the participant higher education learners on their experiences of using the developed tool were investigated using semi-structured interviews. The qualitative data gathered was analyzed following inductive content analysis method (Mason 2002).

The Development of the Self-Monitoring Chart

A chart for effective writing strategies has been developed in order to guide higher education learners by efficiently implementing SRL writing strategies autonomously while assisting them in their online academic writing tasks (Appendix B). The chart was developed in line with the cyclical model of SRL with the phases of forethought, performance, and reflection on performance (Zimmerman, 2000). These phases are represented as pre-writing, writing, and post-writing in SMC. Under each phase, learners are provided with cognitive, metacognitive, affective and socio-interactional SRL strategies that could be implemented to elevate their engagement and their performance in their writing tasks. For each phase, the steps to be completed are listed together with the actions that should be planned or taken at each phase during completing a writing task. In the chart;

Phases: The chart has three phases (i.e., pre-writing, writing, and post-writing) representing forethought, performance, and reflection on performance phases in the cyclical model of SRL;

Steps: They include the main steps to be taken under each phase and reflect cognitive, metacognitive, affective, and socio-interactional SRL strategy categories adapted for writing skill development (e.g., goal setting, organizing study environment, outlining, or editing);

Actions: They comprise cognitive, metacognitive, affective, and socio-interactional SRL strategies to implement under each step (e.g., gathering sufficient knowledge, activating previous knowledge, searching online sources, asking for assistance/feedback, exchanging ideas and sources, etc.).

Covering both lower-level and higher-level writing skills (Wilson, et al. 2016), the chart has a dual purpose: first, it aims to introduce SRL writing strategies by listing them in a systematic chronological order. The second purpose is to guide and enable learners to acquire and improve SRL repertoire and use, digital skills, and collaboration. Figure 1 shows the graphical representation of the SMC.

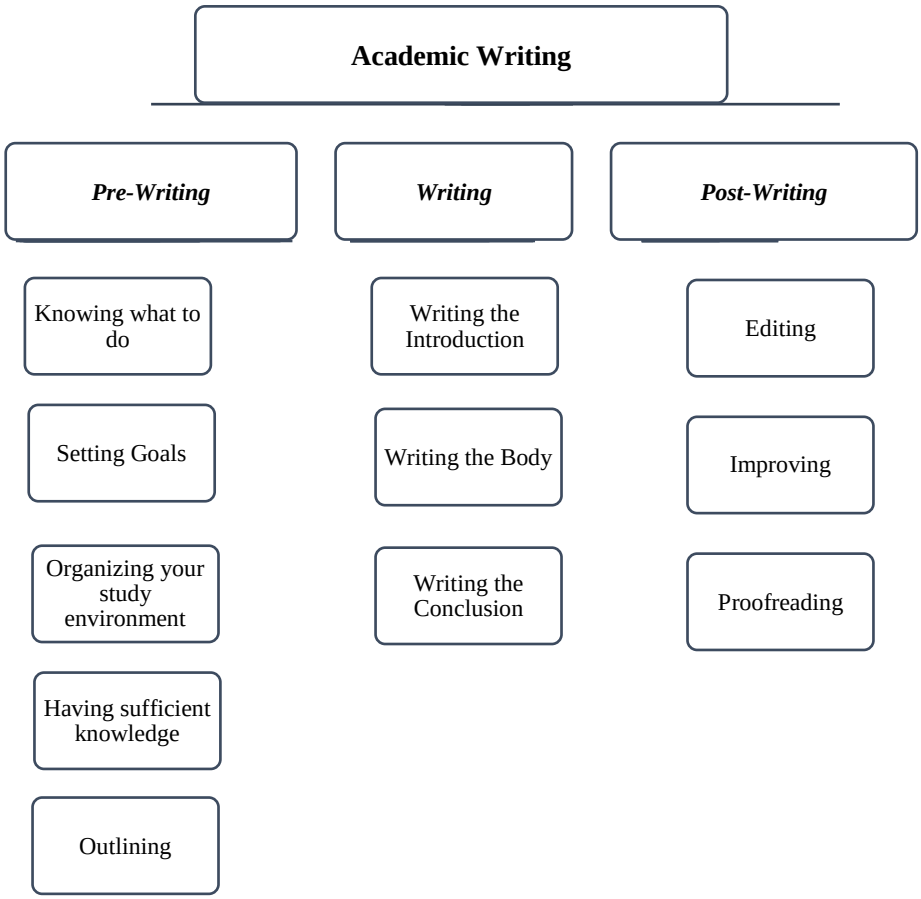

Figure 1. The Graphical Representation of Self-Monitoring Chart for Writing

Context and Participants

The participants were students at English Language Teaching (ELT) departments of two state universities in Turkey. The learners registered to 'Critical Reading and Writing' courses (N=148) were asked to participate on a voluntary basis. Among these, 48 of them agreed to participate in the online semi-structured interviews and signed consent forms. The ethical approval for this study was received by the Research Ethics Committee of one of the universities (Date and Number: 2020/14-6).

Table 1. Demographic information of the participants

	Gender		**Age**			
	Female	Male	17-19	20-22	23-25	26+
F	28	20	11	23	10	4
%	58.3	41.6	22.9	47.9	20.8	8.3
Std. Dev.	.455		.69213			

The majority of the participant learners are female, and their ages varied between 20 and 22 (58.3 % and 47.9%, respectively). The researchers were their course instructors. The course was delivered by the researchers synchronously through the online course management systems of these two universities during Covid-19 pandemic. In line with the aim of the study, the learners were informed about the chart and were asked to follow the phases, the steps, and the actions listed in it as they progressed in their writing tasks. While doing so, they were requested to fill the chart's self-check boxes (i.e., done, not done, will do (when?) for the three argumentative research-integrated writing tasks that they would be assigned in the course. They were expected to submit a completed chart along with each essay submission.

Data Collection Tool and Procedure

Previous to their first assignment, the SMC was introduced to the participant learners through a virtual meeting and a screencast video that explained the chart in detail. The virtual meeting was held previous to the participant learners' first assignment using Google meet and lasted 57 minutes. In the meeting, the chart was explained, the rationale and the theoretical basis were shared, and theoretical and practical information on SRL strategies and their implementations were discussed. During the meeting, the participants were encouraged to share their opinions and ask questions regarding the content and/or the implementation of the strategies in the chart. In addition, a screencast video was prepared by one of the researchers and lasted 74 minutes. In the video, the researcher explicated and exemplified each phase, step, and action in the chart in a detailed way while explaining each action's corresponding strategies. The video link was shared with the participants together with the SMC chart that they were supposed to fill while completing their first writing task. They were asked to fill the chart for each of the following three assignments as well and send it along with their each assignment.

Following the submissions of three argumentative research-integrated writing tasks along with filled SMCs, the semi-structured interviews, developed by the researchers to investigate the learners' opinions on the SMC, were conducted online with the volunteering learners (see Appendix A). These interviews were recorded and were transcribed verbatim by the researchers. The qualitative data was analyzed following inductive content analysis method (Mason, 2002). In the first step of the analysis, each researcher interpreted the themes and codes separately. Then, these first results for the emerging codes were compared and the differences were discussed until the disagreements were resolved. In order to increase credibility and transferability of the data, the researchers worked on the themes together. After the researchers tabulated and interpreted the themes and codes together, another coder worked with the researchers on some randomly selected episodes from the interview transcripts. The calculated interrater reliability was based on percentages using the following formula: [Reliability= (number of agreements)/ (number of agreements+number of disagreements)*100] (Miles & Huberman, 1994). The interrater reliability in this study was found to be 89 %, which is considered to indicate a considerably high level of reliability as any value above 75% is considered to be acceptable (Mackey & Gass, 2005).

FINDINGS

In the semi-structured online interviews conducted, the participants' opinions on the SMC were elicited. The emerging frequent themes regarding the participant learners' opinions were directed towards two main categories: The themes in first category were related to "Opinions on SRL strategies and their implementations", which had three sub-categories as a) "becoming aware of the strategies", b) "learning how to employ the strategies", and c) "being motivated/encouraged to use the strategies".

Table 2. Frequencies of themes and subthemes for the first category

	Awareness		**Implementation**			**Motivation to use**	
	Became aware with SMC	Already knew some	Pre-writing	Writing	Post-writing	Highly	Moderately
F	32	16	32	14	38	28	14
%	66.6	33.3	66.6	29.1	79.1	58.3	29.1

According to the results, the majority of the participants became aware of the SRL writing strategies for the first time by the help of SMC (66.6%) while some of them stated that they already knew some of the strategies (33.3%). As one of the participants put it; '*It was not until the time that you have sent this chart [that I had used] these strategies that you have shown us in the self-monitoring chart*' (L12).

The participants also commented on the use of the strategies during their writing tasks stating that they practiced implementing various SRL strategies during different phases of their writing assignments. For example, one of the participants expressed that '*These strategies are the key supports that help me to improve my writing skills. Although I use all the strategies from time to time, in my writing process, I started to use the brainstorming strategies before starting the actual writing all the time, a grammar checker for the purpose of examining and checking examples about the subject while writing, and I will continue to use them. I also use the links from post-writing section*' (L7). Another participant commented in a similar way; '*Thanks to this chart, I've minimized my grammar errors. Plus, the pre-writing section supported me to make up sentences from random brainstorming ideas, and I verified the accuracy of my paper with samples. Moreover, I can say that writing does not scare me like it used to as I have understood that by following the steps, I can do it easily*' (L11).

There were responds for using SRL in pre-writing, writing, and post-writing stages, yet, post-writing strategies was the most highly mentioned (79.1%). As one participant stated; '*I became much more conscious about how I should approach towards a writing assignment. Especially for the post-writing part, I believe that I have started to benefit from them*' (L18). Similarly, L9 said that '*During this process, I have learnt what exactly I should do to edit my writing. Beforehand, I used to read my written work and could not find anything to change before I submit it*'.

Another frequently mentioned SRL writing strategies during the interviews were those in the pre-writing phase (66.6%), such as goals setting and planning as stated in the following excerpt: '*Firstly, I believe the chart is really helpful for those who get anxious and unaware of what, or how to write. It does not only provide simple instructions but it also gives tips to the students. Especially the pre-writing section is a very basic and sufficient guide to start a paper and for gathering one's thoughts around*' (L34). One of the participants told his first experience in the following words: '*Beforehand, I was just starting to write and then I was submitting my assignments. Now, what I have learned is that it is a process that requires planning*' (L19). Another one said that '*I have learned to organize my work as I can now make a plan for myself and write an outline for a research assignment. I am able to plan on making my homework assignments better now*' (L22). Another learner explained how SMC assisted her to implement the strategies for setting goals and planning: '*I get help from this chart, especially when setting short goals that will organize my writing environment and control my writing process*' (L31).

The smaller group of participant learners has also indicated that with the help of this chart, they were able to become more aware of and could use these strategies in the 'performance phase' (29.1%), as they could monitor and evaluate their performance in writing. For instance, L33 stated that '*My friend and I exchanged our writing assignments and we gave feedback to each other's essays. Afterwards, we made some corrections on our assignments before we resubmitted them. I believe this process will help me get better grades*'.A similar comment was made by another participant; '*It helped me to be more structured in the writing process and to pay attention to even small points. In this way, I think my rate of making mistakes have decreased'* (L15).

Overall, the participants pointed out that SMC increased their awareness of different strategies to be employed while they were involved in any writing activity and it also helped them to utilize some strategies for goal setting, performance, and evaluation successfully. They also revealed that they were willing and motivated to make use of SRL writing strategies in their future academic life as thanked the course teachers, i.e., the researchers, for the personalized guidance for autonomy.

The second category included the themes related to the participants' engagement levels in their writing tasks while using SMC and the frequencies and the percentages of the themes and subthemes are given in Table 3 below:

Table 3. The frequencies of the themes and subthemes for the second category

	Spending more time on …					**Motivation**	
	Planning	Searching for Resources	Writing	Editing	Communicating about writing tasks	Highly	Moderately
F	32	14	28	29	11	32	16
%	66.6	29.1	58.3	60.4	22.9	66.6	33.3

As can be seen in Table 3 above, the majority of the participants stated that they started to spend more time and energy on their writing tasks after using SMC, which indicates higher levels of engagement in writing. Specifically, they reported to spend more time on planning their writings, as stated by one participant: '*I am still using those strategies and they help me a lot. I used to get in trouble with my timing and I struggled a lot of times about how to start writing. I realized that I didn't use to spend any time on planning my writing. That chart gave me the planning skill*' (L6); or as another participant put it; '*I believe the chart is beneficial as it is very detailed. … There are different actions in each step. They include many tips from brainstorming to samples with useful links. They all helped me to plan every single detail about how to do it and when to do it. I saw that when I spend enough time on planning and organizing, I have better writing quality*' (L4).

They also reported to spend more time on organizing or editing their writing tasks (e.g., '*Thanks to this chart; I believe every student like me is a better writer than they were. This chart helps you to make a unity in your writing by following the steps. It helps you to organize your ideas and prepare you to the last version of your writing piece. It shows that you can't reach the perfect version of your writing if you do not care and observe it as long as it requires*'(L20); '*First of all, I think it provides a broad perspective for the writing skill since the table is too detailed and you need to work on it several times to understand it. While examining the chart, I have made a lot of use of the table in my homework processes by organizing many things, so I think it is very beneficial/helpful, though I realized now finishing my writing tasks takes much longer*'(L12) '*I've minimized my grammar errors with the help of this self-monitoring chart. It urged me to control the tiniest points of my papers. It takes more time now; but thanks to the chart, I am no longer nervous to write a paper since there is a chart that I can keep in control my papers*' (L14).

The other important theme that emerged from the interviews carried out is 'being motivating'. Most of the participant students stated high levels of motivation towards writing thanks to using the SMC (66.6%). While a smaller group stated moderate levels of motivation (33.3%), there were no responds indicating de-motivation or discouraging effect of using the SMC. As stated by one of the learners; '*I learned effective writing strategies thanks to this self-monitoring chart. Through this chart, I realized my mistakes better. Besides, it affected positively my attitudes towards writing. Now I think I kind of like to write*' (L37).

Many students thought that once they became aware of the strategies that could be used in their writing assignments, they became more motivated for their writing assignments in the future, as the participants stated, '*I am planning to do more research after the feedback you gave us because I have learnt a lot about writing*' (L19); '*I have learnt many different websites that I was not aware of and also the different techniques of searching online which I am planning to use in the future for my assignments*' (L12); ' *It was quite beneficial. Why not use them in the future as well? I think they will all help me get higher grades*' (L10); '*Additionally, I would like to point out that I am going to -without a doubt- take advantage of this chart for the upcoming assignments aiming for writing skills*'(L21).

The last group of themes included the responses related to "Opinions on SMC as a Tool", which yielded negative and positive groups of themes with multiple sub-categories under each. Their distribution is given in Table 4 below:

Table 4. The distribution of negative and positive opinions on SMC as a tool

	Negative Opinions on SMC as a Tool			**Opinions on SMC as a Tool**			
	Complex	Time-consuming	Unnecessary	Practical	Clear	Useful	Supportive
F	5	2	1	26	34	39	21
%	10.4	4.1	2	54.1	70.8	81.2	43.7

While the majority of the opinions elicited regarding the use of SMC were highly positive, eight participants expressed negative opinions. They either found the use of the chart complex (10.4%), time consuming (4.1%), or unnecessary (2%). As expressed by one of the participants, '*The chart was a little bit too detailed for me. I sometimes got bored following the steps. They were too many and complicated*' (L18).

On the other hand, the positive comments were significantly higher. The participants found the chart to be practical (54.1%), clear (70.8%), useful (81.2%), and supportive (43.7%). A high number of students mentioned the usefulness of the chart stating that; '*I found it very useful and helpful in terms of effectiveness of my writing skills, and I could better understand what I have done and what I should do next for these writing steps thanks to this chart*'; (L42) '*The chart is definitely beneficial because it made me realize what i know and what I'm lack of. It also gives many tips on brainstorming with some useful links to benefit from*' (L16) '*The chart was helpful since I controlled my papers according to the points that are written on the chart. It was a very detailed chart, and it helped me analyze my papers in depth. There were many tips such as brainstorming and samples'* (L13). They also stated the support they felt when using the chart; '*I found it pretty supportive for writing. It helped me when I wasn't sure if something that I wrote was correct or wrong. Since I could easily open the chart and look over it, it was a great option for me to get rid of the doubts of my writings*' (L17). The practicality was another frequently mentioned theme: '*In my opinion it is very beneficial to have such a chart. I can say that it is easier for the article to be prepared to be divided into pieces and planned in an orderly fashion like a skeletal system ... writing techniques that were previously very complicated started to become a little more understandable for me. I can't say that of course I got it done, but my point of view has changed and it started to get clearer about writing*' (L24) '*Thanks to this table, my grammatical mistakes have decreased, my writing has become more organized and qualified. In addition, the fact that everything in the table is divided into parts in detail, it has made this process easier for me by enabling me to do the writing assignments I have overlooked in a more disciplined and organized manner*'(L25).

Overall, the participants' opinions on the SMC and their experiences of using it were mostly highly positive and one participant explains it as: '*Finally, it affected me positively. While I was thinking that there was not anything else I should be careful about, I recognized several points where I am to be more cautious. It also approved some things that I am already doing, which was a relief for me. Now, with the help of the chart, I am trying to be more thorough*' (L29).

CONCLUSION

Up until the outbreak of Covid-19 pandemic, online education was delivered in some institutions, usually by choice. Today, it is the

mode of learning for all schools around the globe, and it seems likely to be the case in the future, and thus, it has become an essential for learners to be equipped with the strategies that will be beneficial for them to deal with the challenges of the virtual learning settings. Training learners to become more autonomous, particularly at higher education level, could help them adapt to the new era of online learning. Equipping them with SRL learning strategies, enhancing their digital literacies, and providing collaborative learning experiences to compensate for lack of social interaction seem to be among the starting points. In order to help smoother transition to virtual learning environments, not only learners but also teachers need support in terms of applicable and efficient methodologies for online learning. Instructional suggestions that enhance learner engagement and motivation should be provided in order to help teachers.

To promote SRL strategies, teachers could integrate SRL strategy training programs or any other form of guidance to their online teaching practices in order to introduce and equip their learners with flexible and effective use of cognitive metacognitive, affective, and socio-cultural writing SRL strategies. Despite the many negative impacts of the pandemic, developing methods and means to assist higher education learners to become autonomous is likely to be among the positive outcomes. Academic writing courses at higher education level could provide one of the viable venues for such integration.

As an attempt to provide a tool for higher education learners to be equipped with self-regulated learning strategies (SRL) in order to assist them to be productively engaged in their academic writing tasks, a self-monitoring chart has been developed. The SMC chart proposed in the study is meant to assist higher education learners throughout their academic writing improvement by assisting them to implement SRL writing strategies while providing practical tips on implementation and resources. The overall findings indicate that the learners greatly benefited from implementing the SMC. They reported to have become aware of SRL writing strategies, to have learned how to implement them, to be more engaged in writing tasks and more motivated to write. Yet, according to the opinions of the participant learners, the SMC needs improvement in several aspects. First of all, it needs to be simplified for the first time users in order not to overwhelm them. Also, as the participants stated that they benefited greatly from the practical examples and web sites mentioned, more examples, digital resources and applications, and practical alternatives should be added to the chart. Further studies with larger samples and mixed data are needed to improve the chart. As research in the field has frequently highlighted the importance of tailoring SRL instructional practices based on situational factors because learners' adoption of strategies is affected by both context and some learner characteristics (Csizer & Tanko 2017; Han & Hiver 2018), the SMC chart could be tailored based on the contexts intended to be used. Also, future studies could investigate the impacts of such tools on learners' achievement.

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APPENDIX A: Semi-Structured Interview Questions

1. Before using the SMC, were you familiar with SRL writing strategies? If yes, which ones? How often did you use them?
2. Has using the SMC helped you to become familiar with SRL writing strategies? If yes, which ones?
3. Did you use/Do you still use these strategies for your writing assignments? How often?
3. Which of the SRL writing strategies do you find most helpful for you? Why?
4. Do you think your engagement level for L2 writing has changed after using the SMC? If yes, how?
5. How did this chart affect your view towards foreign language writing?
6. What is your opinion about the chart? Do you think it was beneficial/helpful? If yes, how did you benefit from it?
7. Please share any other opinions or comments you have.

Thank you for your contributions.

APPENDIX B: Self-Monitoring Chart for Effective Writing Strategies

Phases	Steps	Actions	Have you ……?	Self-Check		
				Done	Not Done	Will Do (when?)
Pre-Writing	Knowing what to do	Understanding the Assignment	Make sure you know exactly what the topic is Make sure you know exactly what the specific focusing points in the topic are Check whether it is research-integrated or based on personal opinions/observations paper Clarify in your mind what you are expected to dwell on throughout your writing (Are you going to explain or summarize or discuss or argue, etc.)			
		Knowing the Formatting requirements of the assignment	Make sure you know the required format (e.g., paragraph, essay, research paper, report, etc.) Make sure you know any specific requirements for the page layout			
		Attending to the Deadline	Take note of the assignment deadline Make sure you know where and how you are supposed to submit it (e.g. online, in class, etc.) Make sure you get ready mentally			
		Attending to the Required Length	What is the required length in number of words or pages? Try to keep focused and calm			
		Attending to the Required Style	What tone is expected from you [a) academic & scientific or casual; b) formal or informal; c) argumentative or informative or entertaining]?			
	Setting Goals	Set short and long term goals for your writing improvement	Decide when to start Decide when to finish Decide which grade you want Visualize and decide on the final quality of your assignment Think about ways to maintain your concentration (e.g., rewards, self-talk, help from peers or parents, doing physical exercises, etc.)			
	Organizing your study environment	Set an optimum study environment to write	Eliminate distractions that might interfere with writing Avoid watching television/ using cell phones/ talking with friends/ multi-tasking / listening to music, etc. while working on a writing task Work on writing tasks at one's most productive times (e.g., early in the morning, late at night, in the afternoon, etc.) Work on writing tasks at one's most productive places (e.g., at home, in one's own room, in a library, at school, in a park, etc.) Work on writing tasks under one's most productive conditions (e.g., silence, darkness, crowd, organized or clean environment, etc.) Avoid disturbance from other people, physical environment, other thoughts or duties, psychological tensions, etc.			
	Having sufficient knowledge on the topic the topic	Brainstorming	Activate your previous knowledge on the topic. Write them down if it helps Use brainstorming techniques (e.g, mind mapping, listing, etc.) Check https://www.wework.com/ideas/worklife/effective-brainstorming-techniques for more techniques			
		Gathering necessary Resources	Conduct extensive research using credible sources (e.g., Google Academic, University Library – Science Direct or Sage, Elsevier, JSTOR, or Taylor & Francis Journals)			
		Reading on the topic	Keep on the main topic and take notes of the relevant information you find. Remember to note the publication details for Citation using APA)			
	Outlining	Finding the main points/arguments to be addressed in the writing assignment	Identify at least two main arguments that you will argue in your writing to support your stance			
		Deciding on the order of the main points/arguments to be addressed in the writing assignment	Decide how to order the main arguments you have decided			
		Identifying how to explain each main point/argument	Decide what information you need to explain each main argument Collect required information to explain your argument from credible sources Refer to your notes if you have already completed your search on the topic			
		Identifying how to support each main point/argument	Decide what information you need to support each main argument Collect required information to support your argument from credible sources Refer to your notes if you have already completed your search on the topic			
		Identifying how to exemplify each main point/argument	Decide what examples you need for each main argument Collect required examples for your argument from credible sources Refer to your notes if you have already completed your search on the topic			
		Identifying what to write as an introduction	Check sample college papers/essays to get ideas on what to write in introduction (e.g., https://mypaperwriter.com/samples/ https://www.shemmassianconsulting.com/blog/college-essay-examples https://collegepapersamples.com/ https://resources.library.lemoyne.edu/guides/history/handbook/sample-papers) Find online sources for best samples and share these sources with your friends Make sure you take notes of the ideas/phrases/styles you like			

		Identifying what to write as a conclusion	Check sample college papers/essays to get ideas on what to write in conclusion (e.g., https://mypaperwriter.com/samples/ https://www.shemmassianconsulting.com/blog/college-essay-examples https://collegepapersamples.com/ https://resources.library.lemoyne.edu/guides/history/handbook/sample-papers) Find online sources for best samples and share these sources with your friends Make sure you take notes of the ideas/phrases/styles you like			
Writing	**Writing the Introduction**	Writing an effective and intriguing starting statement(s)	Check your notes from sample essays for useful/effective the ideas/phrases/styles to write starting statements			
		Writing appropriate and striking lead-in statement(s)	Check your notes from sample essays for useful/effective the ideas/phrases/styles to write lead-in statements			
		Writing an effective Thesis Statement	Check your notes from sample essays for useful/effective the ideas/phrases/styles to write a Thesis Statement			
		Hinting the main arguments to be discussed throughout your essay	Check your notes from sample essays for useful/effective the ideas/phrases/styles			
	Writing the Body	Writing the first body paragraph	Check your notes from sample essays for useful/effective the ideas/phrases/styles			
		Integrating the main argument to be discussed in the first paragraph	Write an effective Topic Sentence that will introduce your main argument for this paragraph Check your notes from sample essays for useful/effective the ideas/phrases/styles to write a Topic Sentence			
		Explaining clearly what you mean by your argument	Make sure you use clear explanation of what you mean so that the readers do not have to guess or complete the story or be misled by incomplete/vogue statements			
		Writing supportive evidence	Write supportive statements (facts, testimonies, research results, official reports, statistics, etc.) to back up your argument Add clarifying/highlighting examples (where applies)			
		Writing the second body paragraph	Check your notes from sample essays for useful/effective the ideas/phrases/styles			
		Integrating the main argument to be discussed in the second paragraph	Write an effective Topic Sentence that will introduce your main argument for this paragraph Check your notes from sample essays for useful/effective the ideas/phrases/styles to write a Topic Sentence			
		Explaining clearly what you mean by your argument	Make sure you use clear explanation of what you mean so that the readers do not have to guess or complete the story or be misled by incomplete/vogue statements			
		Writing supportive evidence	Write supportive statements (facts, testimonies, research results, official reports, statistics, etc.) to back up your argument Add clarifying/highlighting examples (where applies)			
		Repeat for the third/fourth/fifth paragraphs				
	Conclusion	Start the conclusion with a signaling transition/connector, etc.	Check your notes from sample essays for useful/effective the ideas/phrases/styles			
		Restate your thesis or write a general conclusive statement	Check your notes from sample essays for useful/effective the ideas/phrases/styles			
		Summarize your main arguments briefly (the ones you want to emphasize)	Check your notes from sample essays for useful/effective the ideas/phrases/styles			
		Write a concluding remark	Check your notes from sample essays for useful/effective the ideas/phrases/styles for concluding remarks (e.g., suggestion, prediction, recommendation, warning, a personal stand, a famous quote, etc.)			

