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Potential Benefits and Risks of Artificial Intelligence in Education

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Abstract

Artificial Intelligence (AI) technologies are rapidly advancing and causing deep-seated transformations in all aspects of life. In particular, the widespread adoption of generative AI systems like ChatGPT is taking this transformation to even more dramatic dimensions. In this context, the most comprehensive impact is observed in educational systems. Educational systems, on one hand, are faced with the urgent need to rapidly restructure education in response to skill changes in professions caused by the proliferation of such systems in the labor market. On the other hand, challenging questions arise about whether and to what extent these systems should be integrated into education, how they should be integrated if at all, and how ethical issues arising from AI systems can be addressed. This study evaluates the potential benefits and possible risks of using AI systems in educational systems from the perspectives of students, teachers, and education administrators. The systematic review considered the relevant studies on the potential benefits and risks of AI in diverse academic databases. Therefore, the study discusses the potential uses of AI systems in education, as well as the risks they may pose. Policy recommendations are developed to maximize the benefits of AI systems while mitigating the ethical and other issues they may cause. Additionally, the study emphasizes the importance of increasing AI literacy for all education stakeholders. It suggests that raising awareness of both the benefits and ethical issues caused by AI systems can contribute to enhancing the benefits of these systems in education while minimizing their potential harms.

Keywords: artificial intelligence, ChatGPT, ethics, education, AI literacy, education policy.

Eğitimde Yapay Zekâ Uygulamalarının Potansiyel Yararları ve Riskleri

Yapay zekâ (YZ) teknolojileri hızla gelişmekte ve yaşamın tüm alanlarında köklü dönüşümlere yol açmaktadır. Özellikle, ChatGPT gibi üretken YZ sistemlerinin yaygınlaşması bu dönüşümü çok daha dramatik boyutlara taşımaktadır. Bu bağlamda, en kapsamlı etki eğitim sistemlerinde gerçekleşmektedir. Eğitim sistemleri bir taraftan, bu tip sistemlerin işgücü piyasasında yaygınlaşması ile mesleklerde yaşanan beceri değişikliklerine hızla cevap üreterek eğitimi yeniden yapılandırma zorunluluğuyla karşı karşıyadır. Diğer taraftan, bu sistemlerin eğitime dâhil edilip edilmeyeceği, edilecekse nasıl ve ne derece dâhil edileceği, YZ sistemlerinin yol açacağı etik sorunlara nasıl cevap üretilebileceği gibi zorlayıcı sorularla yüzleşmektedir. Bu çalışmada bu kapsamda YZ sistemlerin eğitim sistemlerinde kullanılmasının potansiyel faydaları ve olası riskleri öğrenci, öğretmen ve eğitim yöneticileri açısından değerlendirilmektedir. Çalışma sistematik derleme deseninde tasarlanmıştır ve YZ'nin potansiyel yararları ve riskleri konusunda kapsamlı değerlendirme sunabilmek için farklı akademik veri tabanlarında yer alan çalışmalar dikkate alınmıştır. Bu nedenle bu çalışmada, YZ sistemlerinin eğitimde nasıl kullanılabileceği ve yol açabileceği riskler ele alınmaktadır. YZ sistemlerinin sağlayacağı faydayı maksimum yaparken yol açacağı etik ve diğer sorunların etkilerini hafifletmeye yönelik politika önerileri geliştirilmektedir. Ayrıca, tüm eğitim paydaşları açısından YZ okuryazarlığının artırılması, YZ sistemlerinin sağlayacağı faydaları kadar yol açacağı etik ve diğer sorunların da farkındalığına yol açacağı ve böylece bu sistemlerin eğitimde faydalarını artırırken zararlarının hafifletilmesinin mümkün olabileceği vurgulanmaktadır.

Anahtar kelimeler: yapay zekâ, ChatGPT, etik, eğitim, yapay zekâ okuryazarlığı, eğitim politikası.

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INTRODUCTION

Artificial Intelligence (AI) technologies are widely used in various aspects of life. Particularly, the introduction of generative AI systems like ChatGPT has led to deep-seated changes in systems across all fields, causing significant transformations in labor markets and, consequently, in areas ranging from education to healthcare, economics to security (Acemoğlu & Restrepo, 2018; Frank et al., 2019; Perc, Ozer, & Hojnik, 2019). AI and data-driven smart systems, continually expanding as they complement each other, have resulted in people now living within an AI ecosystem composed of such socio-technical systems. The AI ecosystem has leveraged human-machine interaction to another level (Crawford & Calo, 2016; Harari, 2017; Süleyman, 2023). In fact, at this point, there is a discussion of a 'machine culture' generated or mediated by machines within AI ecosystems (Brinkmann et al., 2023).

At this point, discussions on the profound changes by AI systems in life, as well as the problems they have caused or may cause in the near future, are intensively debated (Süleyman, 2023). Data protection and privacy are at the forefront of these discussions, as the development of these systems by a limited number of institutions increases the control risks within the AI ecosystem (Boyd & Crawford, 2012). On the other hand, issues in the training data used during the learning process of AI systems reproduce existing biases in society and pose a risk of perpetuating inequalities (Aquino, 2023; Ulnicane & Aden, 2023). There is also a vigorous debate about the necessity for AI systems to consider ethical and moral values; otherwise, it may lead to other societal conflicts such as the perpetuation of biases (Rahwan, 2018; Stahl, 2023).