Post-Writing	**Editing**	Edit your writing for grammar use accuracy	Use tools to help you (e.g. computer such as Office program software tool grammar check, Grammarly, WhiteSmoke, LanguageTool, etc.) Exchange with peers to give each other feedback			
		Edit your writing for vocabulary use accuracy	Use tools to help you (e.g. computer such as Office program software tool language check, Grammarly, MyVocab, LancsLex, WhiteSmoke, LanguageTool, etc.) Exchange with peers to give each other feedback			
		Edit your writing for spelling	Use tools to help you (e.g. computer such as Office program software tool language check, LanguageTool, etc.) Exchange with peers to give each other feedback			
		Edit your writing for punctuation & capitalization	Use tools to help you (e.g. computer such as Office program software tool language check, LanguageTool, etc.) Exchange with peers to give each other feedback			
		Edit your writing for formatting style (e.g. APA Style)	Visit useful web sites to learn and check for formatting (e.g., https://apastyle.apa.org/ https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_style_introduction.html https://www.easybib.com/guides/citation-guides/apa-format/ Find online sources for best samples and share these sources with your friends			
		Check for Originality	Visit useful web sites to check for originality (i.e., plagiarism) (e.g., TurnitIn, Ithenticate)			
	Improving	Edit your writing for redundant/irrelevant sentences	Read throughout and underline less relevant or redundant statements/sentences Eliminate the ones you find irrelevant or misplaced Exchange with peers to give each other feedback			
		Edit your writing for completeness	Read throughout and decide if every argument you state is supported/explained/exemplified Add statements if you think there is a need Exchange with peers to give each other feedback			
		Edit your writing for coherence (logical flow of ideas between/among sentences and paragraphs)	Identify the points where you move from one argument to a different one. Is there a logical transition? Reorder the arguments/statements if you think necessary Exchange with peers to give each other feedback			
		Edit your writing for cohesion (effective transition between/among sentences and paragraphs)	Identify the points where you move from one argument to a different one. Is there an efficient /appropriate transitory word/phrase? Add connectors, transitions if necessary Exchange with peers to give each other feedback			

		Improve sentence structure quality, variety and effectiveness	Analyze college level sample essays (e.g., https://mypaperwriter.com/samples/ https://www.shemmassianconsulting.com/blog/college-essay-examples https://collegepapersamples.com/ https://resources.library.lemoyne.edu/guides/history/handbook/sample-papers) Find online sources for best samples and share these sources with your friends Make a list of useful phrases/structures as you read through sample essays Keep a journal/notebook to record the useful phrases/structures you have noted to help you improve your writing quality Check your writing and determine the structures that could be replaced by the ones you noted from the sample writings			
		Improve vocabulary quality, variety and effectiveness	Use variety of vocabulary and avoid repetition or use of weak words (check https://www.thesaurus.com/ https://www.merriam-webster.com/thesaurus https://www.collinsdictionary.com/dictionary/english-thesaurus) Analyze college level sample essays (e.g., https://mypaperwriter.com/samples/ https://www.shemmassianconsulting.com/blog/college-essay-examples https://collegepapersamples.com/ https://resources.library.lemoyne.edu/guides/history/handbook/sample-papers) Find online sources for best samples and share these sources with your friends Make a list of useful phrases/words as you read through sample essays Keep a journal/notebook to record the useful phrases/structures you have noted to help you improve your writing quality Check your writing and determine the structures that could be replaced by the ones you noted from the sample writings			
	Proofreading	Proof-read your writing with a fresh mind and apply necessary changes/improvements	Correct/change/improve where necessary			
		Evaluate/Assess your writing using the rubric/criteria used by your teacher	If you are not happy with your evaluation result, repeat editing cycle			
		Have a peer proof-read your writing for constructive feedback (do the same for your friend) apply necessary changes/improvements	Give clear and constructive feedback to your friend. Make sure you avoid general/vague/cliché feedback such as “I like it”, “it is good”, “good”, “not good”, etc. Be specific to help. Remember, you are not asked for your opinion but for your expertise in writing and your attention to details.			
		Evaluate/Assess your writing again using the rubric/criteria used by your teacher	If you are not happy with your evaluation result, repeat editing cycle If you are happy with the result, reward yourself!			
	Submit!	**Congratulations!**				

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Review Paper

A Systematic Review of Tech-supported Collaborative Creativity Practices in the Field of Education

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ABSTRACT

This study aims to make a systematic review of technology-supported collaborative creativity pedagogy and practices in the field of education by focusing on peer-reviewed articles published in journals between 2014 and 2019. The targeted educational levels were specified as elementary, secondary education and teacher education students. 21 studies were examined from different aspects: (a) forms of technology and technological features with pedagogical affordances and (c) teachers and students' roles, and the pedagogical approach, (c) problems and solutions. A narrative synthetic approach was employed to categorize, analyse and synthesize the data according to themes developed. The findings indicate majority of the studies employed different types of pedagogies, and yet all follow student-directed pedagogies or theories drawing on social-constructivism. In the selected studies, three teachers' roles were identified: giving planned or explicit guidance, promoting dialogue between students during the process of creation and orchestrating collaborative creativity flow of students. And, students' roles were also found to be in parallel with the teachers' roles. With regard to forms of technology, among 5 major technological forms, web-based were the favoured technology due to its affordances. Besides, the selected studies showed there are teacher-related, student-related and tech-related problems, and students overcome these problems through solving the problem together, being considerate about their team members and valuing their teachers' effort. Therefore, the papers selected for this review indicated that the problems were not perceived as obstacles to collaborative creativity both by students and teachers. Instead, they were considered as a means to boost collaboration and creativity.

INTRODUCTION

Today, there has been an increasing attention to enhancement of skills of collaboration and creativity in different subject domains as a part of 21st learning agenda. Thanks to technology, many things can be accomplished in a collaborative way by working together as a team. In educational context, technology has impelled both teachers and students to act outside their traditional comfort zone, and this has changed their ways of teaching and learning a subject.

21st century has now been demanding creation through collaboration by using technology in educational contexts. In the related literature, it is argued that ICT can promote creative thinking by means of its contribution to problem solving, creative knowledge and social interaction. And through this social interaction, it is believed that ICT enables users to create content with others collaboratively, and promote interaction and communication with students. (Wheeler, Waite, & Bromfield, 2002)
In the last couple of decades, the definition of creativity has altered. Creativity, which was defined as individual process, has been tackled differently than before, affected by social constructivism (Vygotsky, 1987). Consequently, a new strand of theory called "collaborative creativity" has emerged, which emphasizes collaboration and dialogue in creation process of a product that manifests both novelty and social value (Sawyer, 2013; Glăveanu, 2014). Collaboration is now believed to be at the heart of creative practice and due to its multi-layered nature with diverse levels and characteristics, doing collaborative work has its own benefits as and challenges for creative production. To accomplish collaboration, some elements are vital, and if they are involved, then it is certain that the benefits will be more. Supporting this view, Sonnerburg (2004) proposed a collaborative creative framework that highlights the importance of communication and togetherness for creating in collaboration, and defines some characteristics accordingly such as being open to communication, trusting each other and being ready to take risks.

In this vein, collaboration is not easy to put into practice. It requires harmony out of dissonance, and it is not easy to embrace and expand the spirit of positive relations of interdependence when everybody has its own reality and way of doing things. In the study of Chiu and Hsiao's (2010), 290 middle school students' responses to the interview questions showed that there are four different types of interaction occur among students: passive, silent, off- task behaviour and active knowledge-sharing. This study shows students should share what they know with each other, and the other types of interaction should occur less frequently if creative collaboration is desired to be accomplished. Besides, Eteläpelto and Lahti (2008) discussed another challenge for collaboration in their study. They argued some students are emotionally sensitive in-group works, and as a solution to this, they explained teachers'

demanding responsibility: a teacher should provide emotional scaffolding, encourage students to give supportive comments to each other, and set groups based on history of shared working, thus ensuring students to feel comfortable while working together. This is one standpoint given in one study regarding teachers' role. But in fact, there are varying views for teachers' role to promote collaborative creativity among students.

Regarding teachers' role, there are two opposing views: some believe that teachers should adopt deep learning approach and they should act as moderators, not as instructors (i.e., should advise and facilitate learning, but should avoid direct or explicit instruction) (Beijaard, Verloop, & Vermunt, 2000; Huang, 2002). On the other hand, some other scholars highlight the importance of use of strategies by students, guidance of students towards desired attitude, and use of explicit directions by teacher (Kirschner, Sweller & Clark, 2006; Daemmrich, 2010; Lin & Yang, 2011). Aside from being equipped with sufficient competence in using technology, teachers re expected to manage the balance between control and flexibility in their pedagogical design and teaching. They also need to consider the challenges and affordances of task (ie. matching technology and task), technological literacy level of students as well as the needs of students, and these all render teachers' role even more sensitive and demanding. In this sense, there are so many variables that teachers need to be in control of.

As long as there is an appropriate use of pedagogical approach as well as pedagogically appropriate use of technology, technology is considered to enable collaborative creativity nurturing platform with wide range of tools (Henriksen, Mishra, and Fisser, 2016). Therefore, one of the persisting agenda of today has become designing technology-enhanced pedagogy for promoting collaborative creativity skills in different subject domains (Craft, 2012). In the literature, this issue has not yet been systematically reviewed in terms of classroom pedagogy and practices conducted at various settings and disciplines. However, it is known that teachers need a synthesis of contemporary, evidenced based practices that foster collaborative creativity of students by technology use. Therefore, this review aimed to fill this research gap and findings from this study are supposed to build practice that is more effective in the future by identifying conditions and resources for co-creativity. To that end, three guiding research questions were formed in order to reach an understanding for the conditions that is supportive of collaborative creativity.

RQ1: In the selected studies, what forms of technology have been preferred to support collaborative creativity practices among students? And what are the pedagogical affordances these technologies?
RQ2: What are the common pedagogical approaches and the most preferred roles of teacher(s) and student(s) in order to foster collaborative creativity?
RQ3: What problems and possible solutions regarding collaborative creativity practices have been discussed in the selected studies?

To be able to answer proposed research questions above, 21 studies were examined from different aspects: research focus, forms of technology and technology with pedagogical affordances, teachers and students' roles, pedagogical approaches. And based on these analyses, key findings and implications are also discussed comprehensively. And as a result, this study presents some important steps that need to be followed by an instructor to foster collaborative creativity with a figure including steps to guide future studies for implementation.

METHODOLOGY

Literature Search and Criteria for Paper Selection

The present study covered studies that have focused on tech-supported collaborative creative practices of a five-year time frame 2014-2019, with a view to portraying the recent practices across the field of education. The collaborative creativity, which is the subject-matter of this study, appeared in a few studies in 2008, but it was seen to appear more commonly in studies after 2010, a date marked by the release of iPad and android tablets. However, in this study, the five-year time frame between 2014 and 2019 was chosen to be examined because as indicated by Johnson, Adams, Becker, Estrada, & Freeman (2014) in in NMC Horizon Report published in 2014, there is an increasing presence of technology in schools as an opportunity to foster collaboration and creativity as a primary goal, not as a sub-goal to improve the performance of another skill.

Following the methodological framework proposed by Levac, Colquhoun, and O'Brien. (2010), the paper selection was carried out in five phases: a) identifying the corresponding research questions, b) identifying studies that are relevant for those questions, c) selecting studies, d) charting data, and e) summarizing and reporting results.

Literature research was done initially by using electronic databases including Science Direct, ERIC, Wiley Online Library, and Google Scholar. And to be able to do research, the following set of keywords were identified: "education," "creativity, "technology," "computer," "technology", "collaboration," and "collaborative." Then, some other keywords were iteratively developed after examining the titles, abstracts and keywords of studies. Thus, the following keywords were also included in the search process: "digital", "cloud-based", "web-based", "simulation"," "mobile", and "Wiki". Finally, the following search string was created to cover the variables proposed in the research questions (education, collaboration, creativity, and technology). Then, in line with Webster and Watson's (2002) guidelines for conducting literature search and paper selection, which suggest that some leading journals need to be examined manually to ensure reliability, the following two leading journals were examined manually; Thinking Skills and Creativity Journal and Computers and Education. The steps of search and inclusion of studies can be summarized as follows in Figure 1.

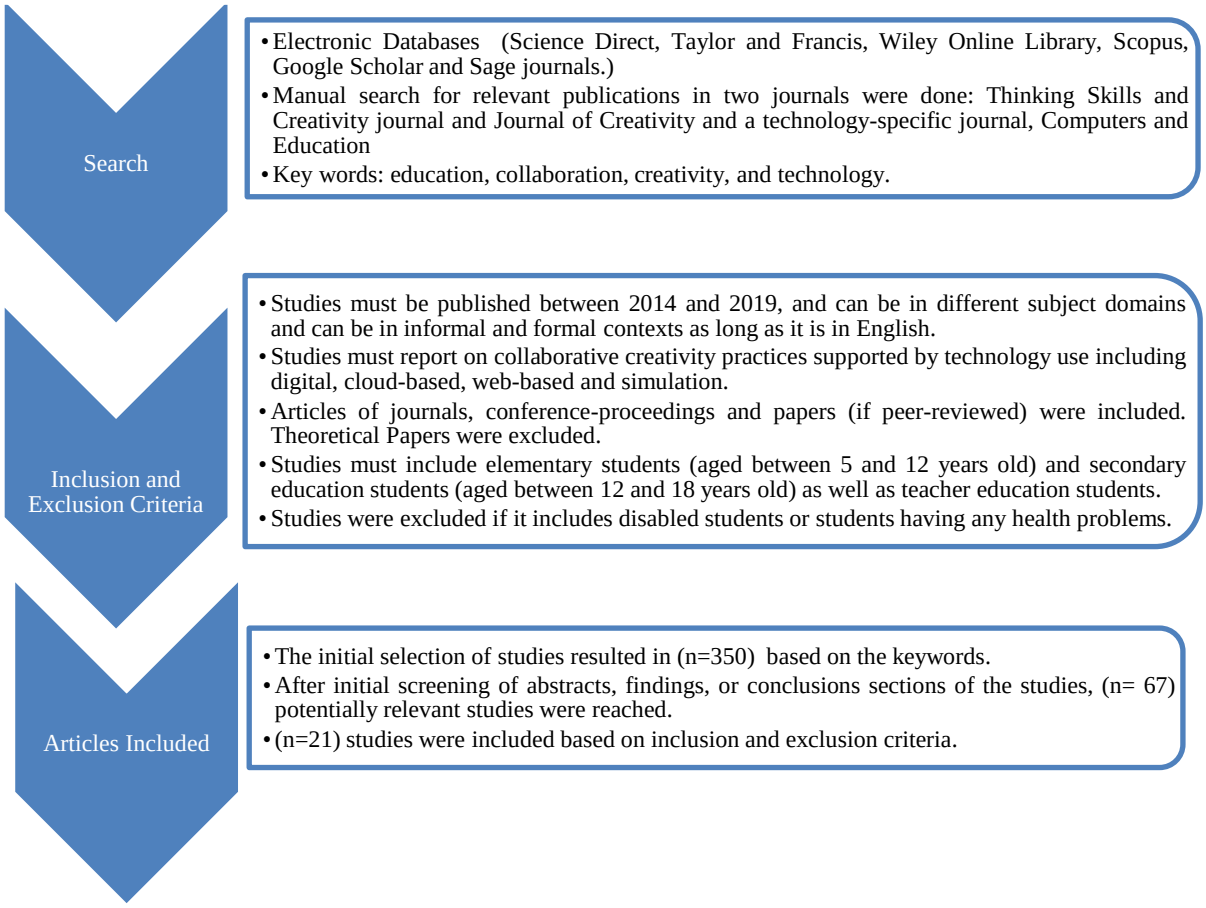

Figure 1. The steps of search and inclusion of studies

As Figure 1 shows above, the initial selection of studies resulted in 350 studies only based on keywords. Data were obtained from the *abstract, findings, and conclusion* sections of the studies. The initial screening resulted in a database of 67 potentially relevant studies, all between the years 2014 and 2019. These studies were then subjected to further screening based on aforementioned inclusion/exclusion criteria. Forty-six of these studies were excluded from the review since they were not found eligible owing to several reasons such as date (n=5) inappropriate educational level or age group (n=17) or unspecified age (n=1) in one case. Apart from these reasons, some of these studies were excluded mainly because they were focusing on affordances of tech-tools without referring descriptions of practice and their outcomes on students' creativity (n=10) and because they were theoretical papers, book chapters, or reviews (n=11). Of these studies, in one study, there was no mention of a digital tool (n= 1), and one other study (n=1) was only available in Spanish. As a result of this process, only 21 studies were found suitable for the present review.

For data analysis, since qualitative findings of the studies aimed to be analysed systematically, a narrative synthetic approach, which is an approach to the systematic review, was used to categorize, analyse and synthesise the data according to themes developed (Davis et al., 2009). A narrative synthetic approach can be defined as a descriptive written summary of included studies and their findings, and it was mainly preferred when the aim is to summarize the data using words rather than statistically calculate the pooled effect of the findings (Petticrew and Roberts, 2006). The data obtained from the studies were stored in evidence tables, thereby supporting objectivity.

FINDINGS

The systematic review and analysis have been administered with 21 studies (See Appendix A). In the appendix, the list of the reviewed studies can be found. The analysis of aforementioned studies revealed important insights with regard to conditions and resources for collaborative creativity. The findings are presented under three headings in parallel with the research questions: pedagogical affordances of tech-tools, teachers and students' roles, and specified pedagogical approach/ instruments. Summary of the reviewed studies and overview of the core data extracted from the selected studies aiming to give an answer to the proposed research questions.

Pedagogical applications and affordances of tech-tools (RQ1)

Table 1 presents information about the forms of technology used in in the reviews based on educational levels. Out of 21 studies, 13 of these were done in secondary education, but one of these studies consisted of both secondary education and elementary education students as study groups (Atwood- Blaine, 2019), and therefore; in counts presented below, the total calculation regarding

the use of the technological forms in secondary education were (n=13). (n=5) of these were used in teacher education level, and the rest of these studies (n=4) were done in elementary education level.

Table 1: The forms of technology used in in the reviews based on educational levels

		Levels of Education		
		Elementary Education	Secondary Education	Teacher education
		Count	Count	Count
Forms of Technology	Digital technology	0	3	1
	Cloud-based technology	0	2	2
	Web-based technology	3	7	2
	Smart Technologies	1	0	0
	Simulation	0	1	0

As seen from the table 1, it was seen that web-based technologies or applications constituted the majority (n=12) in the educational levels presented below. The second most used forms of technologies were cloud-based technology (n=4) and digital technology (n=4). Smart technology and simulation were each used once (n=1 and n=1, respectively). With regard to features of the technologies to promote and orchestrate collaborative creativity, seven forms of technology identified in the studies are presented below.

Web-based Technology

Web-based technologies were the most widely used technology in the selected studies due to its affordances. The main affordance of web-based technologies is that they include network applications accessible over the Internet. Aside from this, all platforms have properties enabling collaborative creativity. In the selected studies, web-based applications include multimedia, socialmedia, mobile technologies, google docs, wiki platforms, Orbis Dictus platform, Storyboard, Poetry Machine, Docu Viz and Author Viz. In the study conducted by Lin, Chang, Hou, and Wu (2016), it was seen that *google docs* provided with feasible social learning platform by enabling real-time co-editing, collaborative concept-mapping, interactive communication, revision history, and provided flexible student- driven planning rather than discrete writing process of teacher-driven planning, drafting, redrafting etc.), and due to these affordances, it was found to be more effective platform than paper-pencil method. In the same study, *Docu-viz and author-viz tools* were also seen to encourage students to monitor each other's' contributions and progress, for instance, whether they do balanced revision and or do group reflection. *Orbis-Dictus*, another platform used in the study of Poce, Agrusti, and Re (2017) also yielded important benefits like supporting the didactic path by providing all the necessary tools, aside from providing the students with feasible and dynamic environment. In the study of Pifarré et al. (2014), *Wiki platform*, similar to Google docs platform, was also seen to provide the students with important functions, such as; editing, history, and plus that, different from google docs, it also had a discussion page where the students had the chance to discuss together which in turn fostered group reflection. *Multimedia tools*, which were used in the Feriansyah (2018), also had an important contribution to students' digital photography task by supplying them with visuals with different effects and transitions, and *Story board* also enabled students to include or insert photos, description of the photos, and story narration. The use of *Poetry machine* as web-based application in the study of Kantosalo and Riihialo (2019) also enabled editing, changing words, and creating a poem in collaboration. Mobile Technologies were used only in two of the selected studies. Regarding mobile technology use, and its affordances, Kim, Suh and Song (2015) discussed that *mobile phones* enabled instant communication and access to information, and its major contribution to collaborative creation was to offer computational tools for learning (e.g. semantic mapping, 3D graphing, stimulating scientific phenomena etc.) Atwood-Blaine (2019) used situated mobile games allowing for creating text, using audio, and taking video notes while also connecting with other players. Atwood- Blaine (2019), apart from using mobile phones, used *Glogster*, a web-based application, which provided the students with a template for creating electronic posters in collaboration. Lastly, *Social Media Technologies* were used in Kivunja (2015) where they helped students to share, co-create content, discuss learning and assessment activities, and modify content generated by their peers.

Cloud- Based Technology

In the selected studies, after web-based technology, cloud-based technologies were the second most used because it can also offer real-time "visual" collaboration just like web-based technologies. In the selected studies, cloud-based technologies consist of caccoo.com, sketcheboard.com, GeoGebra and Edmodo. In the study of Pifarre (2019), it was seen cloud-based technologies *(caccoo.com and sketcheboard.com)* offered a wide array of collaborative creative practices for its users thanks to their various affordances: 1) accessing others ideas, 2) connecting through cloud-based technology 3) seeing others' ideas simultaneously, 4) making immediate responsiveness to others' ideas and contributions, 5) manipulating shared artefacts, 6) making multimodal representation of ideas, 7) having tangible information, 8.modifying shared artefact), 9) saving information, and 10) reusing saved information. Granberg & Olsson (2015) conducted a study that employed dynamic software program, GeoGebra, to understand how it fosters students' creative reasoning and collaboration during mathematical problem solving, and it was seen that *GeoGebra* supplied students with feedback that both verifies and falsifies ideas and hypothesis of them, and also enabled them to try out multiple ideas during (math) problem solving. In the study of Xiang (2016), *Edmodo* was used by teacher to create a virtual classroom environment for collaborative creative writing project, and it was also used to post rules to the students while the students collaborate and get organized for writing. Besides, Limbua and Markauskaite (2015) preferred to use Cloud-base technology for online collaborative writing practice and the platform helped students to divide work between themselves just like Edmodo platform,

and like all the other platforms, it enabled them to share ideas and insights, thereby promoting a deeper understanding of what they are doing, in this case, creative writing.