In short, it is emphasized that dramatic harms can occur in societies in all areas where AI systems are used, such as education, health, security, etc., when these systems do not take into account ethical and societal values. It is highlighted that from the design phase to the implementation phase, AI systems must consider ethical and moral values to align their behaviors with societal values (Rahwan, 2018; O'Neil, 2016; Piano, 2020; Stahl, 2023; Suleyman, 2023).

Education systems are directly and profoundly affected by this transformation. The first dimension of this impact is closely related to how education systems can rapidly respond to the radical and continuous changes in the skill sets demanded by the labor market (Acemoğlu & Restrepo, 2018; Frank et al., 2019). At this point, significant transformations are taking place in labor, with some professions disappearing, the required skill sets for continuing professions being updated, and even new occupations emerging in the labor market (Arntz et al., 2016; Aghion & Howitt, 1990; 1994; Bartelsman et al., 2004; Frank et al., 2019; Pajarinen et al., 2015).

Education systems, on one hand, are responding to the rapid and profound changes in the dynamics of the labor market, while on the other hand, they are facing a much different challenge of how these systems can be used in education, dealing with the ethical and other complications that their use may bring. AI systems, especially generative AI systems like ChatGPT, have the potential to significantly transform educational environments. This potential encompasses almost all areas, from changes in learning environments to the use of supplementary resources, from the student's learning processes to school management policies, and from measurement and evaluation approaches to the teacher's role in the classroom (Chen et al., 2022; Chiu, 2023; Grassini, 2023; Lo, 2023; Rudolph et al., 2023).

Therefore, in this study, we address the potential uses of AI systems in education and the risks they may pose. Additionally, we are developing policy recommendations aimed at maximizing the benefits of AI systems while mitigating the effects of ethical and other issues they may cause.

The advantages and risks of AI applications, which have a profound impact on education, will also provide important insights into these two dimensions. Furthermore, Farrokhnia et al. (2023) conducted a SWOT analysis of the effects of ChatGPT that provides important insights. According to the study findings, ChatGPT has strengths and benefits in that the answers it generates are extremely relevant to the information requested, that it is open to continuous development based on new information, that it differentiates the answers by taking previous answers into account when creating the answers, and that it can create answers associated with the inputs by taking into account complex inputs. A number of risks and threats are presented by GhatGPT in the same study, including that students are not able to gain a deep understanding due to the limited information provided by GhatGPT, that it reduces academic integrity, it reproduces content that may violate equal opportunity in education through the training data, as well as that it does not appear to be identical to any other information. It has been demonstrated that his constant quoting from sources has led to plagiarism accusations (Cotton, Cotton & Shipway, 2023), and that superficializing information limits the development of high-level cognitive skills. According to the same study, ChatGPT offers an array of educational opportunities, including the development of personalized

educational materials, the acceleration of information access, the provision of materials that can support complex learning, as well as reducing teacher workloads.

From a teacher's perspective, Humble and Mozelius (2019) conducted a SWOT analysis of artificial intelligence-based applications. According to this study, AI-supported applications are especially useful for meeting personal learning needs, are capable of transferring school education into the digital realm, and can serve as the basis for digital systems that provide students with rapid and personal feedback. As a result of this study, the weakness of the applications was demonstrated in the following way: the AI-based software that is used in education quickly compiles existing text and data and outputs it to the students with little innovation, and it is difficult to determine which biases and errors have contributed to the results obtained. According to this study, if teachers are not sufficiently knowledgeable about the structure and benefits of AI applications, they may direct their students too much toward these applications if they are not sufficiently informed. They are open to continuous development, so they may replace teachers who provide educational support, as well as reducing students' capacity to learn independently and conduct research. There has been some concern expressed regarding the possibility of reducing high-level and in-depth thinking skills.

A SWOT analysis of AI applications in higher education was conducted by Denecke, Glauser, and Reichenpfader (2023) from the perspectives of academics and students. The study found that the main advantages of AI applications are the ability to provide personalized learning opportunities, the ability to easily perform repetitive tasks, and the ability to provide students with interesting learning materials. In contrast, it has been argued that these applications may provide significant errors in terms of their results and feedback, as well as expanding the bias associated with the texts on which they are based. It has been noted, however, that the greatest threat to these applications is the need for teachers and academics to receive training in order to be able to use these applications effectively, that ethical principles must be included in this training, and that there may be violations of privacy rights and personal rights in the data sets that the applications use.

METHOD

This study is designed within the qualitative research perspective with a systematic review of the papers and reports on potential benefits and risks of AI in education. Systematic reviews allows authors to evaluate the previous data and research and contribute to the literature with recent developments for a more comprehensive perspective on any subject (Newman & Gough, 2020). Within this scope, the secondary data, findings and reviews on the AI and education are included as an extension to SWOT analyses of AI-based applications such as ChatGPT in an educational context. Major studies considering the relationship between AI with education in a critical context are considered. The study used document analysis to cover the topic, allowing researcher(s) to evaluate the elaborative scientific studies and current materials on related subject(s) (Morgan, 2021). In this manner, the potential benefits and risks of AI systems on students, teachers, and education administrators are identified. Subsequently, steps to increase these benefits and mitigate risks for students, teachers, and education administrators are outlined, along with the development of macro-level education policies.

SYSTEMATIC REVIEW

Potential Benefits

AI systems provide numerous alternatives to assist and support the responsibilities of students, teachers, and education administrators. One of the most significant potentials of AI systems is their ability to support learning in a personalized and adaptive manner (Zawacki-Richter et al., 2019). The active use of supportive mechanisms in education is possible at all stages within this context. Such systems can monitor the real-time learning process and emotional state of each student, supporting personalized adaptive learning (PAL) (Peng et al., 2019). Generative AI systems like ChatGPT have the potential to advance and enhance the PAL approach to a greater extent (Rudolph et al., 2023).

Teachers now have increased options for enhancing their educational environments with supplementary materials, starting from preparing lesson plans (Atlas, 2023). With this new situation, there is a radical change in teachers' workloads. While conventional workloads decrease, teachers are required to focus more on the personal development of individual students in the classroom. Moreover, they have the potential to create a much more innovative and interactive learning environment, moving away from conventional settings (Rudolph et al., 2023).

Teachers can actively use AI systems in preparing teaching materials, creating exams, conducting assessments, providing feedback to students, and developing interactive and innovative learning scenarios

(Grassini, 2023; Khan et al., 2023; Wang et al., 2023). Particularly, the assumption that each student is unique increases the possibility of individualized education in the classroom. Using intelligent tutoring systems (ITS), teachers can offer personalized education (Rudolph et al., 2023; Zawacki-Richter et al., 2019). Thus, the individual development of each student can be closely monitored, and resources tailored to their development can be provided. These resources are not limited to school settings; their accessibility outside of school environments can enhance the support of education in non-school settings (Grassini, 2023; Rudolph et al., 2023). On the other hand, there is an increasing opportunity for teachers to actively use AI systems in tasks ranging from assigning homework to generating questions. This allows teachers to spend the time they would allocate to preparing such materials on reviewing and improving the generated materials instead (Grassini, 2023; Sok & Heng, 2023).

The widespread use of AI systems is observed to transform classroom teaching activities, leading to much more interactive educational experiences (Sok & Heng, 2023). In fact, thanks to these systems, the flipped classroom approach, where education continues not only in the classroom but also remotely, is becoming more common (Rudolph et al., 2023). As a result, classroom time can be used much more efficiently (Lo, 2023). Specifically, the use of ChatGPT enables the generation and utilization of interactive scenarios that support students' collaborative problem-solving abilities (Rudolph et al., 2023). These systems, especially with ChatGPT usage, enhance students' potential for collaboration with peers, allowing for group discussions in projects and increasing opportunities for real-time feedback (Gilson et al., 2023; Kasneci et al., 2023; Lo, 2023). AI applications also facilitate the interaction between humans and machines, as well as between humans within a digital context (Seo et al., 2021). The AI enables more repetitive tasks to be completed easily, as well as providing more opportunities for creative and complex tasks (UNESCO, 2019). Furthermore, AI may also learn the level of students in a group and present diverse and individual options tailored to the needs of each individual and group (Bhutoria, 2022; Kamalov et al., 2023). In this context, radical changes are also occurring in the assessment and evaluation of students, despite the many shortcomings of AI systems in this area. AI systems offer different options for assessing and evaluating students' assignments and exams (Babitha & Sushma, 2022; Conijn et al., 2023). Additionally, teachers can use these systems to create open-ended questions and provide rapid feedback. Automated or semi-automated assessment systems can be established to provide feedback to enhance students' learning outcomes (Kasneci et al., 2023; Sok & Heng, 2023).

In schools, various systems commonly used for assessing essay writing, such as Automated Essay Scoring (AES), Automated Writing Evaluation (AWE), and Automated Written Corrective Feedback (AWCF), can now be integrated into a single system (Koltovskaia, 2020; Rodolph et al., 2023). Consequently, feedback mechanisms are strengthened, particularly to help students improve their writing skills after assessment (Garcia-Gorrostieta et al., 2018; Nazari et al., 2021; Rudolph et al., 2023; Zawacki-Richter et al., 2019).

One of the most significant potential applications of AI systems is the easy identification of a student's development and challenges (Grassini, 2023; Kasneci et al., 2023). This makes it easier for the teacher to contribute to overcoming these challenges for the student. In this stage, teachers can use these systems to create personalized support materials for the student, allowing for the active utilization of individualized support mechanisms for each student (Trojer et al., 2022).

Similarly, students are actively using AI systems in their educational journeys. The amount of assistance students receive from AI systems in preparing assignments and presentations is increasing day by day, and the use of these systems for such purposes is becoming more widespread. Especially with the language translation support of these systems, students not only access educational materials in their own country but also have the opportunity to access and translate materials from other countries in this context (Grassini, 2023). In other words, not only can resource limitations be overcome, but also the access to compensatory and development-supporting resources for the student's own shortcomings is increased. In fact, this opportunity is not limited to the population of school-age individuals; it can also address the lifelong education and development needs of adults. A similar potential exists for teachers in their professional development. These systems have the potential to continuously support the professional development of teachers (Chiu, 2023).