Digital technology

Digital technology was the third most used technology in the selected studies. In the study of Schmoelz (2018), three digital writing tools were used, and their affordances were explained as follows: a) *Iconoscope* helped students to develop ideas for the theme by drawing shapes and colours, b) 4Scribes served as collaborative *story-writing tool*, and c) Creative Stories serve as story-writing tool. Digital Storytelling (DST) Platform *(www.meschola.it)* was used in the study of Rubino, Barberis and Malnati (2018), and this platform's major affordance was to visualize data with a graph, which helped teachers to give instant feedback to students about their within-group behaviours and interactions. Daskolia, Makri and Kynigos (2014) also preferred to use Digital Storytelling (DST) Platform and they identified three other important features of DST allowing collaborative creativity: a) learning personally meaningful ways b) moving from inquiry to playful activity c) fostering imaginative expression and bricolage. Only in the study conducted by Mudaly, Pithouse-Morgan, Laren, Singh and Mitchell (2015) there was no reference to affordances of digital technology.

Simulation and Smart Technologies

Simulation and smart technologies were used only once in the selected studies. Out of 21 studies, only Astutik and Prahani's (2018) study employed *simulation* and discussed features promoting social creativity as follows: 1) visualizations that aid students' understanding, 2) allowing manipulations, and 3) leverage direct student interaction. Apart from this, its main affordance is that it can be used easily in informal educational contexts. In Mercer, Hennessy and Warwick' (2017) study, a smart technology form: *Interactive Whiteboard (IWB)* was used and its affordances were discussed as follows: 1) enabling co-constructed artefacts to be created which can be saved, modified or reused at a later time. These created artefacts were also found to render learning histories and trajectories more visible, which can help to trace and chart the cumulative progress of class discussions over time.

Pedagogical approaches or conditions (i.e. teacher(s) and student(s)' role) (RQ2)

RQ2 was answered by referring to a) roles of teacher(s) and student(s), and b) pedagogical approach if specified.

a) Findings with regard to teachers and students' roles to promote collaborative creativity

Aside from the pedagogical affordances of technologies, another dimension that promotes effective collaborative creativity practices is teachers and students' roles. In most of the selected studies, the majority of teachers preferred giving planned guidance (n=14), two other roles were used by teachers very often: promoting dialogue between students during the process of creation (n=4) and orchestrating collaborative creativity flow of students (n=4). Regarding teachers' and students' roles, the following roles were found based on the reviews.

1) Teachers' role: Giving planned guidance:

Teachers give planned guidance, scaffold or actively support student's collaborative creativity in the process of creation. Teachers' have a larger role at the beginning, then teachers become facilitators and finally, students take ownership. As a first step, teachers inform students about the steps to follow and provide them with resources or tools that can support and ensure their joint endeavour: joint engagement and equal contribution through assigned roles. Secondly, teachers watch, guide and assist the ones in need of help with clear explanations and demonstrations (i.e., setting rules, answering questions). And, during this stage, although there is a supported practice, there is also student-student interaction (talking, discussing and creating moments) and students take ownership of what they are doing together. At the end, teachers give feedback and assess the creative output. (e.g., Schmoelz, 2018; Kantosalo & Riihiaho, 2019; Feriansyah, 2018; Rubino et al., 2018; Daskolia et al., 2014; Poce et al., 2017; Kim et al., 2015; Mudaly et al., 2015; Astutik & Prahani, 2018; Atwood-Blaine, 2019; Ridwan, Rahmawati, and Hadi Nugrahaningsih, 2017; Kivunja, 2015; Xiang, 2016 and Lin, Y.-T. 2016).

Students' roles/ activities: Following planned guidance and performing assigned roles, actions and activities

In the study conducted by Feriansyah (2018), students were assigned different roles to accomplish the task of digital photography and collaborative writing: 1) project manager, 2) language editor, 3) photo browser, 4) digital operator and 5) story writer. Likewise, Krishnan, Yim, Wolters and Cusimano (2019) also reported about the roles distributed among students during online synchronous collaborative writing: 1) time keeper, 2) goal monitor and 3) facilitator. In Kim et al., 2015, it was seen that each of the students had an explicit role in the design of a new product through roles assigned to them that can be switched, or combined such as documenters, chief engineers, experimenters and team leaders, thereby; keeping power relationship in students' social relationship under control. Besides, in the study of Rubino et al. (2018), students were informed about what they should do to manage creative flow: posting, liking, commenting and suggesting.

In the study of Astutik and Prahani (2018), students were told explicitly what actions they should perform even if they are assigned specific roles, and they performed the following acts by using PhET simulation when they were carrying out a scientific experimentation: 1) students identify problem 2) students explore creative ideas, 3) students collaborate to create, and 4) students

elaborate on creative ideas. Likewise, in the study of Xiang (2016), the students performed OSGW (Online Group Story Writing through Edmodo by writing together, but the instructor prescribed them to follow this routine: one person begins a story and a second person reads and continues and a third follows and so on and so forth until everyone has his/her turn.
In the rest of the studies, teachers or researchers just gave students the activities without assigning them any roles (e.g. Schmoelz, 2018; Kantosalo and Riihiaho, 2019; Daskolia et al, 2014; Poce et al., 2017; Kim et al., 2015; Mudaly et al., 2015; Atwood- Blaine, 2019; Ridwan et al., 2017; Kivunja, 2015; Lin, Y.-T. 2016).

2) Teachers' role: Promoting dialogue between students during the process of creation:

Teachers encourage students to talk about their joint creation process by showing them ways, strategies and language that can be used to think, discuss and create together. In other words, teachers' role is to construct a dialogic ethos, model dialogic practices and encourage student agency e.g., Mudaly et al., 2015; Rubino et al., 2018; Mercer et al., 2017). In Pifarré, Laura and Alex (2014), Students were asked to find a novel solution for a science problem, and to that end, they were taught to improve their discussions in the wiki by using sentence openers as a scaffold to enrich and diverse students' contributions in the wiki. Besides, students were taught about five kinds of openers: 1) to give information (e.g., in my opinion); 2) to learn someone else's point of view by asking questions (e.g. What do you think about; could you give an example); 3) to express disagreement (e.g., I do not agree with; because); 4) to express agreement (e.g., I agree with; because); 5) to give reasons and summarize the discussions (e.g., to synthesize, and thus, students learned some strategies regarding promoting and enriching group dialogue.

Students' roles/ activities: Being in a constant dialogue between each other and performing communicative strategies

Here, students were informed about communicative strategies (i.e. asking questions, explaining reasons, giving justifications, examples, suggestions and building on one another's ideas etc.). Additionally, students were expected to use these communicative strategies (e.g., Mudaly et al., 2015; Rubino et al., 2018; Mercer et al., 2017). In similar vein, in the study of Pifarre (2019), students were expected to brainstorm and examine pros and cons of ideas etc. as a communicative strategy. In Pifarre et al. (2014), apart from searching about the topic and undertaking a web-based inquiry activity by working in pairs, students also employed communicative strategies exemplified by the instructor: discussing pros and cons of construction of a heating plant next to their city and putting forward arguments in favour or against the construction a heating plant next to their city.

3) Teachers' role: Orchestrating collaborative creativity flow of students:

Teachers designed different learning phases and tasks with tangible goals to foster groups' creativity flow. Generally, students are guided to inquire and solve problems. Here we have guiding without feeling guided. That is, there is an implicit scaffolding of students. Together with this, the technology is used as tutor by giving feedback orchestrating students' collaborative practices (e.g., Kim et al., 2015; Hemling, Crooks, Oliver, Brenner, Gilbertson, Lisensky and Weibel., 2014 Granberg and Olsson .,2015; Pifarre , 2019).

Students' role/ activities: Performing hands-on roles when doings tasks with tangible goals to foster collaborative creativity flow

In Hemling et al. (2014), students had explicit hands-on roles in construction of microfluidic device. Similarly, in Kim et al., (2015), students tried to solve everyday science problem: forces and energy. In Granberg and Olsson (2015), the task was mathematical problem and students were expected to use their creative reasoning. In the study of Pifarre (2019), students' role was more about supporting dialogue between each other, and therefore it was not included in this category, but instead included in the category where the students' role is to perform communicative strategies to remain in constant dialogue.

b) Findings with regard to Pedagogical approach/ instruments employed to promote collaborative creativity practices in the selected studies

All of these technological features and their pedagogical affordances would be meaningless and ineffective if teachers use the technology without proper pedagogy. Therefore, pedagogy has of paramount importance. In most of the selected studies, the researchers followed certain theoretical backgrounds or they designed pedagogical principles to reach the aim of their studies.
Except for Kantosalo and Riihiaho (2019), Xiang (2016), and Rubino et al., (2018), all the studies specified either their pedagogical approach or their pedagogical notes or principles to reach their aim of promoting collaborative creativity.

Pifarre (2019) summarized how collaborative creativity fostered with the following five principles: 1) teachers should promote middle-c creativity by involving students in solving a challenge related with the school community, 2) teachers should design phases and subtasks with tangible creative sub-goals, 3) teachers should include activities for "thinking together" (i.e. by asking other students to explain the statements of others, by asking students whether they agree or disagree on the statement provided by someone else, by encouraging students to give reasons/justifications for their views and to provide counter-arguments). 4) students should agree on two different ideas and perspectives across time, and 5) students should experience multimodal ways of interaction (face-to-face and computer) and multilevel (whole class and small group discussion) dialogic interaction. In Pifarre (2019), *Middle-c creativity* was chosen as one of the principles, and in this study, it was defined as creativity emerged through active participation of peer-group communities to solve a task or a social challenge. Likewise, Pifarré et al. (2014) emphasized four fundamental *learning to learn together skills*, which include the following principles: 1) mutual engagement, 2) distributed Leadership, 3) peer assessment,

and 4) group leadership. Different from other studies, Schmoelz (2018) emphasized shared enjoyment and immersion in the absence of conscious awareness of thought and control. Krishnan et al. (2019) also argued in a pedagogical principles aiming for collaborative creativity: 1) task considerations, 2) teaching considerations, and 3) grouping considerations.

Most of the studies adopted student-directed pedagogy that avoids top-down approach and emphasizes social-construction of knowledge by using different theoretical underpinnings. Vygotsky (1978) *social constructivist theory*, where students should be given realistic tasks to solve and then given sufficient help to solve these tasks were used in some studies (e.g. Feriansyah 2018; Astutik and Prahani 2018; Lin, 2016). The idea is to scaffold students gradually so that students learn to gain knowledge or do something themselves until they no longer need someone's' assistance. Besides, Kivunja (2015) adopted *Connectivist theory*, which argues for social construction of knowledge through digital tools. Daskolia et al. (2014) employed *constructivism* that emphasizes learners' creative performance, expressed by active exploration, construction and modification of digital artefacts. Atwood-Blaine (2019) adopted *situated learning theory*, which emphasizes three main tenets: authentic context, constructivism and social interaction. Mudaly et al. (2015) adopted a humanistic perspective to teach science education which is underpinned by the theory of *critical pedagogy* because the aim was to avoid a top-down approach and teach science for social responsibility. Both Hemling et al. (2014) and Kim et al. (2015) employed *inquiry-based pedagogical approach* where teachers are seen as fellow inquirers asking challenging questions to understand scientific phenomena. Ridwan et al. (2017) adopted the *STEAM approach* in Project-based learning where students learn by doing with hands-on activities.

Poce et al. (2017) and Granberg and Olsson (2015) were different from the rest of the authors in terms of their pedagogical approach because they both adopted the didactic approach in which students are asked to carry out the target activities under constant surveillance and control by the teacher. In the case of Poce et al. (2017), technology also served as the tutor, aside from the teacher. However, the didactic approach implemented in this study did not undermine social interaction between students.

Problems and possible solutions (RQ3)

This part provides a discussion of teacher-related, student-related and tech-related problems and solutions in the selected studies. The types of problems observed in the studies are presented in Figure 2.

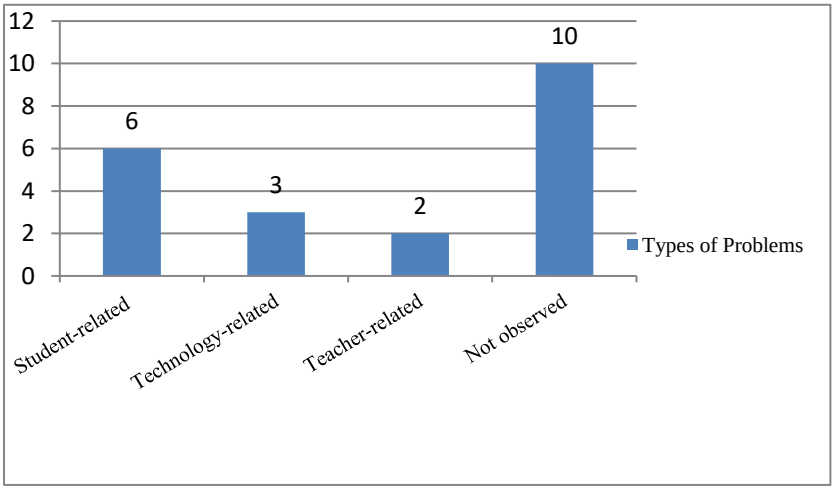

Figure 2. Types of problems observed in the selected studies

As shown in figure 2**,** types of problems observed in the selected studies were categorized as student-related, technology-related and tech-related. In some of the studies, there was no mention of any problems (e.g., Hemling et al, 2014; Mudaly et al., 2015; Lin, Y.-T. 2016; Astutik and Prahani, 2018; Atwood-Blaine, 2019; Ridwan et al., 2017; Schmoelz, 2018; Limbu and Markauskaite, 2015; Poce et al., 2017; Mercer et al., 2017).

Student-related problems

Student-related problems were the one encountered most in the selected studies. In the study of Granberg and Olsson (2015), there were some students engaged in shallow discussions (i.e., out of topic, or irrelevant discussions) because some of them did not go with group rules. As a solution, the teacher monitored the student talks when it stagnates and becomes shallow, thereby regulating the quality of group discussions. Xiang (2016), observed a problem in the plot design of story-writing. In the plot design, each and every one of the students took turns at the beginning, middle, and ending. For instance, one of the students do the beginning and then leave the other student to continue write the middle, then the one who is responsible of writing the middle part of the plot leave the conclusion part to another student. The problem is that taking turns led some of the students feel anxious regarding the quality of plot since they need to trust each other's writing. Though this stood as an important handicap ahead of the students, students learned to be considerate and careful in their plot design by leaving their group members as many imaginations as possible to continue the story. Students also had a language problem because students were Chinese and yet they were expected to write in English, but the teacher solved this problem by guiding them to use an online dictionary and word-processor, to get help from friends and from the Internet. Krishnan et al. (2019) also witnessed group interaction problem in writing process, but the teacher overcame

this by encouraging reflection on Group Writing. Pifarré et al. (2014) likewise argued not all students showed learn together skills. Daskolia et al. (2014) also observed some incidents of misunderstandings and communication, again referring to group dynamics problem, but disagreements and tension within the group were used as an advantage to create collaboration. Kim et al. (2015) observed a different problem: when using mobile technology, it was seen that there was a lot peeking, copying, imitating, replicating, and reusing ideas within the entire class. However, this was not seen as something negative again because students learn from each other, think together and act in collaboration.

Technology-related problems

Technology-related problems were the second most experienced problems. Pifarre (2019) discussed about technology-related problems such as difficulties to enter the shared-space, non-visualization of others' contributions in the shared-space; unfamiliarity with specific software options or lack of internet connection. Nevertheless, it was noted that these problems were addressed with solutions provided by students a) students assisted other students having technological problems and offering help to solve his/her problems by giving prompt and easy-to-understand explanations on how to solve those technological issues; c) students provided explanations by modelling how to solve the problem or by showing these in his/her computer screen and d) students learn and work together to take maximum advantage of software's affordances. Kantosalo and Riihiaho (2019) also discussed about technology-related problems occurred during poetry writing. In this study, the problem was mainly caused by the students' use of several pointers on one computer which led to competition and conflicts among students. Feriansyah (2018) also discussed some of the technical problems encountered during story-writing, but again these problems were solved by students' help to one another (e.g. discussing with the group how to adjust the story duration and asking for group members' opinion how to record the voice-over).

Teacher-related problems

A majority of the studies referred to student-related and tech-related problems encountered in the activities except for two studies where teacher-related problems are discussed. In these studies, teacher-related problems are related to those discussed in the teacher roles section of this paper. Mainly, teacher-related problems are caused by teachers' management style, which causes loosened discipline and some group interaction problems. This loosened discipline is also the consequence of not giving planned guidance (e.g. not explaining and assigning roles), and orchestrating collaborative creativity flow of students (e.g. group interaction and communication problems). In the study conducted by Rubino et al., (2018), the problem of unbalanced interaction and out of topic conversations was caused by teachers' style of management. In the study, two different teacher roles were compared in terms of effectiveness of management. While Teacher A gave greater degree of freedom both in terms of the time available to complete the tasks and of the contents to be developed, Teacher B provided the students with more defined mission. In the first case, Teacher A's style triggered loosened discipline and some group interaction problems, but meanwhile this gave them a greater degree of freedom. On the other hand, Teacher B's style produced more balanced group interaction and less out of topic conversations. The results of this study suggested that regardless of teachers' (teacher A and teacher B) different roles, collaboration and creativity emerged, but it was seen teacher B' management style produced more focussed behaviours than teacher A. Kivunja (2015) noted another issue that affect teachers. According to findings of the study, collaborative creativity practice put extra workload on the teachers' shoulder. However, this was appreciated by the students because they were aware of the extra effort their teacher put to teach them something new in a novel way. Also, the teacher feels the burden, but s/he was aware that the students would become more interested and engaged which in return made his/her job easier. That is to say, the burden of implementing something novel was perceived as positive thing both by teachers and students.

Table 2. Teach-related problems and Teacher A and Teacher B comparison in terms of effectiveness of management style

Problem 1: Teachers' management style: Teachers A versus. Teacher B (Rubino et al., 2018)
Teacher A: do not give planned guidance: (e.g. not explaining and assigning roles) and do not orchestrate collaborative creativity flow of students (e.g. unbalanced interaction and out of topic conversations) * triggered loosened discipline *created group interaction problems **Teacher B:** Give more defined mission assigned to the students. *more balanced group interaction and less out-of topic conversations * more focussed behaviours
Problem 2: Extra Workload: Perception of a teacher versus. Students (Kivunja, 2015)
Teacher's view: The teacher feels the burden, but s/he is aware that the students would become more interested and engaged. **Student's view:** Extra workload is appreciated by the students because they are aware of the extra effort their teacher put to teach them something new in a novel way.

DISCUSSION OF THE FINDINGS AND CONCLUSION

This systematic review informed teachers and scholars regarding necessary conditions to foster technology-enabled collaborative creativity practices. Figure 3 presents some important steps that need to be followed by an instructor to foster collaborative creativity.

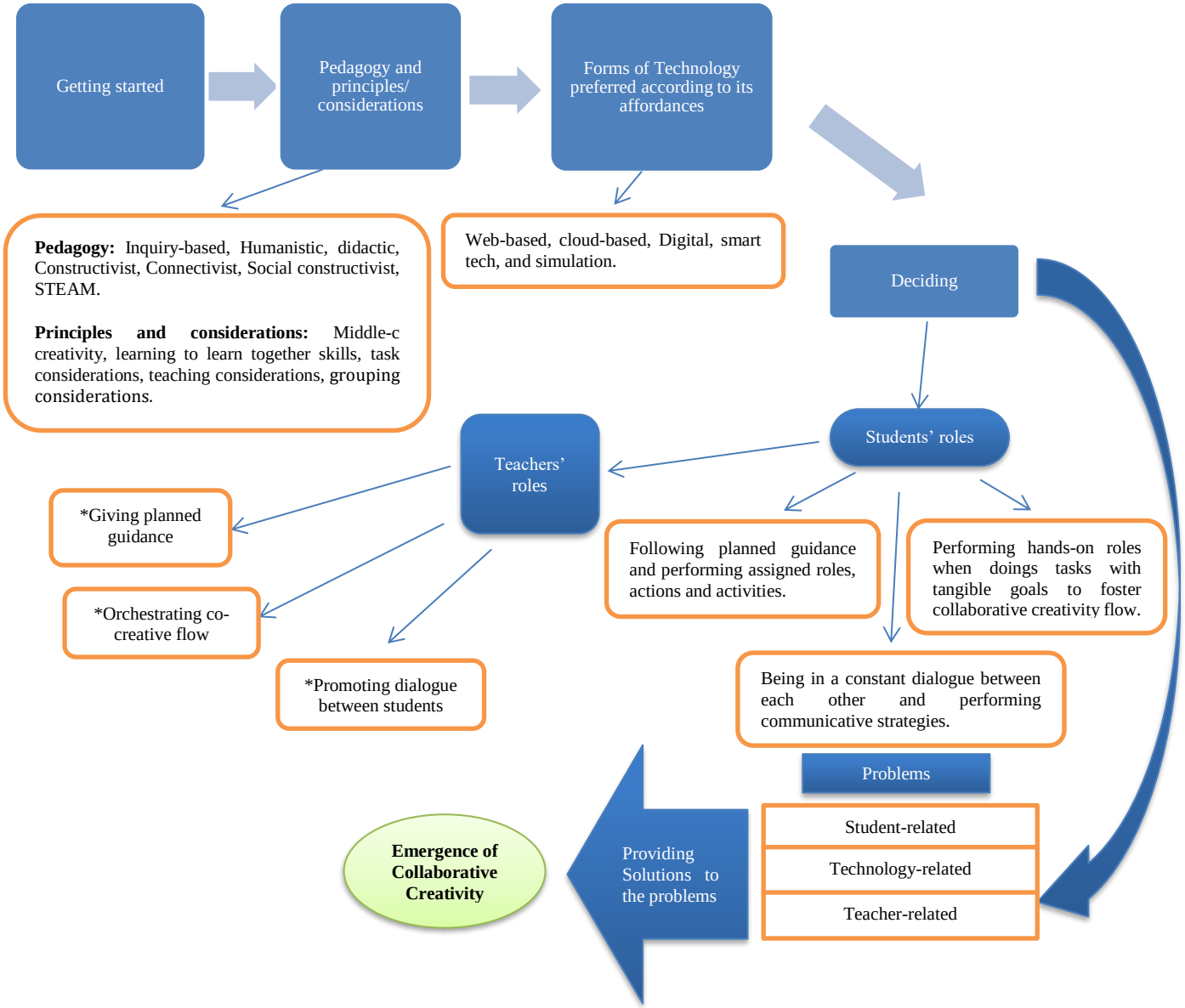

Figure 3. The steps and process followed in the selected studies for the emergence of collaborative creativity.

As shown in figure 3, the steps and process followed in the selected studies for the emergence of collaborative creativity include first determination of the pedagogy and principles, which is later followed by determination of form of technology according to its affordances. Here, this decision was taken according to match between task and form of technology. After deciding these two initial steps, there is another decision-making process ahead of teachers, which include: to decide teachers' role and students' role and to provide solutions to the three types of problems (student-related, technology-related and teacher-related) that they may encounter. After going through all these processes successfully, it is possible to foster collaborative creativity.

The findings indicated that majority of the studies employed student-directed pedagogy and learning theories that underpin social-constructivism. These are: 1) Inquiry-based pedagogical approach, 2) Humanistic perspective supported by the critical pedagogy, 3) Didactic Approach, 4) Constructivism, and 5) Connectivist theory and 6) STEAM approach. Aside from these, studies also highlighted some important pedagogical principles and conducted their studies based on this premises. Some of the implications of these principles are important to discuss for future avenues. First, students should be directed to be creative by solving a real challenge in a social world, and teachers should design phases and goals as clear as possible (Pifarre, 2019). Moreover, as discussed in Pifarré et al., 2014, students need to learn how to learn together and they need to be equipped with these skills. That is, they need to learn to establish mutual engagement, distribute leadership among themselves, learn to do peer-assessment, and also pick up the right person for group leadership. To be more precise, the task, the teaching approach and the group dynamics should be planned in advance, but at the same time, there should not be enforced control over the students which would inhibit their actions and creativity. In line with Csikszentmihalyi (1997), the selected studies showed that precise goals should be set by instructors, yet meanwhile the absence of awareness and conscious control are essential to maintain co-creative flow of students.

As discussed in the studies, three major roles were identified for teachers: 1) giving planned guidance, 2) promoting dialogue between students during the process of creation and 3) orchestrating collaborative creativity flow of students. None of the identified roles of teachers portray teachers as a complete bystander to students' collaborative creation process. Instead, teachers are there to

mentor, monitor and facilitate the process in three different ways. The studies also highlighted that the conception of teacher as a direct source of information can be avoided and learning and doing process can be more student-centred if teachers conduct a need analysis (Herbert, 2007; Lim & Morris, 2009). Instructors need to know about group dynamics, students' level of openness to dialogue and collaboration, students' knowledge of communicative strategies and ICT, and how to assign roles to students based on student characteristics and so forth. For this reason, this review gives an important tip to teachers and educators: if they can carry out a need analysis, a facilitating deep learning approach can be used more effectively (Floyd, K. S., Harrington, S. J., & Santiago, J.; 2009; Jang, 2008; Rovai, 2007).

Students' roles were also found to be in parallel with teachers' roles: 1) following planned guidance and performing assigned roles, actions and activities, 2) being in a constant dialogue among each other and performing communicative strategies, 3) performing hands-on roles while doings tasks with tangible goals to foster collaborative creativity flow. This shows that it is important to create collaboration of a teacher and student to ensure collaborative creativity from outside and inside. Thus, it is possible to keep students under control while offering students a degree of freedom that fosters co-creative flow.

Regarding the forms of technology used, web-based technologies were found as the most widely used form of technology. Then, the list was followed by cloud-based technology as the second most used and digital technology as the third most used technologies. The rest of the technologies, simulation and smart technologies, were used only once. Apart from its features, the major reason why web-based preferred widely is because web-based technology devices such as mobile phones, social media, computer and so forth. can be used by mainstream. The cloud-based technology came out as the second most used technology because just like web-based technology, it can offer real time communication, and additionally, it can offer "visual" communication and can be used offline. Due to these features, cloud-based technology is far more collaboration-based compared to web-based technology, but despite this, web-based technology has nevertheless the upper hand in the studies. This may be attributed to the fact that web-based technology has longer history and it is cheaper compared to cloud-based technology.

Three main problems were identified in the selected studies: teacher-related, student-related and tech-related problems. And among these, "student-related" problems came out as the most commonly encountered problem. This was followed by technology-related problems and then by teacher-related problems. Majority of the student-related problems were about unbalanced contribution, shallow (unproductive) discussions, and experiences of disagreements and tension among students. As for technology-related problems, students' unfamiliarity with the softwares and technological tools were listed as one of the major shortcomings experienced by the students. In addition to this, the features of technological tools sometimes led to competition and conflicts among students. When it comes to teacher-related problems, teachers' management styles stand out as the main reason. Though different types of problems identified in the studies, it was indicated that these problems could be tackled through student-student and teacher-student cooperation and communication. Therefore, this study can inform teachers/educators that obstacles and challenges should not fear them because students can find ways to handle them with ease as long as they communicate among each other, and as long as teachers assist them by guiding them to solutions. Therefore, in the selected studies, the majority of the problems could be solved and even disadvantages could be turned into advantages when the collaborative spirit was maintained. Students could solve the problems in three ways: 1) by solving the problems coming together, 2) by being considerate towards their team members and 3) by valuing their teachers' effort. Therefore, it would not be wrong to say that, in the papers selected for this review, problems were not perceived as obstacles to collaborative creativity both by the students and the teachers. Instead, they were considered as a means to boost collaboration and creativity.

There are some limitations on the findings of the systematic review however. This systematic review was limited to peer-reviewed articles written between 2014 and 2019. The fact that only 21 publications have been analysed may have limited the impact of our implications and recommendations. Apart from this, the selected key words chosen might not include some other possible combinations of keywords, thereby leading up to another limitation. Lastly, major limitation may have caused because of discussing different forms of technology, educational contexts and subject domains which require heterogeneous screening of studies, but in order to control these shortcomings, the key words were kept as much rich and inclusive as possible. Despite these limitations discussed above, the findings of this study have several important implications for future research:

I. Much of the studies conducted are qualitative, and therefore, future studies should design a larger-scale empirical study and should design mixed method approach to provide different insights.
II. Even though there have been several studies conducted using different technological tools, future studies should further investigate effective ways to establish a dialogic, multimodal and multi-voiced shared-digital space by focusing more on group dynamics, teachers' roles and student roles. Moreover, while implementing collaborative creativity, it is important for students to engage in reflective dialogues to maintain group spirit and interaction. Hence, future studies should further investigate the ways of supporting reflective dialogues that widen and deepen students' understanding of collaborative creativity practices.
III. Apart from these, future studies should be done to investigate further how co-creative flow emerges with implicit knowledge, in other words, without conscious awareness of thought and control.

In addition to implications for future research, the following recommendations for policy and practice have been drawn out based on the findings of this review:

I. It would be helpful if teachers get training about the ways to promote technology-mediated collaborative creativity of students in educational contexts. To be more precise, even if teachers have enough technological competence, many of them still do not know practical ways to boost collaborative creativity by using technological tools. This is mainly because they may not have knowledge regarding pedagogical affordances of technological tools. Therefore; if training provided to teachers, they can provide better environment to produce collaborative creativity by matching the features of technology with the task considered to be implemented.

II. It would be helpful if students get training on working as a team member and teachers get training on controlling group dynamics. Group dynamic is an important variable to control to ensure collaborative creativity. In this respect, students need to learn what is meant to be a team member whereas teachers need to know what criteria need to be considered before allocating students to groups or peers. As discussed in the selected studies, collaborative creativity cannot emerge in the absence of disagreements and tension, and yet these should not be in the form of fight and competition among students. This fine line between disagreements and fight, and tension and competition need to be set properly, by rendering this training an absolute requirement.

III. It would be helpful if a need analysis can be conducted by teachers before creative collaboration practice. This is absolutely necessary because if an instructor wants to use facilitative deep learning approach in a more effective way, then they need to know about the needs of students. If they meet the need of students, this can give way to more student-centred approach and can foster emergence of co-creative flow with implicit knowledge where there is little to no teacher interference to students' practice except for guiding explanations and demonstrations.

In a nutshell, this paper has reviewed 21 studies on tech-enhanced collaborative creativity practices conducted in the field of education between 2014 and 2019. The review has focused on important issues that are key to foster collaborative creativity, and as a result, it was seen that for the emergence of collaborative creativity, the studies follow similar decision-making process: 1) deciding pedagogy / principles, 2) deciding forms of technology based on its affordances, and after that, 3) deciding teachers' role and students' role, and finally 4) solving problems. These are the key educational variables enabling or inhibiting the emergence of collaborative creativity. In this respect, this review has contributed to the field by identifying the key educational variables, and by showing how these variables have been implemented in the most effective way in the selected studies.

Ethics and Consent: Ethics committee approval is not required as it does not involve clinical researches on humans as well as it does not contain Retrospective studies in accordance with the Law on Protection of Personal Data.

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APPENDIX A: Reference List of the Reviewed Articles (N=21)

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Research Paper

An Investigation of the Relationship between University Students' Digital Burnout Levels and Perceived Stress Levels

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ABSTRACT
The aim of this study is to examine the relationship between university students' digital burnout levels and their perceived stress levels. The population of the research consists of students studying at İnönü University, Malatya, in the spring semester of the 2020-2021 academic year. The data were collected online. The sample included 925 students who voluntarily participated in the research. According to the results obtained in the research; students' digital burnout levels are above average and their perceived stress level is moderate. Students who use smart phones to connect to the Internet have higher levels of digital burnout than those who use desktop/laptop. The digital burnout levels of students studying at undergraduate level are higher than students studying at graduate level. There is no difference between students' digital burnout levels and perceived stress levels according to the classes they study and the level of use of digital devices. As students' internet usage time increases, their digital burnout levels and perceived stress levels also increase. There is a moderately positive and significant relationship between students' digital burnout levels and their perceived stress levels. As students' digital burnout levels increase, so do their perceived stress levels.

INTRODUCTION

People frequently use digital technology for such things as communicating, sharing information, learning, doing shopping, doing banking transactions and working remotely. In this period, digital devices began to be used more intensively by students and teachers. Due to the pandemic conditions, many countries have begun to provide distance education thereby increasing use of digital devices. The COVID-19 pandemic has forced schools to close in 191 countries and affected at least 1.5 billion students and 63 million primary and secondary school teachers (Unesco, 2020). Turkey is among the countries that implemented distance education for the longest time. Currently, schools in Turkey are partially open. Students studying in primary, secondary and high schools go to school on certain days of the week and take courses through distance education at other times. Faculties/vocational colleges providing applied education in universities provide face-to-face education to certain classes, while other faculties/vocational colleges continue with distance education. It has become a necessity to use these technologies due to the pandemic that has affected the whole world, which has brought about digital burnout.

Burnout

The concept of burnout can be traced back to 1974, when Freudenberger defined it as "feelings of failure and weariness or compression resulting from excessive claims related with energy, personal resources or the worker's spiritual strength" (Guadalupe & Juan-Carlos, 2013). Freudenberger (1974, 1975), has characterized burnout, besides its other symptoms, as fatigue, susceptibility to physical weakness and disease, sleep disorders, weight changes, irritability and frustration, cynical and suspicious attitudes, psycho-hardness and professional inefficiency (Bianchi, Schonfeld & Laurent, 2018). Burnout describes a state of severe stress that leads to severe physical, mental and emotional fatigue. Much worse than ordinary fatigue, burnout makes it difficult for people to cope with stress and carry out daily responsibilities. People with burnout often feel they have nothing left to give and may be afraid to get out of bed every morning. They may even adopt a pessimistic outlook on life and feel hopeless (Fraga, 2019).

“Burnout is a psychological syndrome of emotional exhaustion, depersonalization, and decreased personal success that can occur in individuals working with other people in a certain capacity. The most significant aspects of burnout syndrome include increasing emotional exhaustion, professional incompatibility, reduced productivity and professional motivation, the formation of negative attitude towards vocational activities, violations of interpersonal relations systems, lack of personal success and formation of dependent behaviors (Schaufeli & Salanova, 2007; Maslach, Jackson & Leiter, 1996; Zhao & Ding, 2020).

Symptoms of Burnout

Physical signs of burnout

Physical signs of burnout include feeling exhausted and sluggish, reduced immunity, common diseases, having the muscles or headaches very often, sleep disorders, indigestion, dizziness, tiredness and fatigue, tinnitus, weakened immune system, eczema, hay fever and asthma.

Emotional symptoms of burnout

Emotional symptoms of burnout can be sorted as failure and self- doubt, feeling helpless, trapped and defeated, feeling alone in the world, a condescending and negative outlook, decreased sense of satisfaction and achievement, increased irritability, boredom, lack of motivation, feelings of stagnation, low self-esteem, restlessness, an inner feeling of emptiness, anxiety, hopelessness and a sense of uselessness (Smith, Segal & Robinson, 2020).

Behavioral symptoms of burnout

Avoidance from liabilities, skipping work or going to work late and leaving early, lack of concentration, decision inability, self-doubting, performance loss, social withdrawal trends, increasing coffee and alcohol consumption, spending less time for relaxing or entertaining activities, irritability and anger, dissatisfaction, procrastination (Rožman, Treven, & Cingula, 2018; Smith, Segal & Robinson, 2020).

Burnout syndrome has been one of the most discussed mental health problems in modern societies in recent years. In a world facing major socioeconomic challenges, people experience ever-increasing pressure in their daily lives, especially in the workplace (Heinemann & Heinemann, 2017), thus affecting productivity and performance (Packirisamy, Meenakshy & Jagannathan, 2017).

Burnout is a state of emotional, physical and mental exhaustion caused by too much and prolonged stress. It occurs when the individual feels distressed, emotionally tired, exhausted and so cannot meet the constant demands. As stress continues, the individual begins to lose the interest and motivation that initially drove him to take on a particular role (Smith, Segal & Robinson, 2020).

Digital Burnout

Digital Technology has become an integral part of modern life. The use of digital technology is "a general term that covers various devices, services and types of use" (Dienlin & Johannes, 2020).

According to the report 'We are Social (2021)', the world population is 7.83 billion while the number of mobile phone users is 5.22 billion (66.6%), the number of users with internet access 4.66 billion (59.5%), and active social media users 4.20 billion (53.6%). Average daily internet usage time is 6 hours 54 minutes, social media usage time is 2 hours 25 minutes, television watching time is 3 hours 24 minutes, listening to music from the internet is 1 hour 31 minutes and playing games is 1 hour 12 minutes.

Despite the fact that digital tools have an effect that relaxes, entertains or helps people to spend their free time, excessive use of these tools brings digital burnout.

Digital burnout describes the negative impact of technology on our mental and physical health, along with symptoms such as restlessness, cognitive problems, emotional fatigue, and anxiety or stress. It occurs when we fail to turn electronics off and instead allow them to take over our lives; as a result, it affects our relationships, work performance and social activity (Grossmann, 2019). However, due to the pandemic that has affected the whole world, it has become a necessity to use these technologies. People have started to use these technologies more frequently to do their work from home and receive their education remotely. Caused by such requirements, digital burnout or feelings of anxiety, exhaustion and apathy caused by spending too much time on digital devices have been a growing problem. As technology makes us more dependent on each other and outbreaks us to bring in computers to work, pushing for tablets and smartphones to trust, the risk of extinction increases (McLean, 2020). The problem of digital burnout, however, is specifically related to fatigue, anxiety, depression, or decreased interest in a job, caused by too much time on digital devices. Digital burnout can be difficult to diagnose, because the problem develops slowly and people may not know they run up too late (McLean, 2020).

Burnout can also be regarded as being always in an online connection via smartphones, laptops and tablets, which will predispose us to burnout exacerbated by digital overuse in times of lockdown. This excessive use of digital technology in times of lockdown will contribute more to digital burnout (Sharma e t al., 2020)

While some signs and symptoms of digital-induced burnout are similar to general burnout, the main difference between the two is that the primary source – prolonged use of digital devices – is known. (Marius, 2021).

Stress

Stress is “a feeling of physical tension and/or anxiety when it is thought that the individual cannot cope with the demands placed on him” (Hellriegel and Slocum, 2008). According to Selye (1976), stress is "the body's indistinct response to any demand made on itself"; that is, the rate we live at any given moment. All living creatures are under stress, and anything pleasant or unpleasant that accelerates the intensity of life causes a temporary increase in stress, thus creating a corrosive effect on the body. A painful blow and a passionate kiss can be equally stressful. According to Folkman & Lazarus (1984), stress is "a state resulting from the organism's interaction with a harmful stimulus or environment", and is an uncertain reaction of the body to an environmental demand (Soytürk, 2011).

Perceived stress is the feelings or thoughts an individual has about how stressed they are at a particular time or during a particular period of time. It includes the uncontrollability and unpredictability of one's life, how often one has to deal with disturbing difficulties, how much change has occurred in one's life, and confidence in one's ability to cope with problems or difficulties (Phillips, 2013).

When the conducted studies are examined; Reinecke et al. (2016) stated in their study that multiple transactions on the internet, sending, receiving and checking private e-mails and messages on social media increase the level of perceived stress of individuals. The indirect effect of the increase in the burden of communication manifests itself as a decrease in the level of burnout, depression/anxiety and psychological well-being. computer-mediated communication (CMC) behavior that, ultimately, increases their risk of stress and psychological health impairments.

Thomée, Eklöf, Gustafsson, Nilsson, and Hagberg (2007) in their study in Sweden with 1 year follow-up, found that high-level use of digital devices (computer, mobile phone) increased stress and depression. Again, Thomée, Härenstam, and Hagberg (2011) have carried out a study with 4156 young adults (20-24) in Sweden with 1-year follow-up and concluded that there is a correlation between stress, sleep disturbance and depression, and excessive cell phone use. Akın and İskender (2011) determined that there is a positive relationship between excessive internet use and depression, anxiety and stress in a study involving 300 university students. Samaha and Hawi (2016) concluded that there is a weak positive relationship between excessive phone use and perceived stress level, and Lepp, Barkley, and Karpinski (2014) concluded that students who use excessive phone have higher anxiety levels. Bilge, Baydili and Göktaş (2020), in their study, concluded that there is a moderate and positive relationship between excessive social media use and depression, anxiety and stress.

Purpose of the Research

The unexpected developments in the world - the present pandemic - have changed all the habits of people. The businesses, shopping, banking transactions, education services have all started to be done remotely by using the latest technological tools. Therefore, the use of computers, smartphones and tablets has also increased enormously. Continuous exposure to these devices and digital stimuli has affected people both physically and psychologically. Developments in the digital world affect people both positively and negatively. On the one hand, the Internet provides the opportunity for people to have a pleasant time, research, access and share information, on the other hand, its excessive use can cause introversion, depression and stress. If the stimuli that causes stress are not dealt with, a feeling of pessimism emerges and this manifests itself as anxiety, depression, insomnia and fatigue (Gökler & Işıtan, 2012). Determining the relationship between the digital burnout levels of university students and their perceived stress levels is going to contribute to the measures to be taken in this direction. In this context, the aim of the research is to examine the relationship between the digital burnout levels of university students and the stress they perceive.

METHOD

Model of the Research

Relational survey model, one of the quantitative research methods, was used in the research. “Scanning models are research approaches that aim to describe a past or present situation as it is. The event, individual or object that is the subject of the research is tried to be defined in its own conditions and as it is” (Karasar, 2005). In survey research, a sample is selected from the population to describe the views or characteristics of a large community on a subject. (Fraenkel, Wallen & Hyun, 2012).

Population and Sample

The population of the research consists of students studying at Malatya İnönü University in the spring semester of the 2020-2021 academic year. 925 students who voluntarily participated in the sample were included. Demographic characteristics of the participants are given in Table 1.

Table 1. Demographic Characteristics of Participants

		Frequency	Percent
Gender	Female	607	65.6
	Male	318	34.4
Level of education	Associate Degree	158	17.1
	Undergraduate	721	77.9
	Graduate	46	5.0
Class	1st Grade	294	31.8
	2nd Grade	220	23,8
	3rd Grade	193	20.9
	4th Grade	203	21.9
	5th Grade	15	1.6
Internet Usage Time (Excluding Classes)	1-3 hours	145	15.7
	4-6 hours	362	39.1
	7-10 hours	275	29,7
	10 hours or more	143	15.5
Do you have a smartphone?	Yes	904	97.7
	No	21	2.3
Do you have a computer?	Yes	746	80.6
	No	179	19.4
Do you have a tablet?	Yes	211	22.8
	No	714	77.2
Device Used to Connect to the Internet	Desktop/Laptop	208	22.5
	Tablet	12	1.3
	Smartphone	705	76,2
Level of Using Digital Devices	Poor	25	2.7
	Moderate	403	43.6
	Satisfactory	497	53.7
	Total	925	100.0

Data Collection Tools

Perceived Stress Scale (PSS): The scale, which was developed by Cohen, Kamarck and Mermelstein (1983) and adapted into Turkish by Eskin et al. (2013), consists of a 5-point Likert type and a total of 14 items. The scale is designed to measure how stressful some situations in a person's life are perceived. 7 items with positive expressions are scored in reverse. The scores of PSS range from 0 to 56. A high score indicates that the person has an excessive perception of stress. The Cronbach alpha coefficient of the Turkish form of the scale is 0.87 (Eskin et al. 2013). The Cronbach Alpha internal consistency coefficient we calculated in this study is 0.85.

Digital Burnout Scale: The scale was developed by Erten & Özdemir (2020). It consists of 24 items and three sub-factors named "digital wear", "digital deprivation" and "emotional exhaustion". High scores to be obtained from the scale indicate that the level of digital burnout is high. The Cronbach's alpha internal consistency coefficient of the scale is 0.946. The internal consistency coefficient of Cronbach's Alpha which was calculated in this study is 0.960.

Data Analysis

Data were collected online. The links of the scales used to reach the students were shared through the learning management system used by the students for distance education and in the social media groups created to communicate with the students. In the normality test, the kurtosis and skewness coefficients were found to be in the range of ± 1 (George & Mallery, 2016) and the data showed normal distribution. Therefore, data were tested using the t-test, one-way analysis of variance test (ANOVA), for independent groups with descriptive analyzes (mean and standard deviation) and parametric analyzes. Pearson Product Moment Correlation Analysis was used to determine the relationship between students' digital burnout levels and their perceived stress levels. The significance level was taken as $p<.05$.

FINDINGS

In this section, the findings obtained as a result of the statistical analysis of the collected data and their interpretations are presented.

Table 2. The Results of Pearson Product Moment Correlation Analysis Conducted to Determine the Relationship between Students' Digital Burnout Levels and Perceived Stress Levels

Variable	n	r	p
Digital Burnout Perceived Stress	925	0,585	,000

According to Table 2, there is a moderately positive and significant relationship between students' digital burnout levels and their perceived stress levels (r=0.585, p<.01). Accordingly, as students' digital burnout levels increase, so do their perceived stress levels.

Table 3. t-test Analysis Results of Students' Digital Burnout Levels and Perceived Stress Levels by Gender

	Gender	n	$\bar{x}$	S	Sd	t	p
Digital Burnout	Female	607	72.21	23,22	923	5,651	,000
	Male	318	62.86	25.11			
Perceived Stress	Female	607	29.51	9.13	923	3,682	,000
	Male	318	27.16	9.32			

According to Table 3, a statistically significant difference was found between the digital burnout levels of male and female students participating in the research (t(923)=-5,651, p<0,05) in favor of male students. Accordingly, male students' digital burnout levels ($\bar{x}$ =62,86) are lower than female students ($\bar{x}$ = 72,21). Similarly, a statistically significant difference was found in favor of male students between perceived stress levels (t(923)=3,682, p<0,05). Male students' perceived stress levels ($\bar{x}$ =27,16) were found to be lower than females' ($\bar{x}$ = 29,51).

Table 4. ANOVA Analysis Results of Students' Digital Burnout Levels and Perceived Stress Levels According to the Device They Use to Connect to the Internet

		Sum of Squares	Sd	Mean Squares	F	p	Difference
Digital Burnout	Between groups	7262,631	2	3631,316	6,226	,002	A<C
	Within groups	537747,364	922	583,240			
	Total	545009,996	924				
Perceived Stress	Between groups	339,980	2	169,990	1,985	,138	No difference
	Within groups	78974,792	922	85,656			
	Total	79314,772	924				

A- Desktop/Laptop B- Tablet C- Smartphone

According to Table 4, a significant difference was found between the students' digital burnout levels (F(2; 922) = 6,226, p<0,05) according to the devices they use to connect to the internet. According to the results of the Tukey test conducted in order to determine among which groups the differentiation was, the differences were found to exist between the students using smartphone ($\bar{x}$=70,56) and those using desktop/laptops ($\bar{x}$=63,98). There was no significant difference between the stress levels perceived by the students according to the devices they use to connect to the internet (F(2; 922) = 1,985, p>0,05).

Table 5. ANOVA Analysis Results of Students' Digital Burnout Levels and Perceived Stress Levels by Educational Levels.

		Sum of Squares	Sd	Mean Squares	F	p	Difference
Digital Burnout	Between groups	4010,529	2	2005,265	3,417	,033	C<B
	Within groups	540999,467	922	586,767			
	Total	545009,996	924				
Perceived Stress	Between groups	801,918	2	400,959	4,709	,009	A<B
	Within groups	78512,854	922	85,155			
	Total	79314,772	924				

A- Associate Degree B- Undergraduate C- Postgraduate

According to Table 5, a significant difference was found between the students' digital burnout levels (F(2; 922) = 3,417, p<0,05) according to the education levels of the students participating in the research. According to the results of the Tukey test, which was

conducted to determine between which groups the differentiation is, this difference is between the students studying at undergraduate level ($\bar{x}$=70,04) and those studying at graduate level ($\bar{x}$=62,60). Likewise, a significant difference was found between the students' perceived stress levels (F(2; 922) = 4,709, p<0,05). This difference is between students studying at undergraduate level ($\bar{x}$=29,19) and students studying at associate degree level ($\bar{x}$=27,17).

Table 6. ANOVA Analysis Results of Students' Digital Burnout Levels and Perceived Stress Levels by Grades.

		Sum of Squares	Sd	Mean Squares	F	p	Difference
Digital Burnout	Between groups	981,567	4	245,392	,415	,798	No difference
	Within groups	544028,428	920	591,335			
	Total	545009,996	924				
Perceived Stress	Between groups	264,518	4	66,129	,770	,545	No difference
	Within groups	79050,254	920	85,924			
	Total	79314,772	924				

According to Table 6, students' digital burnout levels (F(4; 920) = ,417, p>0,05) and perceived stress levels (F(4; 920) = ,770, p>0,05) were not found to have a significant difference.

Table 7. ANOVA Analysis Results of Students' Digital Burnout Levels and Perceived Stress Levels According to Daily Internet Use Time.

		Sum of Squares	Sd	Mean Squares	F	p	Difference
Digital Burnout	Between groups	43220,048	3	14406,683	26,442	,000	A-B<C-D
	Within groups	501789,948	921	544,832			
	Total	545009,996	924				
Perceived Stress	Between groups	1457,783	3	485,928	5,748	,001	A-B<C-D
	Within groups	77856,989	921	84,535			
	Total	79314,772	924				

A- 1-3 hours B- 4-6 hours C- 7-10 hours D- more than 10 hours

According to Table 7, a significant difference was found among the digital burnout levels (F(3; 921) = 26,442 p<0,05) of students participating in the research according to their daily internet usage times. According to the results of the Tukey test, which was conducted to determine between which groups the differentiation was, this difference was found among the students using the internet for 1-3 hours ($\bar{x}$=58,28); 4-6 hours ($\bar{x}$=65,27); 7-10 hours ($\bar{x}$=74,61) and more than 10 hours a day ($\bar{x}$=78,48). Likewise, a significant difference was found between students' perceived stress levels (F(2; 922) = 4,709, p<0,05). This difference exists among the students who use the internet for 1-3 hours ($\bar{x}$=26,75); 4-6 hours ($\bar{x}$=28,02); 7-10 hours ($\bar{x}$=29,68) and more than 10 hours a day ($\bar{x}$=30,53).