The increasing capabilities of Generative AI systems, particularly in Large Language Models (LLM), are influencing foreign language education (Grassini, 2023; Kasneci et al., 2023; Wang et al., 2023). As a result, both platforms supporting students in learning new languages and opportunities for teachers to enrich teaching materials for this purpose are on the rise. Specifically, while options like Grammarly and Wordtune are widely used for correcting English texts, ChatGPT enhances these options (Fitria, 2021; Koltovskaia, 2020; Rodolph et al., 2023). Similarly, the potential for AI systems to provide new perspectives in artistic fields such as poetry, music, and

painting is increasing, enriching education in these areas (Elgammal et al., 2017; Gangadharbatla, 2022; Köbis & Mossink, 2021; Rubinstein, 2020).

AI systems also have the potential to be used in educational management. With these systems, updating education policies both at the school level and systematically based on real data has become much easier (Chiu, 2023). These systems can assist students in selecting courses/activities based on their preferences, determine the likelihood of attending these courses/activities, and aid school administrations in decision-making and recommendations (Tsai et al., 2020; Villegas-Ch et al., 2020; Chiu, 2023).

A number of stakeholders within the field of education have stated that AI applications can be beneficial to the education process in a variety of ways. First and foremost, it has been repeatedly stressed that these applications have the potential to meet individual learning needs, as well as to develop support materials and respond to learning needs outside of the classroom (Bhutoria, 2022; Chen, Chen & Lin, 2020). AI applications have the greatest potential in this regard since they are capable of providing 'personal feedback,' which is one of the most important needs in schools. The use of artificial intelligence applications has opened up a new era, particularly in the field of assessment (Farazouli et al., 2023; Kamalov, Santandreu & Gurrib, 2023). By determining individual learning needs, assessment opportunities have been developed that better address these needs. Thus, systems are now available that are capable of automatically scoring written answers of students and producing results comparable to those of human raters (Mizumoto & Eguchi, 2023; Ramesh & Sanampudi, 2021). With the use of artificial intelligence, it is possible to create platforms which facilitate the work of education stakeholders in evaluating applications and cater to their personal requirements. The use of these technologies has also found great application in foreign language teaching, as recently demonstrated by LLM's support.

Potential Risks

In the previous section, while addressing the potential offered or soon to be offered by AI systems in improving the quality of education, in this section, the risks associated with this use are discussed. Privacy and data protection come at the forefront of these risks. It is critically important to safeguard the data generated for both students and teachers during the active use of AI systems in education. The compromise and misuse of this data for non-educational purposes pose greater risks (Kasneci et al., 2023; Tili et al., 2023). Especially, being captured and utilized by commercial recommendation algorithms carries the risk of restricting individuals' lifelong freedom.

One of the foremost risks is the inequalities in accessing AI systems. Disparities in digital literacy both between countries and within each country, and furthermore, inequalities in access to digital technologies, will result in only a segment of society benefiting from the advantages these systems offer (Cotton et al., 2023; Grassini, 2023). This risk is not limited to students but also applies to teachers (Rudolph et al., 2023). In particular, inadequate digital literacy among teachers or their lack of awareness or reluctance to use such technological capabilities will disadvantage educational environments compared to teachers who make use of these opportunities (Dignum, 2021). Thus, while the advantaged continuously increase their advantages with the contribution of these systems, disadvantages accumulate, leading to additional disadvantages and perpetuating inequalities. Considering that the most significant issue in educational systems is the increasing inequalities with the Matthew effect (Stanovich, 1986; Özer, 2023a; Özer, 2023b; Suna et al., 2020; 2021; Suna & Özer, 2022), the risk of these inequalities becoming insurmountable with generative AI systems is now a challenging problem (Chiu, 2023; Dignum, 2021).

Beyond general digital literacy inequalities, there are serious disparities related to AI literacy. While students rapidly address this deficiency due to the advantages it provides them, most teachers perceive this literacy as associated with technology teachers, and even in this context, school administrators are seen as the most disadvantaged group (Chiu, 2023). In such a situation, it will not be possible to consistently manage the transformations caused by AI systems in schools.

AI systems deeply impact the learning and education processes for both students and teachers. As mentioned above, these systems can provide very positive support mechanisms. The challenge lies in how and to what extent these systems are used. Transferring all the load on these systems, instead of being supportive aids is considered to have negative effects on students' development, skill acquisition, critical thinking, problem-solving skills, and research and thinking skills (Kasneci et al., 2023; Mhlanga, 2023; Shiri, 2023, Sok & Heng, 2023). On the other hand, it is warned that exams entirely prepared by these systems may not fully meet the learning objectives, potentially leading to deficiencies in learning outcomes (Al-Worafi et al., 2023).

For students, the riskiest situation is the potential consequences of not using these systems consciously and ethically in the education process. Having students complete all their assignments using these systems not only raises ethical issues but can also mask a lack of learning (Halaweh, 2023; Skavronskaya et al., 2023). Thus, students might jeopardize their learning and accelerate their corruption by developing behaviors that undermine respect for labor, such as plagiarism. Therefore, the number of platforms aimed at detecting such ethical issues has been continuously increasing in recent times (Naik et al., 2015). Despite often being insufficient due to the continuous development of AI systems, significant investments are being made in this field to strengthen the value of original work in the education sector (Basic et al., 2023; Grassini, 2023; Katz et al., 2023).

Another risk related to this is the inadequacy of the existing measurement and evaluation approaches used in education (Chiu, 2023). New approaches are needed to assess and evaluate efforts accurately and determine the contribution of these systems to student performance (Farrokhnia et al., 2023; Lo, 2023; Rudolph et al., 2023; Tili et al., 2023). Otherwise, there is a risk of rewarding students who use these systems unethically. Students who actively use AI systems for assignments or projects may receive higher grades than their peers who do not use these systems (Sok & Heng, 2023). Especially considering the inadequacies of existing programs used to identify students who complete their entire assignments with the help of these systems or to determine the similarity rates of generated texts, the situation becomes even more dramatic (Lo, 2023). Moreover, due to the risk of grading of unsuccessful students as successful with the support of these systems, their failures can be masked, depriving them of the opportunity to benefit from timely supportive feedback mechanisms to compensate for their deficiencies (Grassini, 2023; Lo, 2023).

Another risk, especially with the widespread adoption of generative AI systems like ChatGPT, is that the information generated for each lesson in education becomes more comprehensive and interdisciplinary (Miao & Ahn, 2023). In this new situation, it is no longer sufficient for teachers to be equipped only in their own fields; they are expected to be knowledgeable in the intersection areas of their fields with other disciplines and provide teaching with a much more interdisciplinary approach in the classroom (Chiu, 2023; Dignum, 2021). Otherwise, the teacher may be inadequate in dealing with this information in the classroom.

In this context, another risk is the proliferation of biases in the outputs generated by AI systems. As known, these systems learn from data influenced by societal relationships, and biases based on factors such as religion, gender, race, and culture in the data they use for learning can directly infect the system, thus embedded in their results. Therefore, it is not possible for every generated piece of information to be up-to-date, accurate, and reliable (Lo, 2023). For instance, an AI system trained on a dataset consisting of articles and works from a specific population can exhibit bias in evaluating the works produced by students outside of that population (Grassini, 2023; Mbakwe et al., 2023). On the other hand, numerous inaccuracies have been identified in bibliographic information produced by such systems (Lo, 2023; King, 2023; Mogali, 2023). If not corrected, there is a risk that these biases can be further exacerbated and institutionalized through the education system.

The active use of AI systems in education and the transfer of the workload to students through these systems, combined with teachers actively utilizing these systems, pose a risk of leading to new employment approaches by inaccurately assessing teacher efforts and reducing the need for teachers (De Cremer et al., 2021; Grassini, 2023; Howard, 2019). However, in the new situation, teachers are actually experiencing a shift not only in conventional workloads but also towards increased workloads as they adapt their focus to the new environment. This shift involves preparing innovative lesson plans and materials, with a particular emphasis on personalized education (Sok & Heng, 2023). In other words, teachers now have to spend a significant portion of their time enriching educational environments with new systems and focusing on reviewing students' work and providing feedback (Rudolph et al., 2023).

The strongest consensus in the literature regarding the risks associated with AI applications relates to concerns regarding data privacy violations (Huang, 2023; Marshall et al., 2022). Despite the fact that AI applications, specifically ChatGPT, were not developed to use verbatim texts, the fact that the algorithms produce results using these texts has led to many debates about the nature of the data used. This has led to ChatGPT being accused of 'democratizing plagiarism' by Welle (2023), and it was highlighted that the data underlying the algorithms are essentially intellectual property. It is also important to note that academic integrity is another risk that is frequently mentioned in this respect. Furthermore, if students use these technologies to answer exam questions, they may also become dependent on the competence of AI applications without clearly demonstrating their capabilities. Thus, commonly used applications, such as ChatGPT, have become capable of passing some exams successfully (Mehrabanian & Zariat, 2023), raising questions about the validity of these digital evaluations. The application standards are being updated to include stricter security measures for digital evaluations. AI

applications also present the risk of furthering the existing digital inequalities in society and falling further behind, especially in light of the fact that socioeconomically disadvantaged groups are not as likely to benefit from these technologies as their peers (Bulathwela et al., 2024). A technology such as artificial intelligence may serve as a tool to increase existing inequalities if disadvantaged groups are not supported and unable to make effective use of these technologies. Lastly, AI-based technologies may be able to reduce the need for teachers, and it was suggested that these technologies should not be considered an alternative to teachers.

DISCUSSION & CONCLUSION

AI systems deeply impact various aspects of life, bringing about radical transformations as their usage becomes more widespread. One of the areas with significant potential is education. Education systems not only face the challenge of rapidly responding to new skill demands in labor markets due to the proliferation of AI systems and automation but also grapple with the issue of how to ethically and effectively integrate AI systems into existing education systems. In this context, this study evaluates the potential benefits and risks of using AI systems in education.

At this point, instead of banning these types of systems in education and learning environments to prevent potential risks, the focus should be on how to integrate them into the system efficiently, promote equality, and, most importantly, do so in an ethical manner. The rapid and widespread use of ChatGPT, especially among students, shortly after its introduction, calls for urgent measures to enhance its effective use and alleviate potential risks. Those who use these systems will not only have advantages during their educational journey but also, when entering the workforce, will be much more advantageous compared to those who do not use these systems.

One of the most crucial stages in the integration of AI systems into the education system is the recognition of the assistive systems used by both students and teachers, as well as institutions. Therefore, educational systems must first reach a consensus with all stakeholders on how these systems can be beneficially used in education and what steps should be taken to prevent potential risks. Otherwise, efficient use of such systems and prevention of unethical usage will not be possible.