Table 8. ANOVA Analysis Results of Students' Digital Burnout Levels and Perceived Stress Levels According to Digital Device Usage Levels.

		Sum of Squares	Sd	Mean Squares	F	p	Difference
Digital Burnout	Between groups	1378,231	2	689,116	1,169	,311	No difference
	Within groups	543631,764	922	589,622			
	Total	545009,996	924				
Perceived Stress	Between groups	492,853	2	246,427	2,883	,056	No difference
	Within groups	78821,919	922	85,490			
	Total	79314,772	924				

According to Table 8, a significant difference was not found between students' digital burnout levels (F(2; 922) = 1,169, p>0,05) and perceived stress levels (F(2; 922) = 2,883, p>0,05) considering their use of digital learning devices.

Table 9. Descriptive statistics of students' digital burnout levels and perceived stress levels

	N	Minimum	Maximum		Sd
Digital Burnout	925	24.00	120.00	68.99	24.28
Perceived Stress		00,00	56,00	28.71	9.26

According to Table 9, the digital burnout levels of the students ($\bar{x}$=68,99) are above average and the perceived stress level ($\bar{x}$ =28,71) is moderate.

DISCUSSION AND CONCLUSIONS

According to the result we obtained in the research; students' digital burnout levels are above average and their perceived stress level is moderate. As a response to the COVID-19 outbreak, many governments have taken steps such as spatial distance - staying home - to reduce its spread and impact (Király et al., 2020). The COVID-19 pandemic and social isolation have predominantly affected adolescents and young adults (Göker & Turan, 2020). As young people stay at home and their communication with other people and friends decreases, digital technologies have started to be used a lot. The frequent use of these technologies has brought along digital burnout. This increases the stress, anxiety and depression levels experienced by people.

It was concluded that male students' digital burnout levels were lower than female students. When the perceived stress levels were examined, it was concluded that the perceived stress levels of male students were lower than female students. According to the results obtained in the studies conducted on different student groups, female students' perceived stress levels are higher than male students (Leung, Lam & Chan, 2010; Andreou et al., 2011; Deasy et al., 2015; Shaw, Peart & Fairhead, 2017; Reyhan & Karaca, 2016; Hancıoğlu, 2017; Çalışkan et al., 2018). However, according to the results obtained in some other studies, there is no difference between the perceived stress levels of female and male students (Baştuğ, Metin & Bingöl, 2014; Ateşoğlu & Erkal, 2016; Akınlotu & Ertan, 2018; Fasoro et al. , 2019; Deles & Kaytez, 2020).

Students who use smartphones to connect to the internet have higher digital burnout levels than students who use desktop / laptop. The fact that students always have their mobile phones with them allows them to connect to the internet at any time. With social isolation, people have started to use social media and digital games too much to communicate and spend their spare time. According to the results of Balhara et al.'s study, approximately half of the participants (50.8%) stated that their gaming habits increased during this period (Balhara et al. 2020). There is no difference between the stress levels perceived by the students according to the devices they use to connect to the internet.

The digital burnout levels of undergraduate students are higher than those of studying at graduate level. Likewise, the perceived stress levels of students studying at the undergraduate level are higher than the students studying at the graduate level. The number of courses taken by graduate students is less than undergraduate students. At the same time, some of the graduate students are working in a job. Undergraduate students, on the other hand, spend most of the day with digital devices as they are enrolled in more courses, and they use these devices to communicate with their friends because they are away from school.

This study concluded that there was no difference between students' digital burnout levels and perceived stress levels according to their grades. Deleş & Kaytez (2020), on the other hand, found that the stress levels of the senior students were significantly higher than the 1st, 2nd and 3rd graders. Moreover, there is a difference between the digital burnout levels and perceived stress levels according to the duration of internet use of the students. As students' internet usage time increases, their digital burnout levels and perceived stress levels also increase. In his study with university students, Gülnar (2016) concluded that as the duration of internet use increases, so do the students' stress levels. There is no any difference between students' digital burnout levels and perceived stress levels according to their level of use of digital devices.

There is a moderately positive and significant relationship between the digital burnout levels of students and their perceived stress levels. As students' digital burnout levels increase, their perceived stress levels increase as well. People often think that they cannot imagine life without their technological devices. Studies show that the use of technology can contribute to stress (Chaves, 2020). According to the results of the annual 'Stress in America' survey of the American Psychological Association, one-fifth (about 18%) of US adults consider technology use a major source of stress in their lives (APA, 2017). In a study conducted with US adolescents, they were asked what is the effect of digital technology use on well-being, and 31% stated that the effects were mostly positive, 45% stated that the effects were neither positive nor negative, and 24% stated that the effects were mostly negative (Dienlin & Johannes, 2020).

To cope with digital burnout;

- According to the results we have obtained in our present research, 84.3% of the participants use the internet for 4 hours or more per day. (Not including the usage for lecturing purposes). This shows that they spend a lot of time in front of the screen. Being in front of the screen for too long disrupts sleep patterns, which causes health problems such as depression, stress, focusing problems, and forgetfulness. Therefore, it is necessary to shorten the screen usage time. In addition, the person should rest, relax and exercise because he/she stays in front of the screen too much.
- Due to the pandemic, it has become mandatory to use digital devices. However, other than these, opportunities should be created where we can realize our hobbies. The question "If I do not use these devices today, what should I do instead?" should be answered.
- The control of software and devices should be completely in the hands of the person. They must be at the service of the person.
- There must be a balance between online and offline life.

- It is not possible to remove digital devices and the internet from our lives, but human life is more important than anything else. Their moderate use will not only make our lives easier, but also their adverse effects on our mental and physical health will be minimized. We should use these devices only to make our life easier instead of making them the focal point of our lives. Computers, smartphones and tablets are indispensable devices in the lives of university students. It should be noted that these devices are not designed to take over life, but to facilitate learning and enrich the learning experience.
- More research is needed to show the solids of whether digital technology is harmful to its users or not.
- The use of technological tools is going to continue to increase. Instead of demonizing technology, scientific studies should be carried out on how to gain healthy and sustainable digital behaviours in our digital world.

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Review Paper

Educational Computer Game for Earthquake

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ABSTRACT
Earthquakes are the movements of the earth's crust that originate in the ground, and they are one of the natural disasters that frighten people because they occur suddenly and often cause great loss of life and property. Earthquake natural disaster is the reality of Turkey and it is important to raise public awareness on this issue. Thanks to the sound effects, realistic animations and three-dimensional virtual environments used in the development of computer games developed in today's technologies, they attract more attention from the players. Digital computer games are used for educational purposes in various fields, enabling learners to increase their motivation towards the relevant subject. It is important to develop educational digital games using up-to-date technologies and present them to young people in accordance with learning. In this study, an educational three-dimensional computer game describing what to do before, during and after the earthquake was developed using the Unity game engine and C# coding language. It is thought that the features of the earthquake educational computer game will attract the attention of everyone from seven to seventy with its three-dimensional virtual environment and educational content, and it can be used for educational purposes in order to increase their motivation for gaining knowledge and experience about earthquakes.

INTRODUCTION

The game is an entertainment activity that people who start with the history of humanity have a good time in their spare time. Thanks to the innovations offered by technology in the digital age, people spend their free time in virtual environments. These virtual environments are social media, news sites, video channels as well as digital games. Although digital games are a favorite leisure activity for adults, young people are more likely to spend time with digital games. The educational-themed preparation of games, which are currently indispensable leisure time activities for young people, enables them to learn while having fun (Kader et al., 2019).

When educational games are used independently of the classroom environment, they ensure the successful transfer of course content (Garris et al., 2002; Turner et al., 2018). Gee (2003) argued that the principles of learning can be embodied with games, and claimed that the theory of learning is embedded in computer games. In pioneering studies on games, it has been found that students can develop more than one way of thinking about the problems they encounter while playing games (Pivec et al., 2004) and that games provide students with a problem-solving experience (Squire, 2005; Pusey, 2018; Shi et al., 2019).

Thanks to the sound effects, realistic animations and three-dimensional virtual environments used in the development of computer games developed in today's technologies, they attract more attention from the players. Studies on the effect of educational computer games on student achievement are current technologies such as augmented reality (Hwang et al., 2016a; Hsu, 2017), mobile software (Tlili et al., 2015; Hwang et al., 2016b; Cheung, 2018), virtual reality glasses (Hu et al., 2016; Sternig et al., 2018) are discussed with three-dimensional games (Bontchev, 2015; Koivisto et al., 2017).

It is important to develop educational digital games using up-to-date technologies and present them to young people in accordance with learning. With this awareness, a three-dimensional educational game with an earthquake theme was developed in the research. Earthquakes are the movements of the earth's crust that originate in the ground, and they are one of the natural disasters that frighten people because they occur suddenly and often cause great loss of life and property (Özdogan, 1993). The aim of this study is to show and enforce the measures that can be taken against earthquakes, which is one of the biggest problems of our country. It tells what to do before, during and after an earthquake.

METHOD

In this research, the developmental research method, which is one of the design-based research method derivatives, was used. With design-based research, tools that will facilitate learning are designed (Brown, 1992). There are two types of developmental research product or program development, which is a derivative of the design-based research method, and researching the educational aspect of the developed material (Richey et al., 2003). In this research, information is given about the development of an earthquake educational computer game.

Unity Game Engine was used for game development, and C# was used as the coding language in the game, and in Turkish. Game mechanics is a system that includes game rules, game control, interaction between players, story transfer, player experience, game equipment, and player emotions during a game (Lundgren & Björk, 2003). Flow Theory, which was introduced by Chickszentmihalyi in 1990, is explained as the ability of the player to challenge and solve the situation in the game. The actor must be successful in order to enter the theoretical flow (Prensky, 2001; Quoted by Facer, 2004). Playing the developed earthquake educational computer game in a three-dimensional environment increases the desire of the users to respond correctly to the situations they encounter and their motivation to complete the tasks. The game was developed over a period of 9 months on a computer with the following features; CPU: Intel i5-8265U, RAM: 8GB, STORAGE: 256GB, SSD Display: 15.6" FHD, OS : Windows 10 Home

The game story was written by an academic and a game programmer, using AFAD (Disaster and Emergency Management Authority in Turkey) earthquake documents. After the game story was completed, it was revised by taking the opinions of the students who took the game programming course at Isparta University of Applied Sciences Computer Programming. The opinions of the students about the game story were taken in the online lesson, and the number of people who attended the lesson was 52. After the game was completed, the same students were asked their opinions about the game and the game was appreciated by the participants.

FINDINGS

The EFM model proposed by Song and Zhang in 2008 got its name from the combination of the initials of the words effective learning environment, flow and motivation. The main purpose of the EFM model is to increase the aspiration throughout the flow. The EFM model aims to increase motivation and increase the level of learning by keeping the student in the flow. While developing the earthquake educational computer game, student motivation compatible with the EFM model was taken into account.

When the game starts, the player is asked “What is an Earthquake?”, “What are the Earthquake Precautions?”, “What Should Be Done in an Earthquake?” and “What to Do After the Earthquake?” information is provided. Missions appear on the left of the game screen (Figure 1).

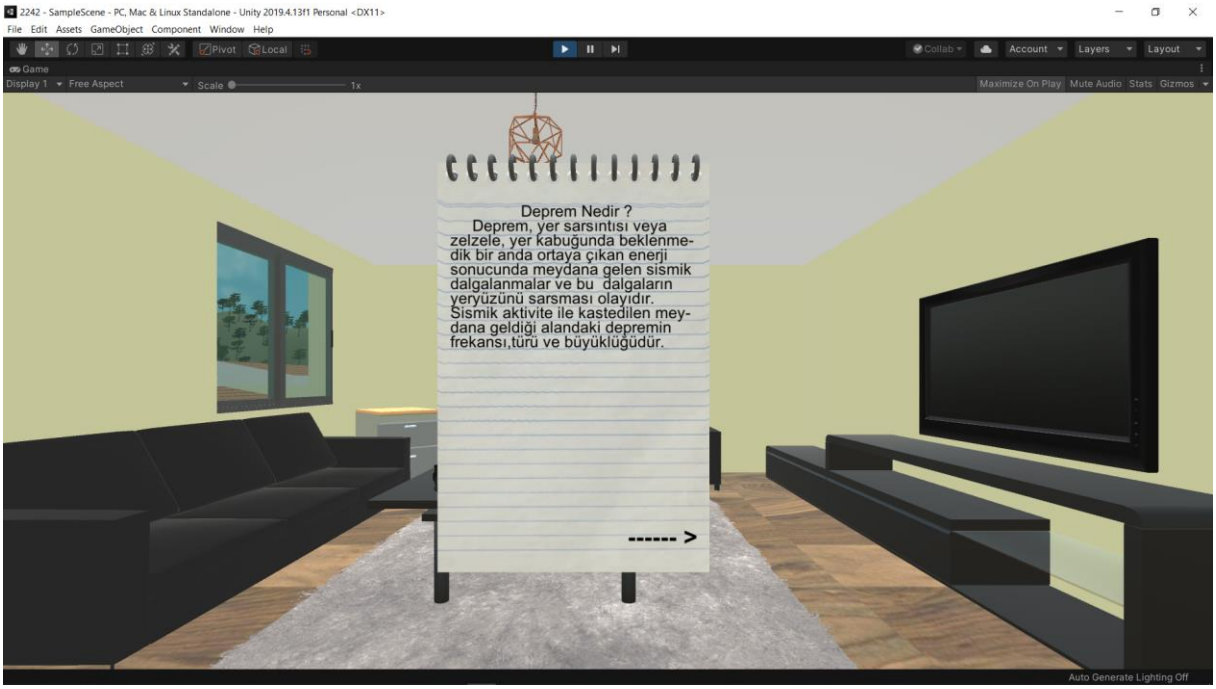

Figure 1. Giving earthquake notification to the player

For pre-earthquake precautions, the first task is for the player to turn on the television. The player cannot see and do other missions without doing this mission. When the TV is turned on, short videos that give information about two earthquakes and explain the earthquake are watched. The videos are taken from AFAD's youtube channel. After watching the videos, the tasks will be visible on the left (Figure 2).

Video 1: https://www.youtube.com/watch?v=6k2QNfmN4mw

Video 2: https://www.youtube.com/watch?v=xJ5tO8S2uzE

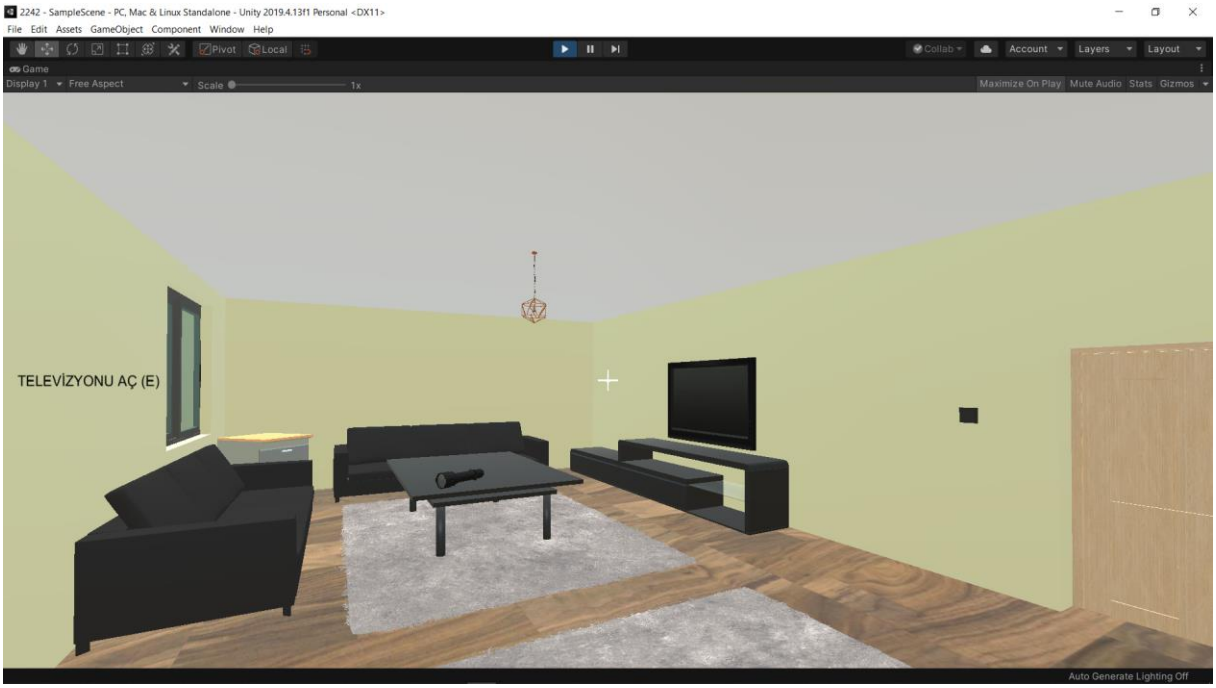

Figure 2. The player's task of watching television

Must do the tasks in the living room, kitchen and bedroom within a certain period of time. In order to see and perform the tasks in the rooms, it is necessary to be in that room. In the hall, the player is asked to fix the bookshelf, wire in front of the shelves and take the flashlight. If the library is not fixed, it will collapse in the event of an earthquake. If it is not pulled alone in front of the shelves, books may fall during an earthquake. He should take the flashlight as he has to put it in the earthquake bag (Figure 3).

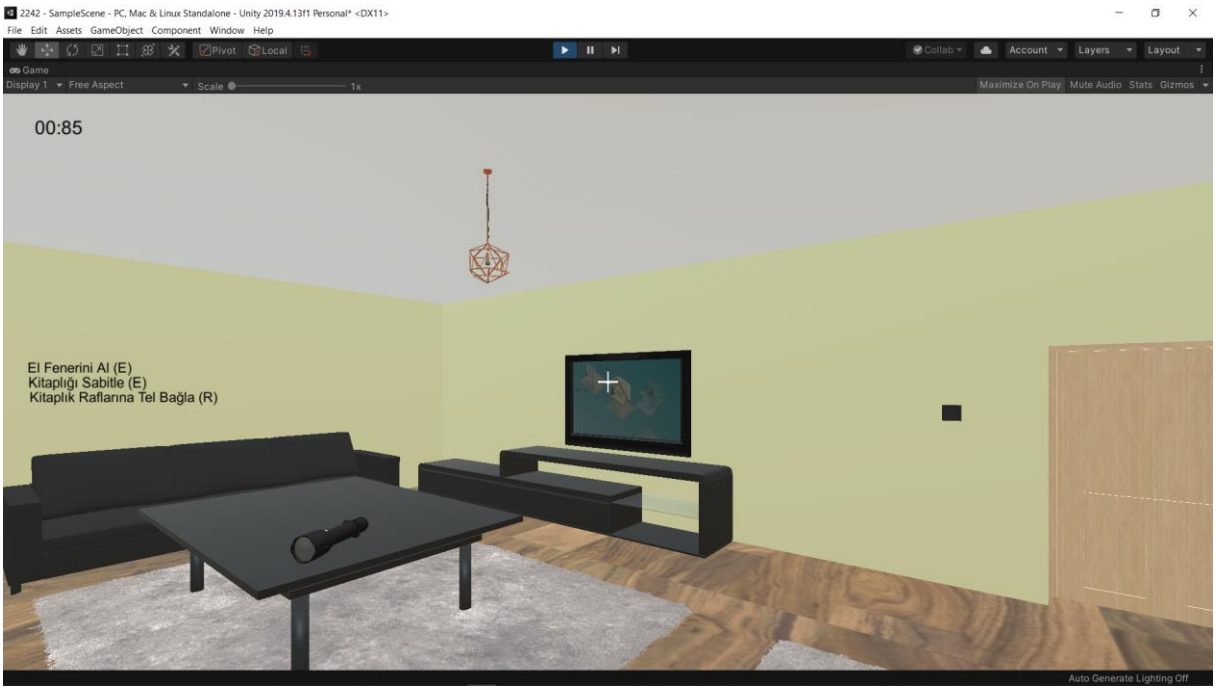

Figure 3. Flashlight acquisition and library tasks

In the kitchen, the player is asked to fix the refrigerator. If the player does not fix the refrigerator, the refrigerator will collapse during the earthquake (Figure 4). In order to put it in the earthquake bag, he must take the water from the table and the pocketknife from the counter.

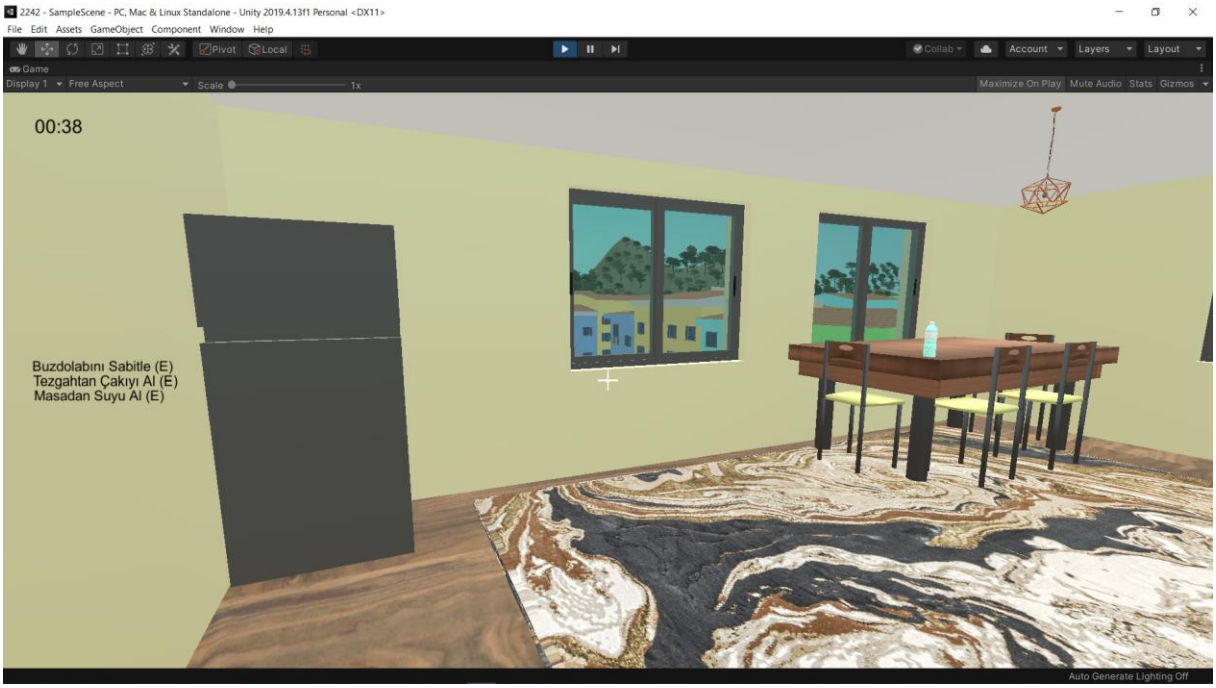

Figure 4. Earthquake precautions for the kitchen

In the bedroom, the player is asked to fix the wardrobe (Figure 5). If the player does not fix the wardrobe, the wardrobe will be destroyed during the earthquake. He should take the first aid kit and the whistle on his desk to put in his earthquake kit.

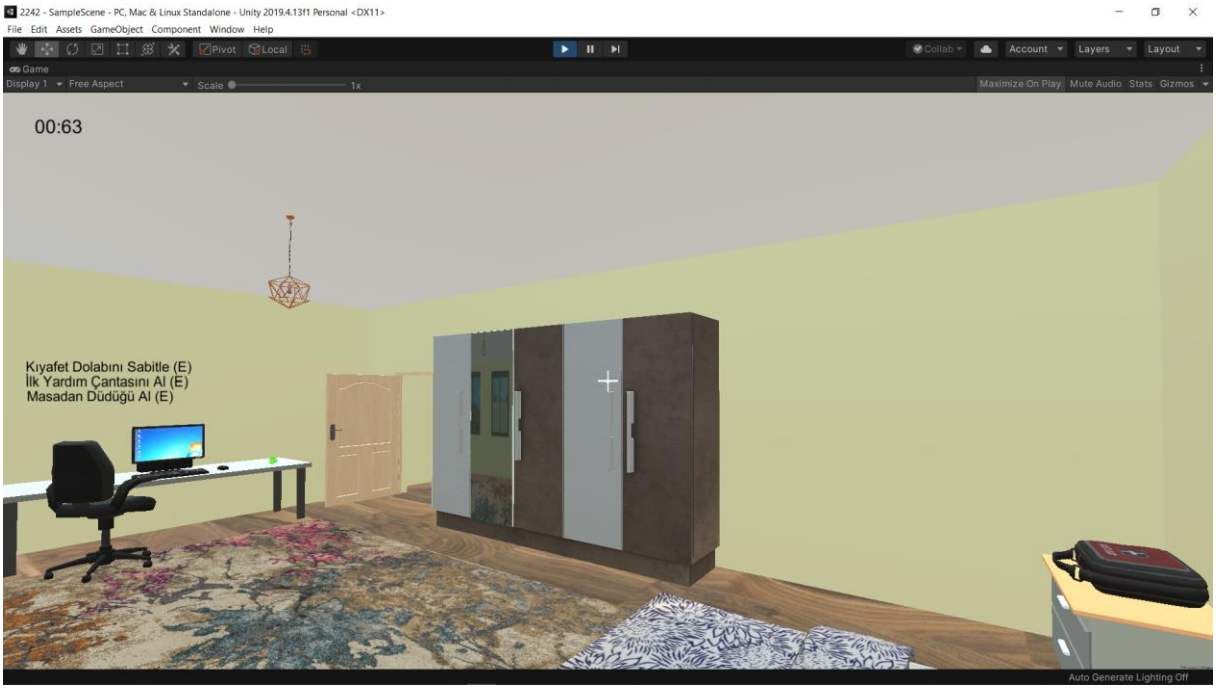

Figure 5. Bedroom earthquake precautions

During the earthquake, the scenario is started after the earthquake measures, after the time given to the player has elapsed, the earthquake takes place. When the earthquake starts, the player is presented with three options and asked to make a decision. These options are; “Skip Out The Window”, “Escape From The Apartment”, “Hide In A Safe Location” options. If he jumps from the window, the player quickly falls to the ground and the game is over (Figure 6). The player can see what will happen if he jumps out of the windows during an earthquake. If he tries to escape from the apartment, at the time of the earthquake, the character leaves the house and tries to escape. But since this should not be done in a real earthquake, the player fails and the game is over.