In the active use of AI systems in education, as well as in other fields, the 'responsible AI' approach, which considers ethical and moral values from the design stage to implementation, data protection, and privacy, should be adopted (Dignum, 2021). In this context, Stahl (2023) suggests re-evaluating the AI ecosystem, which consists of socio-technical systems and includes education, in the context of 'responsible AI.' He proposes placing all steps, from the transparency and accountability of the ecosystem to its alignment with ethical and moral values, under a framework of 'meta-responsibility in the ecosystem.' Therefore, just like in every application within the AI ecosystem, each AI system's processes, from design to implementation, data protection to privacy, should be conducted in a socially value-sensitive manner when used in education (Crawford & Calo, 2016).

In this context, perhaps the most crucial step to be taken is to increase the digital literacy and AI literacy of students, teachers, and education administrators. The importance of digital literacy, especially after the Covid-19 pandemic, and how it can deepen existing inequalities in education have been observed (Özer et al., 2020; Özer & Suna, 2020; Özer et al., 2022). Therefore, initiatives to enhance the digital literacy of students and teachers have the potential to reduce inequalities. Additionally, strengthening the IT infrastructure of schools will further enhance this potential. However, AI literacy in education is relatively new. Thus, there is a risk that inequalities in AI literacy may deepen educational inequalities with the use of AI systems in education. Therefore, comprehensive steps to increase AI literacy should be taken by all stakeholders in education. This way, awareness of how AI systems can be beneficial in education, the problems they can cause, and the ethical framework of their use will increase among all stakeholders in education (Chiu, 2023; Zawacki-Richter et al., 2019).

Certainly, the first step in this regard is to update teacher training programs in higher education. This way, it will be possible to train the next generation of educators who are familiar with such technologies, aware of their risks, and equipped with the skills to use them (Grassini, 2023). Teachers starting their careers with the knowledge and skills acquired through this education will contribute to the healthier implementation of these processes. Additionally, existing teachers in the education system need to undergo comprehensive in-service training in this context (Chiu, 2023; Yau et al., 2022). Similarly, school administrators should receive ongoing training on the potentials and risks of these systems. Thus, teachers and education administrators will not only be aware of the benefits these systems can bring to education and learn how to use them in their work but also act more consciously in the face of potential risks. On the other hand, the use of generative AI systems, especially those like ChatGPT, makes it essential to adopt a more inclusive and interdisciplinary perspective for every subject. Therefore, it is

crucial for teachers to gain an interdisciplinary perspective related to their fields and continuously update relevant skills to ensure synchronization (Chiu, 2023).

AI systems have long been known to have a bias issue and can reproduce biases based on societal factors such as religion, culture, gender, race, etc., through training data. Therefore, careful attention is needed to address these biases when using such systems in education. Otherwise, the risk of these biases becoming widespread and persistent through the use of such approaches in education increases. Additionally, considering that the responses generated by these systems are not always accurate and reliable, it is essential to support students with new skills, such as media literacy, that encourage them to verify the accuracy of this information (Chiu, 2023).

One of the profound changes that should be implemented in education systems is the transformation of existing assessment and evaluation approaches to be more robust and accurate after the use of AI systems. However, this transformation should go beyond being a one-time change; it should be continuous. Given the continuous and dramatically evolving nature of AI systems, each new approach will need constant updates. Particularly, taking serious steps to measure the extent to which students contribute to the preparation of their assignments will also reduce unethical behavior among students. Similarly, accurate measurement and evaluation of performances are crucial. One of the significant challenges in this context is the potential masking of failures for students who are actually unsuccessful due to these systems. This problem could delay interventions that could compensate for failures, leading to the perpetuation of failures and potentially increasing unexpected absenteeism and dropout rates.

Finally, the increasing use of AI systems in the education system requires rapid changes in the role of teachers in education. The role of teachers is gradually evolving towards process management. In fact, the workload and responsibilities of teachers have significantly increased. The transition from conventional teaching to new approaches is particularly challenging for teachers. Teachers are expected to learn and actively use new systems in the context of all their benefits and limitations. While teachers are expected to incorporate these systems into the learning environment interactively and innovatively, they also need to actively and adaptively support the development of each student. In particular, they should be able to actively monitor and track to what extent each student completes assignments and projects with the help of these systems. Therefore, the responsibilities of teachers have significantly increased at this point. Hence, ensuring that this evolution is carried out correctly and swiftly can prevent misconceptions about the inadequacy of the teacher's role, ultimately avoiding cutbacks in employment due to questioning the need for teachers.

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The Effect of Modeling and Computer-Aided Teaching on Astronomy on Some Learning Products of Seventh Class Learners

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Abstract

The primary purpose of this study is to investigate the effect of modeling techniques and computer-aided guidance material on seventh-grade students' academic achievements, creative thinking, and logical thinking skills in Astronomy concepts in the "Solar System and Beyond" unit. This study was carried out with 66 seventh grade secondary school students. This study was carried out with a quasi-structured research design, one of the experimental research methods. This study was carried out in the fall semester of the 2018-2019 academic year. The study used academic success tests, scientific creativity scales, and logical thinking group tests as data collection tools. The experimental group students used the models based on the computer-aided material and modeling techniques developed by the researcher. The control group, on the other hand, only utilized instruction based on the current curriculum. The difference between the two groups is the activities carried out in computer-aided teaching and modeling-supported instruction. The study results reveal that the Academic Achievement, Scientific Creativity, and Logical Thinking Skills of the experimental group students who applied modeling and computer-assisted instruction were significantly higher than those in the control. As a result of the findings obtained in the study, it is recommended to include different science topics and grade levels in future studies.

Keywords: Astronomy, computer - aided teaching, modeling.

Astronomi Konusunda Modelleme ve Bilgisayar Destekli Öğretimin 7. Sınıf Öğrencilerinin Bazı Öğrenme Ürünlerine Etkisi

Öz

Bu çalışmanın temel amacı yedinci sınıf Fen Bilimleri öğretim programında yer alan "Güneş Sistemi ve Ötesi" ünitesindeki Astronomi kavramlarında modelleme tekniği ve bilgisayar destekli rehber materyali kullanılmasının öğrencilerin akademik başarılarına, yaratıcı düşünmelerine ve mantıksal düşünme becerilerine etkisini araştırmaktır. Deneysel araştırma yöntemlerinden yarı-yapılandırılmış araştırma deseniyle yürütülen bu çalışma, Ordu ili Altınordu ilçesinde yer alan bir devlet okulunda öğrenim gören biri deney biri kontrol olmak üzere toplam 66 yedinci sınıf ortaokul öğrencisi ile gerçekleştirilmiştir. Çalışmada veri toplama aracı olarak akademik başarı testi, Bilimsel yaratıcılık ölçeği ve mantıksal düşünme grup testi kullanılmıştır. 2018 – 2019 eğitim-öğretim yılı güz yarıyılında yürütülen bu çalışmada, deney grubunda mevcut öğretim programına dayalı öğretim ile birlikte araştırmacı tarafından ünite kavramlarına yönelik geliştirilen bilgisayar destekli materyal ve modelleme tekniği ile geliştirilen modeller dersler esnasında kullanılırken, Kontrol grubunda ise sadece mevcut öğretim programına dayalı öğretim kullanılmıştır. Çalışmanın sonucunda, Modelleme ve Bilgisayar Destekli Öğretim uygulanan deney grubu öğrencilerinin, Akademik Başarıları, Bilimsel Yaratıcılıkları ve Mantıksal Düşünme Becerileri, kontrol grubunda yer alan öğrencilere göre anlamlı derecede yüksek olduğu tespit edilmiştir. Çalışma da elde edilen bulgular neticesinde, daha sonra yapılması planlanan çalışmalar da farklı fen konularında ve sınıf seviyelerine yer verilmesi önerilmektedir.

Anahtar kelimeler: Astronomi, bilgisayar destekli öğretim, modelleme.

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INTRODUCTION

Education considers the needs and demands of the period it occurs in. Especially since the beginning of this century, there has been a rapid flow of information. For this reason, education should be realized and planned by considering this rapid flow of information (Karakütük, 2012). In our age, it is not enough for individuals to be surrounded by an education system where they can only access scientific information. It is important to use information, transform it into different forms, and improve cognition. Acquisition of various skills is essential in creating cognitively developed individuals. Especially the fact that subjects and concepts contain more complex and in-depth information makes it necessary for individuals to acquire various skills (Altunçekiç et al., 2005; Bakırcı & Kutlu, 2018).

In the process of acquiring skills, the way information is presented to individuals is very important. Our age adopts an understanding that can transform into different forms and ways rather than an understanding in which information is used in only one dimension (Kind & Osborne, 2017). As a result, individuals experience difficulty in learning structurally complex and three-dimensional structures and concepts. High-level skills have great importance in transforming information into different forms and structures, finding alternative ways, and at the same time, discovering one's learning path (Cañas et al., 2017). Thanks to these skills, individuals can gain different perspectives. Creative thinking skills offer appropriate, innovative, and different solutions to the situations that individuals encounter in their mental processes (Yaşar & Aral, 2010). They are skills that individuals should have regardless of whether the environment is formal or informal. The fact that individuals who think about concepts or topics in different ways do not experience difficulties in the learning process is directly related to their creative thinking skills. Creative thinking skills produce new ways of thinking and different thoughts, which is also significant for a science course directly associated with life. As a result, the originality of individuals' products contributes to increasing success and motivation toward the lesson (Bakır & Öztekin, 2014; Ceran, 2010; Zubaidah et al., 2017). For this reason, methods that improve students' motivations and attitudes in developing creative thinking skills are critical. Like creative thinking, logical thinking skills also contribute to individuals' producing different and original solutions (Aksu, 1988).

For this reason, it is essential for individuals to keep up with the times and to improve their metacognitive development. Logical thinking skill enables individuals to think in detail about the situations they encounter during their learning process and to discover their learning methods (Sert Çıbık & Emrahoğlu, 2008). In cases where individuals have difficulties in the learning process, they should not be pessimistic; instead, they should seek solutions within a cause-effect relationship (Karademir, 2013). This is why metacognitive mental practices need to take place. They help individuals' cognitive development in establishing solid relationships between abstract concepts (Kılıç & Sağlam, 2009). Logical thinking skills are directly related to many topics during a science lesson. They contribute to structuring the teaching of abstract concepts such as science. Logical thinking skills offer different solutions to individuals, especially in departments where individuals have difficulty learning science (Aydın & Kaptan, 2014). Individuals with high logical thinking skills have high attitudes and success in science lessons (Çobanoğlu, 2017).