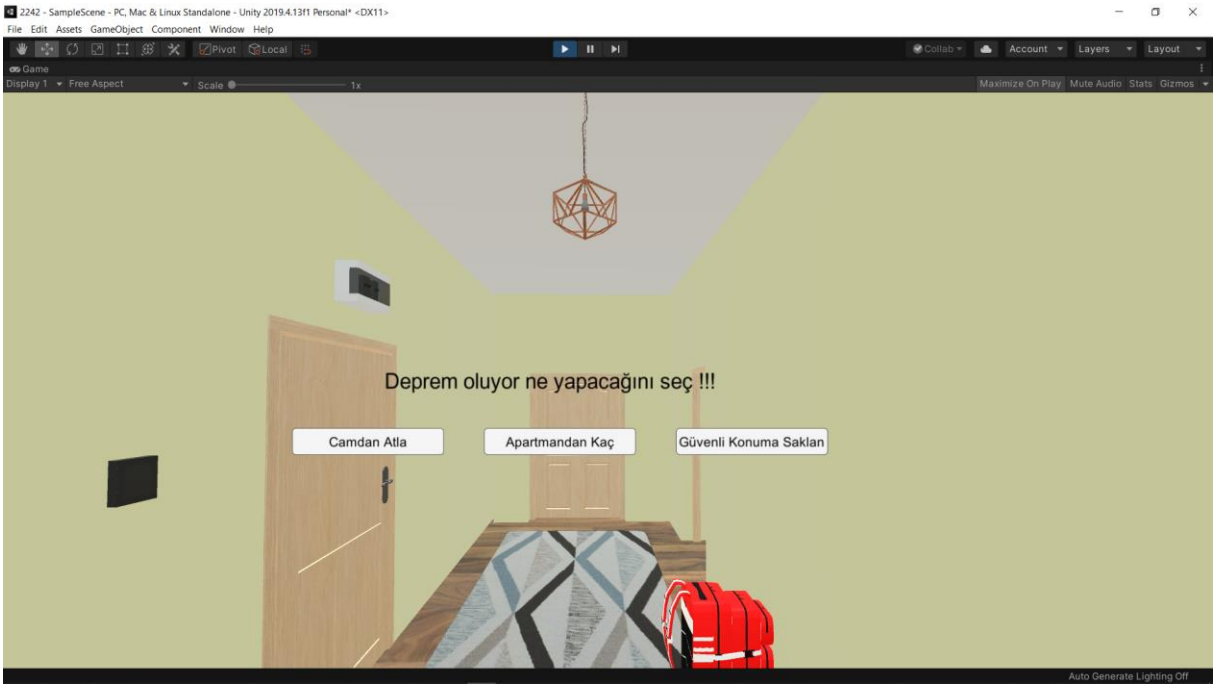

Figure 6. What to do during an earthquake

If player prefers to hide in a safe location, the character moves to a location that is as open as possible, where there are no objects that could fall on him. In this position, the player cannot move for 5 seconds. At the end of 5 seconds, new tasks are given to the player in order to prevent the dangers that may occur after the earthquake (Fig. 7).

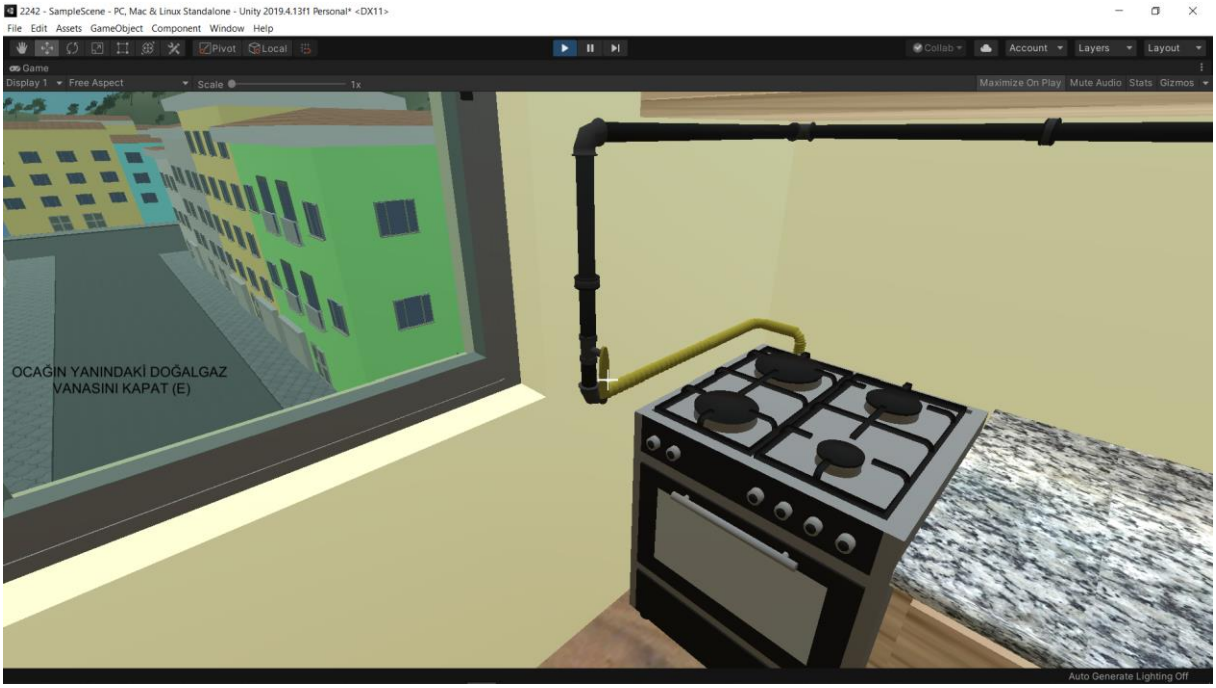

Figure 7. Tasks to be done in the kitchen after the earthquake

The first of these tasks is to close the gas valve. After closing the natural gas valve, the player is asked to take the earthquake bag (Figure 8). The earthquake bag is on the escape route in front of the exit door so that it does not waste time during the escape. Before leaving the house, the player is asked to turn off the electrical fuses located above the exit door (Fig. 9). After performing these duties, he should close the water valve located outside the door and on the right when leaving the house. He is then asked to leave the apartment.

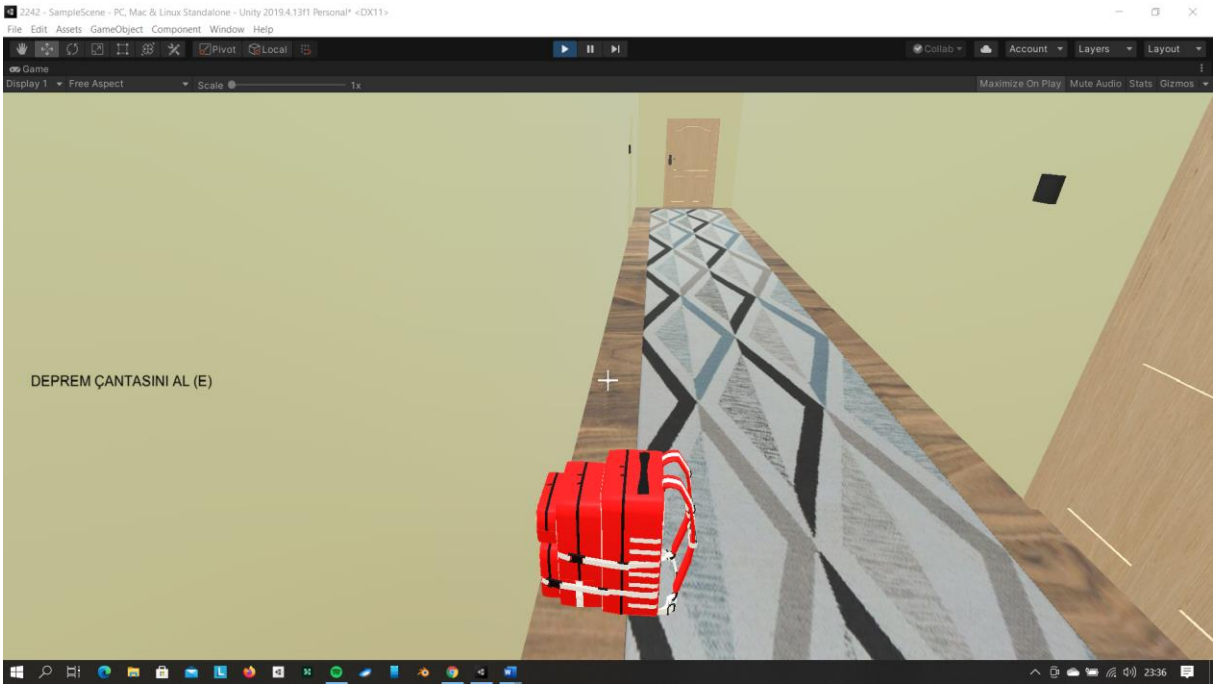

Figure 8. Earthquake bag picking task

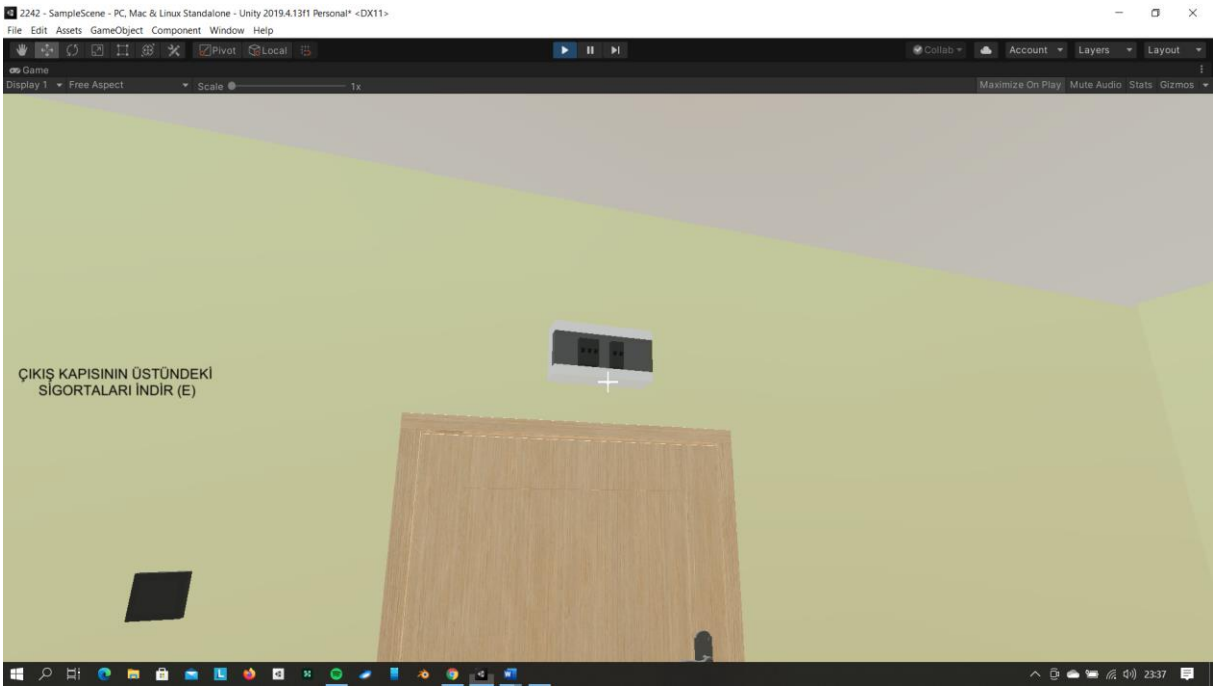

Figure 9. Electrical fuse duty

After leaving the apartment, he has to go to the assembly area (Figure 10). One building opposite the assembly area collapsed in the earthquake (Figure 11). One person could not escape from the destroyed building. It is visibly suspended.

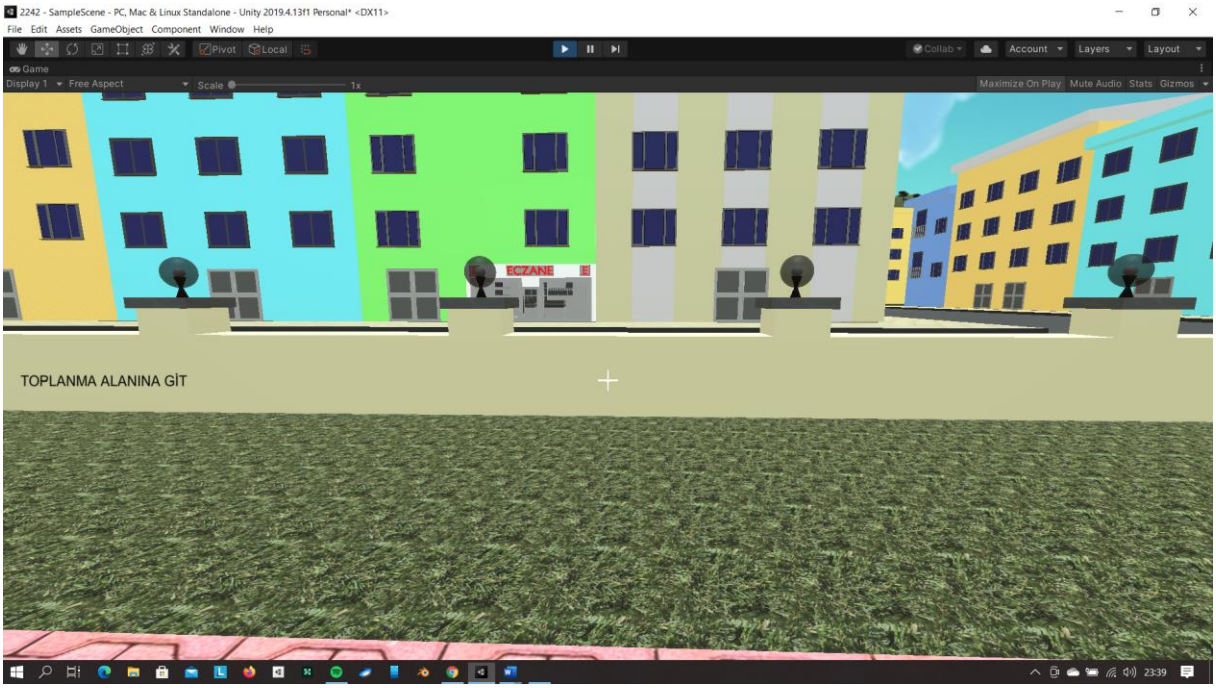

Figure 10. The task to go to the assembly area

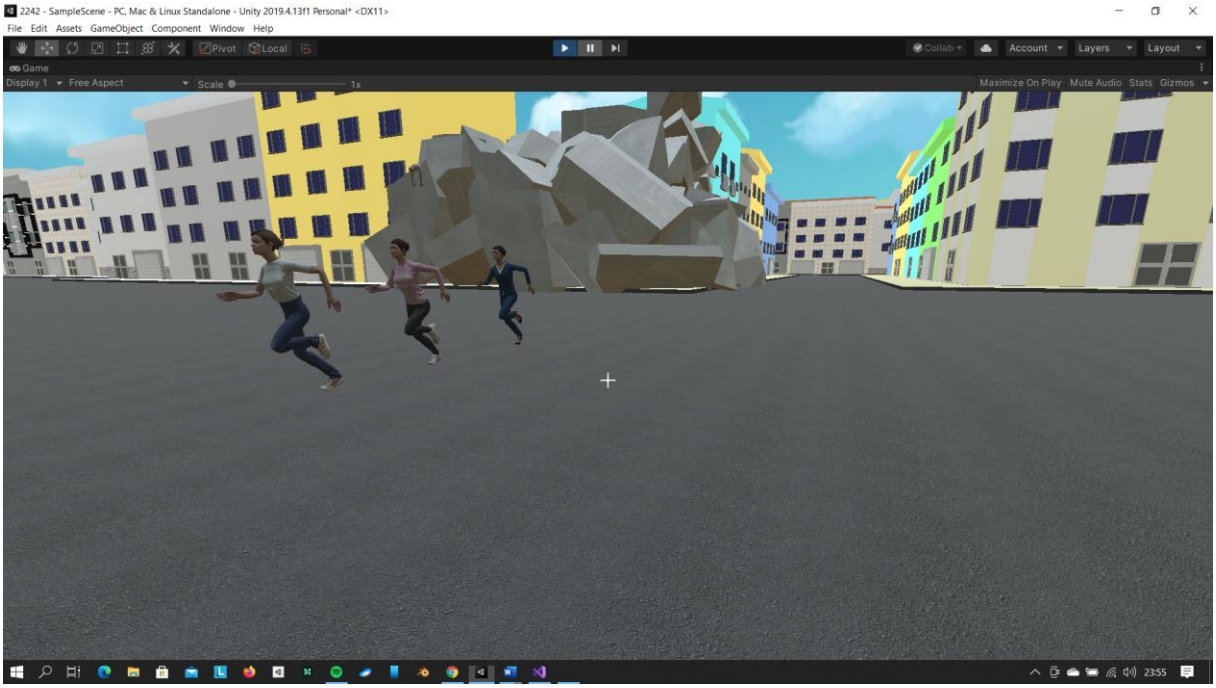

Figure 11. A view outside after the earthquake

When the player approaches the gathering area, he sees the tents inside and other people in front of the tents. When he enters the assembly area, a short article about the precautions he took and the importance of the earthquake bag is shown on the screen and the game is over.

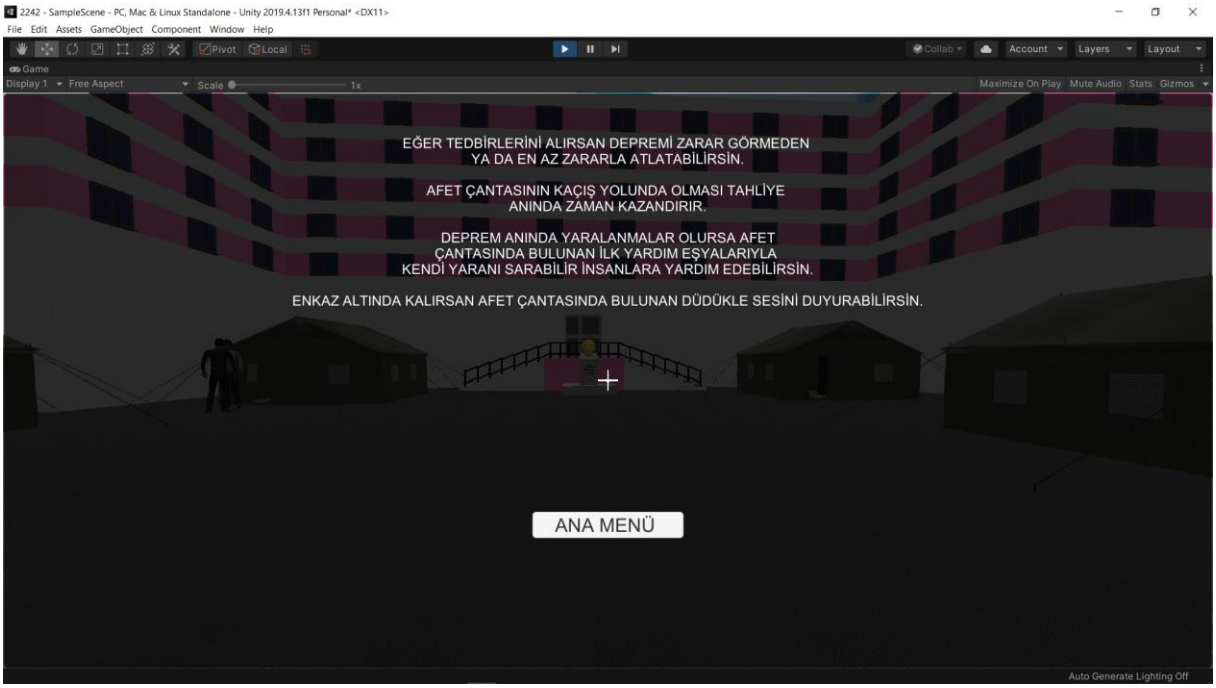

Figure 12. Incoming notifications when players enter the gathering area

CONCLUSION AND RECOMMENDATIONS

In this study, which was carried out with the awareness of the necessity of the development of educational games, the earthquake educational computer game is an interactive game with educational content, which was developed in a three-dimensional virtual environment and includes what needs to be done before and after the earthquake process as a task.

Thanks to the transfer of educational content to the user with three-dimensional and mobile games in current academic studies, there are findings of creating a desire to learn in students, student success and motivation towards the course. It is thought that the features of the earthquake educational computer game will attract the attention of everyone from seven to seventy with its three-dimensional virtual environment and educational content, and it can be used for educational purposes in order to increase their motivation for gaining knowledge and experience about earthquakes.

The earthquake educational computer game was developed in this research, suggestions for future work;

- Development of new levels of the existing game,
- Adding English language option to the current game,
- Developing educational games for all disasters,
- Presenting this educational game to the user through bilateral cooperation with educational institutions and evaluating user opinions.

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Ethics and Consent: Ethics committee approval is not required as it does not involve clinical researches on humans as well as it does not contain Retrospective studies in accordance with the Law on Protection of Personal Data.

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Research Paper

The Effect of Distance Education on Self-efficacy towards Online Technologies and Motivation for Online Learning

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ABSTRACT

This research aimed to investigate the effect of distance education during the COVID-19 pandemic on psychological counselor candidates' self-efficacy perceptions towards online technologies and their motivation for online learning. Single group pretest-posttest model, a quantitative method, was used in the research. The study participants were third-year students at the Faculty of Education, Psychological Counseling and Guidance Department of a state university in the fall semester of 2020-2021. Demographic Information Form, Online Technologies Self-Efficacy Scale and Online Motivation Scale were used as data collection tools. As a result of the research, it was observed that the psychological counselor candidates' self-efficacy for online technologies and online learning motivation scores were above the average. It was concluded that the distance education used during the COVID-19 pandemic caused a statistically significant difference in psychological counselor candidates' self-efficacy towards online technologies, but did not cause a difference in their online learning motivation. There was no significant difference in self-efficacy according to gender and place of residence. However, while there was no significant difference in motivation according to gender, a significant difference was observed in regards to the place of residence in favor of citycenter. It is important to present psychological counselor candidates' perceptions and motivations in regards to distance education, which is an ongoing process at the moment, for their professional development.

INTRODUCTION

Distance education has been used in education for many years. Distance education allows teachers and students from different places to participate in all or most of the learning and teaching process at differing times by using information and communication technologies for interaction (Moore & Kearsley, 2012). Distance education, which provides self-learning opportunity, is individualized, adaptable and flexible method compared to face-to-face education (Kaya, 2002). It provides learners with time-space independence, equality of opportunity in education, the right to education for employees, access to large masses, and education based on students' interests and abilities (İşman, 2011). Associate, undergraduate, and graduate programs in most universities utilize distance education or blended learning environments where face-to-face education and distance education are used together (Cabi & Ersoy, 2017).

Today, there are many terms to describe the implementation of digital technologies in learning, such as distance, online, open, flexible, blended, flipped, hybrid and Massive Open Online Courses (Hartnett, 2016), often used interchangeably, however, there are significant differences in their meanings (Bates, 2016). The root of online learning is based on distance education (Hartnett, 2016).

With the widespread use of distance education, online learning has become significant. Online learning is defined as the transfer of knowledge and skills through electronic technologies and the execution of educational activities through electronic media (Ulutaş, 2016). Online learning environments allow educational practices to be free of physical boundaries of the classroom and student-teacher, student-student interaction takes place as an element of education (Yıldız, 2020). Çelen et al. (2011) stated that course materials in online learning environments should contain information about the course, transfer competencies, provide students with activities and responsibilities and ensure that students are active. This study examined the effect of the distance education process on two different variables: self-efficacy for online technologies and online learning motivation.

Self-efficacy for online technologies

Self-efficacy is one of the most important concepts that affect behavior (Bandura, 1971). Alqurashi (2016) stated that individuals' efficacy beliefs may affect their determination to achieve the desired results in a successful manner, adding that rather than regarding difficult tasks as obstacles to be avoided, individuals with high self-efficacy view them challenges that can improve their skills. The perception of self-efficacy, which is related to learning and performance in distance education, is generally associated with achievement, persistence and effort in educational environments (Horzum & Çakır, 2009).

Online learning activities require a high level of digital literacy and knowledge and skills to use various digital technologies necessary for interaction and communication in online learning environments (Sun & Rogers, 2021). Learners should be able to use online technologies comprehensively to participate in online learning, including how to use the internet, sending and receiving e-mails, participating in online discussions, accessing course materials, and returning homework (Lee, 2015; Wang et al., 2013). Students' self-efficacy beliefs regarding their online learning capacities are an important part of their online learning competencies (Sun & Rogers, 2021).

Self-efficacy is important for learning environments. Since deficiencies in knowledge and skills will hinder online learning, students' online learning self-efficacy is a critical element in measuring student readiness for online learning (Sun & Rogers, 2021). Alqurashi (2016) examined the studies on self-efficacy in online learning environments from 1997 to 2015 and emphasized the need for further research on self-efficacy in online learning environments. Peechapol et al. (2018) examined the studies between 2005 and 2017 in their research and reported that the factors affecting self-efficacy in online learning were learning motivation and attitude, online learning experience and knowledge, feedback and reward, communication and interaction, and social impact. Alemayehu and Chen (2021) found that self-efficacy, motivation and self-monitoring were effective on learning engagement in online learning environments. Murphy and Alexander (2000) regarded self-efficacy as one of the important concepts in studies on motivation in relation to academic achievement. Self-efficacy is one of the key aspects of motivation, a factor required in online learning (Zimmerman & Kollikowichi 2016). Chang et al. (2014) concluded in their research that university students' internet self-efficacy is a factor affecting their motivation.

Online learning motivation

Motivation is defined as the desire or tendency guiding people to perform a specific behavior. (Özbaşı et al., 2018). Learning motivation can be defined as a comprehensive incentive for students to perform behaviors and learning activities to achieve desired goals (Apriana & Hidajat, 2020). Motivation plays a key role in developing and maintaining a sense of community in addition to ensuring learning and achievement in online contexts, (Harnett, 2016). Li and Tsai (2017) found that students' behavior is related to their motivation in online learning environments.

The design of the learning environment is also an important issue for motivation in online learning environments. Understanding students' motivation and what they expect to gain from a course affect the design of the program of that course (Bates, 2016). The ARCS (Attention, Relevance, Confidence, and Satisfaction) Model, which takes its foundation from the expectation value theory, is a method for developing instructional materials from a motivational point of view by emphasizing the importance of motivation on learning (Keller, 1987). Such instructional design approaches are crucial in developing an understanding of motivation in online learning environments (Hartnett, 2016).

Undoubtedly, psychological counseling services of institutions play an important role in the successful execution of distance education processes. In order to support the continuity of learners and to ensure that educational goals are achieved, guidance and psychological counseling services should improve their practices during the course process, post-lesson and evaluation processes (Özer, 2020). It was found that the students had various difficulties in regards to learning and experienced stress, loneliness, anxiety, etc. in the distance education they were given during the COVID-19 pandemic (Apriyanti, 2020; Muslimin & Harintama, 2020). Psychological counseling and guidance service practises developed by identifying the needs and expectations of learners in distance education processes are important to provide functional services suitable to meet individual differences (Özer, 2020). In this case, school psychological counselors have a great role to play. In addition, online psychological counseling has become widespread as a result of the demands of today's learners to use technology for the purpose of receiving psychological support (Zeren, 2017).

In their studies, Tuzgöl Dost and Keklik (2012) and Parmaksız and Gök (2018) found that one of the reasons for the difficulties encountered by the school counselors in their profession was insufficient practice opportunities during their undergraduate education. For this reason, it is important for psychological counselors to have sufficient experiences in their undergraduate training. It will be beneficial to train psychological counselors during pre-service training with experience in distance education and competence and motivation in online technologies since they will have to use these technologies in their professional lives upon graduation. The distance education processes consist of online courses as well as online psychological counseling services. Hence, psychological counselor candidates' self-efficacy and online learning motivation for the technologies they need to communicate with their students during the distance education processes become significant.

This research aimed to investigate the effect of distance education used during the COVID-19 pandemic on psychological counselor candidates' self-efficacy perceptions towards online technologies and their online learning motivation. The research problem is as follows: "Does the distance education utilized during the COVID-19 pandemic have an effect on psychological counselor candidates' self-efficacy perceptions towards online technologies and their motivation for online learning?". The sub-problems of the study are listed below;

1. Does distance education have an effect on psychological counselor candidates' self-efficacy for online technologies?
2. Does psychological counselor candidates' self-efficacy for online technologies differ according to gender?
3. Does psychological counselor candidates' self-efficacy for online technologies differ according to place of residence?
4. Does distance education have an effect on psychological counselor candidates' online learning motivation?
5. Does psychological counselor candidates' online learning motivation differ according to gender?
6. Does psychological counselor candidates' online learning motivation differ according to place of residence?

METHOD

Research model

The research utilized a single group pretest-posttest design, which is one of the quantitative methods. This is - an ideal method to examine the change in a specific group over a period of time when it would be difficult to find a control group (Creswell, 2012). It was not possible to form a control group because the university solely used distance education at the time of the research. Psychological counselor candidates completed their courses, exams and homework in a distance education environment. The courses were taught asynchronously through the university's learning management system and synchronously through a simultaneous conference system integrated into it. In addition to the weekly live lessons, the lecture notes were uploaded to the system every week by the lecturers.

Participants

The participants of the research were the third-year students in the Department of Psychological Counseling and Guidance, at a faculty of education in a state university. Table 1 presents the distribution of students based on their demographic data.

Table 1. Distribution of participants by demographic data

Gender	**N**	**%**
Female	40	63.5
Male	23	36.5
Total	63	100
Device used for online education	**N**	**%**
Smartphone	35	55.6
Computer	28	44.4
Total	63	100
Average duration for device use	**N**	**%**
Less than 1 hour	1	1.6
1-3 hours	9	14.3
3-5 hours	24	38.1
5-7 hours	18	28.6
More than 7 hours	11	17.5
Total	63	100
Average duration for Internet use	**N**	**%**
Less than 1 hour	2	3.2
1-3 hours	25	39.7
3-5 hours	20	31.7
5-7 hours	12	19.0
More than 7 hours	4	6.3
Total	63	100
Place of residence	**N**	**%**
Village	12	19.0
District	18	28.6
City center	33	52.4
Total	63	100

Table 1 shows that the majority of the participants were female and the device mostly used during distance education was smartphone. While participants' average daily device usage time for distance education was 3-5 hours at the most, their internet usage time was 1-3 hours at the most. According to the place of residence, the majority of them resided in the citycenter.

Data collection tools

Demographic Information Form, Online Technologies Self-Efficacy Scale and Online Motivation Scale were used to collect data.

Demographic Information Form: The form that contains information about the gender of the participants, the devices they used for the lessons, the frequency of daily device and internet use for the lessons and their place of residence during the distance education process.

Online Technologies Self-Efficacy Scale (OTSES): The 29-item, 5-point Likert type scale was developed by Miltiadou and Yu (2000) and adapted into Turkish by Horzum and Çakır (2009). The validity and reliability studies of the scale were carried out with university students. As a result of reliability analysis, exploratory and confirmatory factor analysis, it was concluded that the scale is valid and reliable with four dimensions: internet competencies (9 items, reliability: 0.89), synchronous interaction (4 items,

reliability: 0.85), asynchronous interaction I (9 items, reliability: 0.90) and asynchronous interaction II (7 items, reliability: 0.89). The overall reliability of the scale is 0.94.

Online Learning Motivation Scale (OLMS): The 28-item, 7-point Likert type scale was developed by Chen and Jang (2010) and adapted into Turkish by Özbaşı et al. (2018). The validity and reliability studies were carried out with university students. As a result of reliability analysis, exploratory and confirmatory factor analysis, it was concluded that the scale is valid and reliable with seven dimensions: intrinsic motivation to know (4 items, reliability: 0.80), intrinsic motivation to achieve (4 items, reliability: 0.90), intrinsic motivation to experience stimulation (4 items, reliability: 0.81), identified regulation (4 items, reliability: 0.84) , introjected regulation (4 items, reliability: 0.83), external regulation (4 items, reliability: 0.60), amotivation (4 items, reliability: 0.78). The overall reliability of the scale is 0.94. In the scale, 4 items are reverse. The lowest and the highest points can be obtained from the scale are 28 and 196, respectively.

Data collection

Data were collected from students on a voluntary basis in the fall semester of the 2020-2021 academic year. Ethics committee approval was received for this study from the Social and Human Sciences Scientific Research and Publication Ethics Committee of Kırşehir Ahi Evran University, with the decision dated 16.10.2020 and numbered 2020/4. Posttest data were collected 12 weeks after the pretest data collection on a voluntary basis. Figure 1 shows the data collection process.

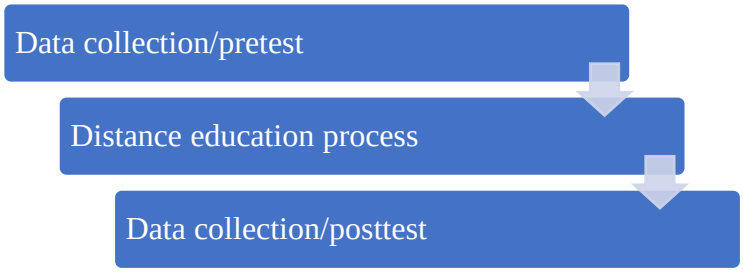

Figure 1. Data Collection Process

Data analysis

The kurtosis and skewness values were examined for the normality distributions of the data. The lowest value is -1,498 and the highest is 0.968. These values are in the range of +1.5, -1.5 indicates that the data show a normal distribution (Tabachnick & Fidell, 2013). Dependent samples t-test, independent samples t-test and ANOVA analysis were performed in the analysis of the data.

FINDINGS

Findings regarding online technologies self-efficacy

Dependent samples t-test was used to examine whether psychological counselor candidates' OTSES scores changed at the end of the distance education provided during the COVID-19 pandemic. Pretest-posttest dependent sample t-test results of for the OTSES are as in Table 2.

Table 2. Dependent samples t-test results for OTSES pretest-posttest scores

OTSES	Test	N	$\bar{X}$	S	Sd	t	p
Internet Competencies	Pretest	63	4.17	0.63	62	-.557	.579
	Posttest	63	4.22	0.42			
Synchronous Interaction	Pretest	63	4.10	0.67	62	.000	1.000
	Posttest	63	4.10	0.51			
Asynchronous Interaction I	Pretest	63	4.07	0.62	62	-2.165	.034*
	Posttest	63	4.26	0.43			
Asynchronous Interaction II	Pretest	63	3.73	0.74	62	-3.338	.001*
	Posttest	63	4.07	0.54			
General	Pretest	63	4.01	0.57	62	-2.321	.024*
	Posttest	63	4.18	0.36			

*p<.05

Table 2 shows that the distance education provided during the COVID-19 pandemic caused a statistically significant difference in the psychological counselor candidates' online technologies self-efficacy perceptions (p<0.5). While the mean OTSES score was 4.01 before distance education, it increased to 4.18 afterwards. The psychological counselor candidates' OTSES scores were above the average. When the sub-dimensions are examined, there are significant differences between the pretest and posttest in favor of the posttest in the dimensions of Asynchronous Interaction I and Asynchronous Interaction II. But, there was no significant

difference between the pretest and posttest dimensions of Internet compenticies and Synchronus interaction (p>.05). Table 3 shows whether the psychological counselor candidates' OTSES scores differed according to gender.

Table 3. Independent samples t-test results of OTSES scores by gender

Gender	N	$\bar{X}$	S	Sd	t	p
Female	40	4.19	0.40	61	0.372	.711
Male	23	4.16	0.30			

Table 3 shows no difference in the psychological counselor candidates' OTSES scores by gender (p>.05). The mean score of female participants was found to be higher than that of male participants, but this difference was not statistically significant. One-way ANOVA analysis was conducted to examine whether the psychological counselor candidates' OTSES scores differed according to their place of residence. Analysis results are provided in Table 4.

Table 4. ANOVA results of OTSES scores by place of residence

Place of residence	N	$\bar{X}$	sd	df	F	p
Village	12	4.00	0.21	62	2.046	.138
District	18	4.19	0.44			
Citycenter	33	4.24	0.34			

According to Table 4, psychological counselor candidates' OTSES scores did not differ significantly according to their place of residence. While those living in the citycenter had the highest mean score and those living in the village had the lowest mean score, this difference was not statistically significant.

Findings regarding online learning motivation

Dependent samples t-test was used to examine whether psychological counselor candidates' OLMS scores changed at the end of the distance education provided during the COVID-19 pandemic. Pretest-posttest dependent sample t-test results of for the OLMS are as in Table 5.

Table 5. Dependent samples t-test results for OLMS pretest-posttest scores

OLMS	Test	N	$\bar{X}$	S	Sd	t	p
Intrinsic motivation to know	Pretest	63	18.73	6.78	62	0.686	.496
	Posttest	63	17.95	6.43			
Intrinsic motivation to accomplish	Pretest	63	15.70	5.73	62	0.193	.847
	Posttest	63	15.52	5.27			
Intrinsic motivation to experience stimulation	Pretest	63	17.63	6.05	62	0.576	.567
	Posttest	63	17.11	5.25			
Identified regulation	Pretest	63	18.54	6.74	62	1.700	.094
	Posttest	63	16.68	5.47			
Introjected regulation	Pretest	63	14.79	6.16	62	-0.988	.327
	Posttest	63	15.79	5.24			
External regulation	Pretest	63	17.16	6.09	62	0.058	.954
	Posttest	63	17.10	5.62			
Amotivation	Pretest	63	18.37	4.43	62	0.644	.522
	Posttest	63	17.79	5.73			
General	Pretest	63	120.92	34.78	62	0.381	.705
	Posttest	63	118.70	31.41			

Based on Table 5, the distance education provided during the COVID-19 pandemic did not cause a statistically significant difference in psychological counselor candidates' OLMS (p>0.5). While the mean OLMS score was 120.92 before the distance education practice, it was found to be 118.7 after the process. Psychological counselor candidates' OLMS general scores were above the average. Table 6 shows whether psychological counselor candidates' OLMS scores differed according to gender.

Table 6. Independent samples t-test results of OLMS scores by gender

Gender	N	$\bar{X}$	S	Sd	t	p
Female	40	115.68	30.34	61	-1.008	.318
Male	23	123.96	33.22			

Table 6 points to no difference in psychological counselor candidates' OLMS scores by gender (p>.05). The mean score of males was higher than that of females, but this difference was not statistically significant. One-way ANOVA analysis was conducted to

examine whether psychological counselor candidates' OLMS scores differed according to their place of residence. Analysis results are provided in Table 7.

Table 7. ANOVA results for OLMS scores by place of residence

Place of Residence	N	$\bar{X}$	sd	df	F	p	Significant Difference
Village	12	100.25	37.82	62	3.922	.025*	
District	18	114.50	34.78				Citycenter>Village
Citycenter	33	127.70	23.59				

*p<.05

According to Table 7, psychological counselor candidates' OLMS scores differed significantly according to their place of residence (p<.05). Examination of this difference by Tukey, one of the Post Hoc tests, showed that the difference was in favor of the citycenter.

CONCLUSION AND DISCUSSION

The results of the research demonstrated that psychological counselor candidates' online technologies self-efficacy perceptions were above the average. OTSES scores significantly increased after the distance education provided during the COVID-19 pandemic. This increase may be due to the extensive use of online technologies in this process by the participants, that is, their improved experience. It was concluded that psychological counselor candidates' OTSES did not differ by gender or place of residence. Chang et al. (2014) reported that males have higher Internet self-efficacy than females while females have higher online discussion participation and final exam scores compared to males. In their research, Yıldız and Seferoğlu (2020) found that distance education university students have high self-efficacy perceptions towards online technologies. In addition,they concluded that males have higher self-efficacy perceptions for online technologies than females. In their research, Öztürk and Kert (2017) examined the effect of an online learning environment on adults' self-efficacy for online technologies. They concluded that while there was a significant difference in some areas according to the courses they attended, there was no difference in others. In a study conducted with university students for a period of time, Lee (2015) reached the conclusion that students' self-efficacy towards online technologies increased.

This study also found that psychological counselor candidates' online learning motivation scores were above average. However, no significant difference was observed in participants' OLMS scores after the distance education provided during the COVID-19 pandemic. There was a significant difference in participants' online motivation in regards to their place of residence, between those residing in the citycenter and the village. This result may be due to the fact that the residents of the village were more likely to experience technical and internet connection problems, causing the village residents to have lower motivation for online learning.

There are studies in the literature reporting that distance education has a positive or negative effect on motivation. In this study, no significant difference was observed in psychological counselor candidates' online learning motivation by gender. However, Chang et al. (2014) concluded that learning motivation in online learning environments was higher in males compared to females. Muslimin and Harintama (2020) concluded that students experienced motivation problems during the COVID-19 pandemic. The study conducted by Hebebci et al. (2020) reported that middle and high school students experienced a loss of motivation in distance education provided during the COVID-19 pandemic. In their study with high school students, Apriana and Hidajat (2020) concluded that the use of Google Classroom in teaching mathematics topics increased online learning motivation. In their research conducted with university students, Susilawati and Supriyatno (2020) reported that the use of WhatsApp during and after COVID-19 pandemic increased students' motivation to learn. Cai and Zhu (2012) stated that the online learning community project had a positive effect on university students' motivation to learn foreign languages.

The COVID-19 pandemic still continues in the world. Distance education, which is mostly used as an option in education, has become a requirement in this process. Governments have embraced online learning during the pandemic to prevent the spread of COVID-19 (Apriana & Hidajat, 2020). It can be argued that counseling services, which include psychological counseling and guidance, are important to support the permanence of distance learners in the system (Özer, 2020). While distance education is provided during the COVID-19 pandemic, psychological counseling services are provided online in many institutions. This research is significant in showing the importance of pre-service training of the psychological counselors employed at institutions that play a major role in the ongoing fight against the COVID-19 pandemic.

Various experimental studies can be conducted to increase psychological counselors' self-efficacy and motivation for the technologies they will use in this process. The present research only addressed motivation and efficacy variables and further studies can be conducted on different variables. In addition, further studies can be conducted with qualitative approaches, to examine this process in more depth.

Ethics Committee Approval: Ethics committee approval was received for this study from the Social and Human Sciences Scientific Research and Publication Ethics Committee of Kırşehir Ahi Evran University, with the decision dated 16.10.2020 and numbered 2020/4.

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Research Paper

The Impact of ICT Instruction on Online Learning Readiness of Pre-Service Teachers

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ABSTRACT

The present study aimed to investigate the impact of a course that included ICT skills on the online learning readiness of pre-service teachers in a completely distance education environment. In the research, single group pre-test post-test model was adopted. The study was conducted with 123 pre-service teachers. The E-Learning Readiness Scale for College Students was used to collect the data. Furthermore, the course academic achievement final scores of the participants were employed. The data collection process continued during the 2020-2021 academic year fall term. The study findings demonstrated that total online learning readiness and sub-dimension scores increased after the Information Technologies Course. It was found that there was no difference across the scores based on gender. The academic achievements of female students were higher. At the beginning of the term, it was revealed that ease of use, online learning readiness and computer self-efficacy, internet self-efficacy and learner control variables varied based on personal computer ownership. At the end of the term, both these variables and academic achievement did not differ across personal computer ownership. There was a correlation between the ease of use variable and online learning readiness both at the beginning and the end of the term. On the other hand, there was no correlation between the academic achievement and ease of use or online learning readiness. It could be suggested that the present study findings could contribute to future studies in terms of online learning readiness.

INTRODUCTION

In history, various events that significantly impacted human life have always been witnessed. One of these events is the Covid-19 pandemic. It started towards the end of 2019 and became a pandemic within a short time as declared by the World Health Organization (WHO, 2021). According to Worldometer (2021), more than 271 million people have been infected and over 5 million people lost their lives. This pandemic is not only a health problem, but also has cultural, sociological and political consequences (Bozkurt & Sharma, 2020). The new normal that governs the life is a good summary of the current state of affairs. Several restrictions have been placed on our lives to prevent the spread of the virus. Mass concerts, theater activities were prohibited or limited, and social spaces such as restaurants and cafes have been closed for in-house activities. Professional life has evolved, and several people started to work at home except mandatory circumstances. Also, education has been mostly online. This has been true for particularly the higher education institutions. All procedures have been conducted online, including exams, except for applied science departments and other applied courses in these institutions. However, the implementation of this approach necessitates the determination of the readiness of learners for online learning environments. Therefore, the investigation of the online learning readiness was deemed necessary.

Online Learning Readiness (OLR)

It is important to examine the factors that affect online learning to develop active instructional environments (Ćukušić, Alfirević, Granić, & Garača, 2010). This is critical for the institutions to develop adequate strategies. The OLR is the key factor for the success of the process (Hukle, 2009). Thus, it is critical to determine the online readiness of individuals and reflect this determination in planning. According to Smith, Murphy, and Mahoney (2003) OLR is the recognition of the personal learning style, self-guidance skill via time management, adoption of the internal motivational resources, and the experiences acquired in this process. Readiness is affected by the physical, emotional, social and communication skills (Wynn, 2002). Online readiness is a complex phenomenon affected by several factors such as computer self-efficacy, online communication self-efficacy and self-control efficacy (Hung, 2016; Keramati, Afshari-Mofrad, & Kamrani, 2011). Also, according to Yu (2018), social competencies with instructor and classmates, technical competencies, and communication competencies are among these factors. Information and communication technologies (ICT) skills are prominent among these factors. Because communication is possible via ICT in online learning. The online learning efficacy was associated with the skills to use these tools (Keramati et al., 2011; Selim, 2007; Tang & Lim, 2013). In other words, the process is efficient with the effective ICT uses of individuals (de Bruyn, 2004). On the other hand, it was reported that OLR was associated with adaptation to the online media time management and experiences on online media (Smith, 2005; Smith et al., 2003). The time spent in these media contributes to the comprehension of the dynamics of the process (Vonderwell &

Savery, 2004). Due to the fact that the time spent on the Internet was associated with OLR (Firat & Bozkurt, 2020), the online readiness of students is even more important. Thus, the OLR of pre-service teachers should be investigated.

Information Technologies Course

The undergraduate teacher training curricula was revised by the Higher Education Council (2021) in the 2018-2019 academic year in Turkey. Thus, Computer 1 and Computer 2 Courses that included ICT skills were replaced by the Information Technologies and Instructional Technologies Courses. Although these courses were criticized due to the reduction in weekly course hours and completely theoretical course content, it was reported that the new courses were beneficial for ICT (Haseski, 2019; 2020; İlic, 2019; 2021c). The Information Technologies Course content was described as follows (Higher Education Council, 2021):

> "Information technologies and computational thinking, problem solving concepts and approaches, algorithms and flow charts, computer systems, basic software and equipment concepts, foundations of operating systems, current operating systems, file management, utilities (third-party software), word processing software, calculation/tabulation/graphics software, presentation software, desktop publishing, database management systems, web design, internet in education, communication and collaboration technologies, internet use, information ethics and copyrights, the effects of computers and internet on children/young adults."

The review of the course content demonstrated that it included basic ICT skills such as internet use, educational communication and collaboration technologies. Thus, the ICT skills of the individuals who attend the course are expected to improve.

Personal Computer (PC) Ownership

The impact of PC ownership on learner behavior was analyzed based on computer self-efficacy in Social Cognitive Theory (Bandura, 1997). Previous studies reported positive impact of PC ownership on computer self-efficacy (Selwyn, 1998; Teo, Wan, Chan, & Lim, 2002). Computer owners also feel more confident and comfortable (Kahveci, Sahin, & Genc, 2011) and exhibit more positive attitudes towards technology in education (Akgün & Topal, 2015; Harvey & Wilson, 1985; Rahimi, 2011; Roussos, 2007). It was reported that technological skills such as the attitude towards the computer and computer self-efficacy and were also effective on online readiness (Pillay, Irving, & Tones, 2007). Other studies reported no correlation between PC ownership and attendance on an online course (Kharma, 2019). It was also found that perceptions about online education did not differ based on PC ownership (Gündüz & İşman, 2018). Thus, the analysis of the PC ownership variable was considered beneficial.

Ease of Use

Perceived ease of use and perceived usefulness are the key factors in technology acceptance (Venkatesh & Davis, 2000). According to Davis (1989), the perceived usefulness is the belief of the individual that her or his performance would improve with technology use. Perceived ease of use was described as the belief that technology would reduce the required effort to complete a task. The facilities owned by the individual are an important obstacle to the increase in these beliefs (Sánchez-Prieto, Olmos-Migueláñez, & García-Peñalvo, 2019). To overcome this obstacle, the facilities should be improved to maximize the ease of use. Thus, the concept of ease of use was examined in the study.

The Aim of the Study

There are several studies that investigated the correlations between OLR and academic achievement (Bernard, Brauer, Abrami, & Surkes, 2004; Dray, Lowenthal, Miszkiewicz, Ruiz-Primo, & Marczynski, 2011; Horzum, Önder, & Beşoluk, 2014; Kerr, Rynearson, & Kerr, 2006) and perceived learning (Horzum, Kaymak, & Gungoren, 2015). Furthermore, it was reported that there was correlation across ICT skills and academic achievement in online education (Ilgaz & Gülbahar, 2015; Schrum & Hong, 2002). Computer self-efficacy and technical skills such as attitude towards the computer were also effective on OLR (Pillay et al., 2007). The positive effects of ICT skills on learning environments are known (Abbitt, 2011; Wang, Shannon, & Ross, 2013). Although there are several studies in the field of health that investigated the pandemic and its outcomes, the number of educational studies is limited (Dehghanbanadaki et al., 2020; Hossain, 2020). For instance, it was reported that the digital competencies of the learners were inadequate despite expectations (Alipio, 2020). Furthermore, it was emphasized that further studies on ICT skills (Bozkurt, 2020), the correlation between learner achievements and OLR (Chung, Subramaniam, & Dass, 2020; Hung, Chou, Chen, & Own, 2010; Joosten & Cusatis, 2020), and OLR levels of individuals in completely distant learning environments (Yu, 2018) were required. Thus, it could be suggested that the analysis of an online learning environment would be significant. Therefore, the present study aimed to determine the impact of an ICT course on the OLR of pre-service teachers.

METHODOLOGY

The Research Model

The present study was designed with the single group pre-test post-test model. According to Creswell and Creswell (2018), single group pre-test post-test design includes a post-test measurement after a pre-test in a single group. This model was selected to measure

the consequences of an application conducted with a specific group (Gottman, McFall, & Barnett, 1969). Thus, the E-Learning Readiness Scale for College Students was applied to the pre-service teachers who attended the Information Technologies Course at the beginning of the semester. Then, the 14-week Information Technologies Course was instructed. At the end of the semester, the same data collection instrument was applied to all participants. The study aimed to investigate the impact of the Information Technologies Course on OLR of the pre-service teachers. Furthermore, the correlation between OLR and academic achievement was analyzed based on their final grades in the course.

The Study Group

In the study, the criterion sampling method was used to assign the participants based on the single group pre-test post-test model. In this method, the subjects that meet specific criteria determined in advance or by the authors are analyzed (Yıldırım & Şimşek, 2011). The pre-service teachers who attended the Information Technologies Course at the faculty of education where the present study was conducted, in the 2020-2021 academic year fall semester. Furthermore, the inclusion criteria also included attendance in the course during the term and in both OLR pre- and post-tests. Eleven students who did not meet these criteria were excluded and 123 pre-service teachers participated in the research. The majority of them were female (69.9%) and participant age ranged between 17 and 24.

Data Collection Instruments

The study data included student achievement and scale scores. Furthermore, the participants were asked about their age, gender, PC ownership and ease of participation in the course to determine demographics. Pre-service teachers were requested to score the ease of use variable between 1 and 10 points as well.

The E-Learning Readiness Scale for College Students used within the scope of the research was developed by Yurdugül and Demir (2017). The 7-point Likert-type scale includes 33 items in 6 factors. There are no reverse items in the scale. The scale could be considered as a highly reliable data collection instrument (Cronbach Alpha = .93). The scale pre-test internal consistency coefficient was determined as .92 in the present study, and the post-test internal consistency coefficient was .91. Based on these findings, it could be said that the internal consistency of the scale was high (DeVellis, 2012; Kline, 2000).

The achievement score was determined as the grade the student received at the end of the course instructed by the author. The grade included student exam grades, course and extracurricular activity grades and the final grade in the term. The activities determined 60% and the final exam determined 40% of the achievement score. In-course and extracurricular activities were compulsory for the students in each topic. The topic weights were taken into account when these activities were graded. The final exam was based on course achievements and topic weights. Thus, the students were graded based on a specification table. The exam included 25 multiple choice questions with 5 possible answers. The form was revised by 3 Computer Education and Instructional Technology experts. The questions were then reviewed by a language specialist, a Measurement and Evaluation expert, before the exam was finalized. For the reliability of the test, correct responses were scored 1 point and incorrect answers were scored 0. The analyses revealed that the internal consistency coefficient of the test was KR-20 = .81. The findings demonstrated that the test had high internal consistency (Wainer & Thissen, 1996).

Procedure and Data Collection

The study data were gathered during the 2020-2021 academic year fall term. In the research, the OLR pre-test was applied by the author before the 14 weeks long Information Technologies Course. Then, the concept of technology, the impact of computers and the Internet on children/young adults, basic search tips, the concept of computer, computer-assisted instruction, basic hardware and software concepts, operating system basics, word-processing software, presentation software, spreadsheet software, algorithms and computational thinking, and Scratch application were instructed. All lessons were conducted online. The lectures were generally pre-recorded and provided before the classes. And the classes included discussions and activities associated with the lecture. After the course content was instructed, the achievement test was applied. When the term and the final exam were over, the OLR post-test was employed. Twenty-three students with low attendance or who missed the post-test were excluded from the study.

Data Analysis and Interpretation

Before the determination of analysis methods, the data were tested for normal distribution. First, the sample size was reviewed. According to Pallant (2001), the sample size should be at least 15 for each group that would be compared. The sample was larger than 15. Furthermore, skewness and kurtosis should be between -2 and +2 (George, 2011). It was observed this requirement was established for all dataset variables. Also, more than one method should be employed to determine the normal distribution (Çokluk, Şekercioğlu, & Büyüköztürk, 2010). These methods include histograms and quantiles. The normal distribution was also confirmed by these methods. Therefore, parametric tests were employed in the study. The research problems and the analyzes adopted in the study are given in Table 1.

Table 1. Research Problems and Associated Analyses

	Research Problems	Type of Analysis
1.	Overall OLR and sub-dimension scores differ across pre-test and post-test results?	Paired Samples t-test
2.	Overall OLR, OLR sub-dimension scores and achievement score based on pre-test and post-test differ across gender?	Independent Samples t-test
3.	Overall OLR, OLR sub-dimension scores, ease of use and achievement scores based on pre-test and post-test differ across PC ownership?	Independent Samples t-test
4.	Is there a correlation between ease of use, OLR pre-test, OLR post-pest, and achievement scores?	Pearson Correlation

The study data were analyzed with statistics software at .05 significance level and reported.

Limitations

The current study has several limitations. The selected research design, the data collection instruments, the study participants, and the collected data are among these limitations.

RESULTS

The findings obtained with the analyses are presented under four main topics. Initially, pre-test and post-test OLR total and sub-dimension scores were compared. Then, OLR and academic achievement variables were analyzed based on gender. In the third section, the variations in OLR, ease of use, and achievement scores across PC ownership are presented. Finally, the correlations between the ease of use, OLR pre-test, OLR post-test and achievement scores are discussed.

Findings on Total OLR and Sub-Dimension Data

To determine the pre-test and post-test scores of the learners based on overall OLR score and sub-dimension scores, paired samples t-Test was used. The results are as given in Table 2.

Table 2. Paired Samples t-Test Results

	$\bar{x}$	Std. Deviation	t	df	p
Computer self-efficacy pre-test – post-test	-4.618	5.205	-9.840	122	.000
Internet self-efficacy pre-test – post-test	-.707	3.594	-2.183	122	.031
Online communication self-efficacy pre-test – post-test	-.902	5.165	-1.938	122	.055
Self-directed learning pre-test – post-test	.317	6.374	.552	122	.582
Learner control pre-test – post-test	-.341	4.349	-.871	122	.386
Motivation towards e-learning pre-test – post-test	-5.065	8.741	-6.426	122	.000
OLR pre-test – post-test	-11.317	21.909	-5.729	122	.000

Based on the results presented in Table 2, it was found that there were significant differences across overall OLR pre-test and post-test scores of all participants ($t_{(122)} = -5.729$, $p < .05$). There were differences between the sub-dimension scores as well. For example, there were significant differences across pre-test and post-test computer self-efficacy ($t_{(122)} = -9.840$, $p < .05$), internet self-efficacy ($t_{(122)} = -2.183$, $p < .05$), and e-learning motivation ($t_{(122)} = -6.426$, $p < .05$) scores. There were no significant differences between online communication self-efficacy, self-directed learning and learner control sub-dimension scores. Based on the mean scores, it was revealed that the post-test score was higher when compared to the pre-test score ($\bar{x}$post-test>$\bar{x}$pre-test). Thus, it could be suggested that the Information Technologies Course where ICT skills are instructed significantly contributed to OLR.

Differences between OLR and Achievement Scores Based on Gender

Independent samples t-test was employed to investigate the differences across the pre-test and post-test overall OLR, OLR sub-dimension and achievement scores of the participants. The t-test results are given in Table 3.

Table 3. Independent Samples t-test results

	Group	n	$\bar{x}$	Std. Deviation	df	t	p
Computer self-efficacy pre-test	Female	86	21.40	6.598	121	-3.505	.001
	Male	37	25.70	5.338			
Internet self-efficacy pre-test	Female	86	24.51	3.760	97.276	-2.765	.007
	Male	37	26.14	2.584			

Online communication self-efficacy pre-test	Female	86	25.92	6.532	121	-2.432	.017
	Male	37	28.95	5.835			
Self-directed learning pre-test	Female	86	47.41	5.781	121	1.248	.214
	Male	37	46.05	4.819			
Learner control pre-test	Female	86	24.02	3.865	121	-.804	.423
	Male	37	24.59	2.929			
Motivation towards e-learning pre-test	Female	86	22.55	8.535	121	.870	.386
	Male	37	21.03	9.648			
OLR pre-test	Female	86	165.80	24.730	121	-.1.427	.156
	Male	37	172.46	21.197			
Computer self-efficacy post-test	Female	86	27.07	4.453	121	-.899	.370
	Male	37	27.86	4.596			
Internet self-efficacy post-test	Female	86	25.77	2.651	121	.355	.723
	Male	37	25.57	3.304			
Online communication self-efficacy post-test	Female	86	27.21	5.785	121	-1.584	.116
	Male	37	28.95	5.049			
Self-directed learning post-test	Female	86	47.19	6.277	121	1.313	.192
	Male	37	45.51	6.939			
Learner control post-test	Female	86	24.58	3.380	121	.217	.828
	Male	37	24.43	3.731			
Motivation towards e-learning post-test	Female	86	27.60	10.944	121	.707	.481
	Male	37	26.11	10.319			
OLR post-test	Female	86	179.42	24.947	121	.205	.838
	Male	37	178.43	23.339			
Achievement score	Female	86	93.58	7.578	52.839	2.513	.015
	Male	37	88.78	10.494			

As given in Table 3, there was no significant difference across the pre-test and post-test overall OLR and OLR sub-dimension scores based on the gender variable. On the other hand, the fact that the difference that favored the males in the pre-test favored the females in the post-test was an interesting finding. This could be due to the higher impact of the course and learning environment on females. Furthermore, there were no differences based on overall OLR pre-test and ease of use scores. In the sub dimensions, there were differences across certain variables. There were significant differences between the computer self-efficacy ($t_{(121)} = -3.505$, $p < .05$), internet self-efficacy ($t_{(97.926)} = -2.765$, $p < .05$), and online communication self-efficacy ($t_{(121)} = -2.432$, $p < .05$) pre-test scores based on gender. This difference favored male participants ($\bar{x}$ male> $\bar{x}$ female). These differences could be due to personal experiences. Furthermore, a significant difference was determined that favored females across achievement scores ($t_{(52.839)} = 2.513$, $p < .05$). This also could be due to women's interest in the distance learning environment.

Differences between, Ease of Use, and Achievement Scores Based on PC Ownership

The independent-samples t-test was used to investigate the differences across the pre-test and post-test overall OLR and OLR sub-dimension scores based on PC ownership, are presented in Table 4.

Table 4. Independent Samples t-test results

	Group	n	$\bar{x}$	Std. Deviation	df	t	p
Ease of use	Nonowner	29	5.97	2.442	39.625	-3.523	.001
	Owner	94	7.71	1.949			
Computer self-efficacy pre-test	Nonowner	29	19.31	6.990	121	-3.316	.001
	Owner	94	23.73	6.050			
Internet self-efficacy pre-test	Nonowner	29	23.55	3.960	121	-2.595	.011
	Owner	94	25.45	3.265			
Online communication self-efficacy pre-test	Nonowner	29	25.93	6.943	121	-.856	.394
	Owner	94	27.11	6.315			
Self-directed learning pre-test	Nonowner	29	46.76	6.139	121	-.268	.789
	Owner	94	47.07	5.355			

Learner control pre-test	Nonowner	29	22.55	4.634	121	-2.890	.005
	Owner	94	24.70	3.082			
Motivation towards e-learning pre-test	Nonowner	29	20.93	7.704	121	-.803	.423
	Owner	94	22.45	9.210			
OLR pre-test	Nonowner	29	159.03	27.100	121	-2.307	.023
	Owner	94	170.51	22.197			
Computer self-efficacy post-test	Nonowner	29	26.59	5.628	37.564	-.839	.407
	Owner	94	27.53	4.090			
Internet self-efficacy post-test	Nonowner	29	25.21	3.087	121	-1.082	.281
	Owner	94	25.86	2.773			
Online communication self-efficacy post-test	Nonowner	29	27.83	6.487	40.448	.095	.925
	Owner	94	27.70	5.350			
Self-directed learning post-test	Nonowner	29	47.86	6.105	121	1.119	.266
	Owner	94	46.32	6.606			
Learner control post-test	Nonowner	29	24.59	3.428	121	.088	.930
	Owner	94	24.52	3.506			
Motivation towards e-learning post-test	Nonowner	29	27.59	12.673	39.694	.219	.827
	Owner	94	27.02	10.143			
OLR post-test	Nonowner	29	179.66	28.240	121	.893	.698
	Owner	94	178.96	23.232			
Achievement score	Nonowner	29	91.24	7.642	121	-.626	.532
	Owner	94	92.41	9.143			

Based on the data presented in Table 4, computer owners' ease of use scores were higher ($t_{(39.625)} = -3.423$, $p < .05$). It was determined that this was reflected in the OLR levels and PC ownership led to a difference between overall OLR pre-test scores ($t_{(121)} = -2.307$, $p < .05$). Also, there were significant differences between computer self-efficacy ($t_{(121)} = -3.316$, $p < .05$), internet self-efficacy ($t_{(121)} = -2.585$, $p < .05$) and learner control ($t_{(121)} = -2.890$, $p < .05$) sub-dimensions scores based on PC ownership. Besides, there was no significant difference across the post-test overall OLR and OLR sub-dimension scores. Achievement scores did not differ across PC ownership as well.

Correlation between the Ease of Use, OLR Pre-Test and Post-Test and Achievement Scores

Pearson Correlation coefficient was employed to examine the correlation across the ease of use, OLR pre-test, OLR post-test and achievement scores of the participants. The conducted analysis is given in Table 5.

Table 5. Correlation between the Ease of Use, OLR Pre-Test, OLR Post-Test and Achievement Score

	OLR pre-test	OLR post-test	Achievement score
Ease of use	.467**	.333**	-.075
OLR pre-test	-	.587**	-.095
OLR post-test		-	-.162

**Correlation is significant at the 0.01 level (2-tailed).

As seen in Table 5, it was found that there were significant and positive correlations between all variables except achievement score ($p < .05$). This could be due to the fact that ICT is a significant factor in distance education environments. According to Cohen (1977), the correlation across OLR pre-test and OLR post-test scores was moderate ($p < .01$, $r = .587$). Furthermore, as ease of use perception increased, both OLR pre-test and post-test scores increased. Ease of use correlated with OLR pre-test ($p < .01$, $r = .467$) and OLR post-test ($p < .01$, $r = .333$). Thus, it could be suggested that ease of use was a significant variable both at the beginning and at the end of the term. Also, although there was no significant correlation across achievement score and the other variables, the negative correlation was an interesting finding.

DISCUSSION

The present study aimed to examine the effect of ICT-based instruction in a completely online learning environment on OLR of the learners. Thus, the readiness of 123 pre-service teachers was analyzed. It could be suggested that the present study findings could be fruitful for the comprehension of readiness, one of the most important factors in distance education. Furthermore, it was also considered that the understanding of the online learning environment, which became compulsory during the pandemic, could contribute to future designs.

The study findings showed that the overall OLR of pre-service teachers improved. This finding was consistent with the literature (Chung et al., 2020; Hung et al., 2010; İlic, 2021b; Yurdugül & Demir, 2017). It could be suggested that ICT skills improved due to the required online learning environment and the Information Technologies Course. The increase in these skills lead to a more active online learning (de Bruyn, 2004; Keramati et al., 2011; Selim, 2007; Tang & Lim, 2013). Computer self-efficacy, internet self-efficacy, and e-learning scores of the participants also increased significantly. This finding was completely consistent with the reports by Hung et al. (2010). Furthermore, the fact that computer self-efficacy and internet self-efficacy skills would increase with computer education (Decker, 2002; Torkzadeh & Koufteros, 1994) confirmed the above-mentioned finding. The findings on motivation were inconsistent with the literature (Yurdugül & Demir, 2017; Yurdugül & Sarikaya, 2013). It is known that this factor yielded lower scores when compared to the others. It could be suggested that the scores were low due to the pandemic-induced obligations at the beginning of the term; however, they increased as the individuals adapted to the online environment (Smith, 2005; Smith et al., 2003) and due to the ICT instruction in the Information Technologies Course. It was determined that the improvement of overall scores was observed in the sub-dimensions as well. This could be due to the impact of the ICT instruction in the Information Technologies Course. Since it was reported that the course was effective in the acquisition of ICT skills (Haseski, 2019), this was an expected finding.

In the study, it was determined that OLR did not differ based on gender. This finding was in line with the findings reported in several studies (Atkinson & Blankenship, 2009; Chung et al., 2020; İlic, 2021b; Masters & Oberpriles, 2004). At the beginning of the term, the OLR of males was better; however, OLR scores of the females were higher at the end of the semester. This finding was parallel with those reported by Chung et al. (2020). It could be suggested that the Information Technologies Course and the learning environment could have contributed more to women. Only the computer self-efficacy, internet self-efficacy, and online communication self-efficacy pre-test scores of the male pre-service teachers were higher. Since certain studies considered computer self-efficacy and internet self-efficacy skills as a single factor (Yurdugül & Sarikaya, 2013), this finding could be expected. On the other hand, the findings that favored male participants could be due to their prior experiences in ICT. The reports that the above-mentioned skills could be improved by ICT experiences were consistent with this inference (Decker, 2002; Torkzadeh & Koufteros, 1994). The finding on the online communication self-efficacy contrasted with the literature that reported no difference (Chu, 2010). Thus, it could be suggested that further research is required. Besides, the achievement scores of females were higher than males. This finding was consistent with the literature, indicating that females focused more on online learning processes (González-Gómez, Guardiola, Rodríguez, & Alonso, 2012). Furthermore, the finding was also in contrast with the studies which reported that males were more successful due to their interest in e-learning systems (Xu & Wang, 2006).

The study findings demonstrated that PC ownership contributed to the ease of use perception of the individuals. This was positively reflected in OLR scores. The facilities available for the individuals are important for the ease of use perceptions (Sánchez-Prieto et al., 2019). The technical infrastructure is required for course access. Thus, the ease of use scores of computer owners were higher. This finding was consistent with the literature (Akgün & Topal, 2015; Harvey & Wilson, 1985; İlic, 2021a; Rahimi, 2011; Roussos, 2007). Considering that active ICT employment led to a more efficient and active process (de Bruyn, 2004), it could be expected that ease of use perception had a positive impact on OLR. It was revealed that there was a significant difference across computer self-efficacy, internet self-efficacy, and learner control sub-dimension scores favoring the computer owners. The finding on computer self-efficacy was in line with the previous study findings that these skills of computer owners were higher (Selwyn, 1998; Teo et al., 2002). Thus, individuals with various skills due to PC ownership were in a better position before the course. Similarly, better internet skills among these individuals were also expected. Furthermore, those who learn online know how to access information (Lawless & Brown, 1997). Learner control of individuals with more personal freedom would also be higher (Lin & Hsieh, 2001). Thus, the higher learner control scores of computer owners were another expected finding in the study. In the last variable analyzed based on PC ownership, it was found that there were no differences across the post-test OLR scores of the participants. PC ownership had no effect on achievement scores. This was unexpected since the participants attended the Information Technologies Course, which contributed to their ICT skills (Haseski, 2019). Furthermore, the study findings were in contrast with the reports that PC ownership had a positive impact on computer self-efficacy and ICT skills (Selwyn, 1998; Teo et al., 2002). The unavailability of the differences observed at the beginning of the term based on PC ownership at the end of the term could be due to the possibility that those who did not own a computer at the beginning could have shared a common computer at home by improving their time management skills. This deduction was verified by previous studies which reported that OLR was associated with adaptation to the online environment and time management (Smith, 2005; Smith et al., 2003) and even the time spent in online environments had contributions (Firat & Bozkurt, 2020; Vonderwell & Savery, 2004).

In the study, a positive and significant correlation was determined between ease of use and OLR. The resources play a key role in educational technology use (Sánchez-Prieto et al., 2019). These resources also affect the ease of use perceptions. Ease of use is one of the key factors in technology acceptance (Venkatesh & Davis, 2000). Furthermore, ICT improves efficiency in online environments (de Bruyn, 2004). The above-mentioned correlation was expected due to these factors. On the other hand, it could also be suggested that the insignificant correlation between the achievement score and ease of use also contradicted with the literature. The correlation across the achievement score and OLR was not significant. Furthermore, it was determined that all correlations with achievement score were surprisingly negative. This finding was consistent with the reports by Hung (2012) that OLR was not an important factor in academic achievement. On the other hand, it was found that this finding was in contrast with the studies, which reported a positive correlation across OLR and learning outputs (Artino, 2009; Bernard et al., 2004; Demir Kaymak & Horzum 2013; Dray et al., 2011; Galy, Downey, & Johnson, 2011; Horzum et al., 2014; Joosten & Cusatis, 2020; Kerr et al., 2006; Kruger-Ross & Waters, 2013). Furthermore, this finding was contrast with the studies which reported that attendance

in ICT courses would improve academic achievement (Yeboah & Smith, 2016; Yu, 2018). Thus, it could be suggested that further research should be carried on the correlation between OLR and learner achievement (Hung et al., 2010; Joosten & Cusatis, 2020).

CONCLUSION AND RECOMMENDATIONS

In conclusion, it was determined that the OLR levels of the learners were higher after they attended the Information Technologies Course. It was also revealed that the overall increase in OLR score was also observed in the sub-dimensions. On the other hand, it was found that OLR score did not differ based on gender. However, the academic achievements of the female participants were better than males. Based on the findings associated with PC ownership, it was determined that this variable led to a significant difference in ease of use, OLR, computer self-efficacy, internet self-efficacy and learner control scores at the beginning of the term. By the end of the term, it was found that there were no differences between the overall OLR, and sub-dimension scores based on PC ownership. It was also determined that the academic achievements did not differ across PC ownership. The findings on ease of use revealed that the variable was correlated with OLR both before and after the instruction unlike PC ownership. Also, quite interestingly, there were no correlations between academic achievement and ease of use and OLR. It could be suggested that the findings of the present study, which was conducted completely online, were significant for the analysis of the impact of ICT courses on OLR of the individuals. Thus, it could also be suggested that future research on the below-listed topics could contribute to the literature:

- Online satisfaction could be investigated in addition to academic achievements.
- Qualitative research that investigates the reasons behind the variables analyzed in the present study could be designed.
- Further longitudinal studies could investigate future variations in OLR.
- Future modeling studies that would combine focused variables and various concepts associated with these variables could be conducted.

Based on the results some practical implications were given as below:

- In online environments, OLR of students should be taken into account. Thus, institutions should employ actions to improve the OLR levels.
- ICT courses could be a key factor in online learning settings. Therefore, these lessons should be considered in detail.
- Attention should be paid to improve the ease of use situations of learners that will affect OLR levels positively.

Ethics Committee Approval: Ethics committee approval was received for this study from Pamukkale University, Sosyal ve Beşeri Bilimler Araştırma ve Yayın Etiği Kurulu on 08.09.2001. Permission of ethics document's number is 68282350/22021/g016. Verbal consent was obtained from the participants before the study as well.

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