Appropriate methods are fundamental in developing two types of skills. In addition, continuity in planning education programs is essential for developing skills (Yağmur, 2010). In addition to the expectations and needs of students, contemporary methods should be used. With the help of various features of computer-aided education, it aims to develop other skills in addition to creative and logical thinking skills. At the same time, it is thought to develop students' creative and logical thinking processes besides teaching concepts. Computer-aided education includes various software and hardware elements. It contributes to students' information acquisition in different forms in our age, where information changes rapidly (Tekmen, 2006). Individuals face different problems in the transformation of information into different forms and in the interpretation of information. Computer-aided teaching is fundamental in teaching the skills required to solve these problems (Demirer, 2009). Enriching the learning process with computer-aided teaching materials contributes to teaching concepts to individuals (Osu, 2017). Computer-assisted teaching materials develop students' creative thinking skills (Yeşiltaş & Taş, 2021). Students who access different forms of information can reach different results about their learning methods. Individuals need to explore their learning ways and methods in the teaching of subjects and concepts (Gürkan & Dolapçıoğlu, 2020). Creative and logical thinking skills help students to explore their learning methods (Aksu, 1988). Individuals gain various skills not only through computer-aided teaching materials but also through modeling.

A model is defined as the representation of a concept, phenomenon, idea, or process. It can be seen as representing a system or process planned to be designed. The model is directly associated with the process it represents. Modeling is the process in which the model created is experienced (Ergin et al., 2012). Modeling does not have to reflect all the features of the concept to be reflected. The modeled concept is presented in simpler forms. This way, models ease students in teaching complex concepts (Arslan, 2013). During modeling, students continue using old and new information together (Batı, 2014). The modeling process of the target concept is carried out without breaking away from theories, laws, and actual knowledge (Suabada & Basi, 2012). The modeling process is designed so that complex and difficult-to-understand structures and processes are better visualized in students' minds and learning processes are developed in the desired direction (Lesh & Door, 2003). Modeling is an effective method of transferring unobservable situations to students. The teaching of abstract concepts occurs similarly (Thomson & Brother, 2008). When the renewed science teaching program is analyzed, it includes concepts challenging to teach in addition to many abstract and three-dimensional groups. Especially the unit "Solar System and Beyond" is one of these units. It can be seen that students have difficulty understanding the subject, and misconceptions occur (Özkan & Bal, 2017; Ryan & Williams, 2007). It is thought that classical lesson materials are partially insufficient. For this reason, in addition to the renewed astronomy education, materials suitable for our age and students' needs should be used in astronomy education (Plummer, 2008). The materials that individuals use and teaching materials and tools help them find different solutions in the learning process of other subjects and concepts. In such implications, teaching processes and materials based on instructional design models should be used (Brown, 1992). Gagne (1985) gathered the principles of the instructional design model in four items:

- Different types of teaching to be carried out are vital for many learning areas.
- Learning processes on the learner are planned in ways that form learning styles.
- Learners' learning styles are different for each learning.
- Graded learning refers to mental skills, how they are realized, and the contents that make up the teaching.

Instructional design is the development of learning activities on a systematic basis to provide the learning environments that learners need (Şimşek, 2014). The differences in the student's learning styles and the accompanying changes in the field of education bring the instructional design models to an essential point in learning environments' preparation. Using instructional design models provides better-quality learning environments (Siribaddana, 2010). Instructional design models include organizing teaching-learning activities and preparing and planning all materials intended for use in this direction. This study's theoretical and theoretical foundations are the ARCS instructional design method. The first and most important strategy of ARCS is the attention strategy, in which students' curiosity about the lesson is aroused and continued throughout the lesson (Kutu, 2011). At this point, in preparing computer-aided and modeling-supported materials, it is aimed to choose materials that will increase the student's motivation towards the lesson, keep their interest alive, and have a high sense of curiosity.

This study aimed to determine the effects of modeling and computer-aided teaching on seventh-grade students' scientific creativity, logical thinking skills, and academic achievement. In addition, it aims to test the relationship between Scientific Creativity scores, Logical Thinking scores, and Academic Achievement scores of experimental and control group students supported by Computer and Modeling.

METHOD

This section contains general information about the research pattern, the research design, the working group containing the descriptions of the sample included in the study, the way of collecting the data, the means of the data collection, and the analysis of the data obtained.

Research Design

The studies carried out by the researchers are expected to provide in-depth and desirable information. Therefore, research designs should be used on the nature of the studies. This study adopted a quasi-experimental research design, examining changes in students' scientific creativity scores, logical thinking skills, and academic achievement scores. The use of pre-test and post-test research designs in our country is suitable for research because of the structure of schools (Çepni, 2014; Kaya, 2015). At the same time, since it is possible to present an existing situation, survey and causal-comparative research are used as descriptive research methods (Çepni et al., 2010).

Participants

The study sample comprises 66 students studying in a public school in Altınordu, Ordu, in the fall semester of the 2018-2019 academic year. There were 33 (male = 11, female = 22) students in the experimental group and 33 (male = 13, female = 20) students in the control group. In the sample selection of the study, a simple random sampling method was used. In this method, all units have an equal chance of being selected for the sample (Büyüköztürk, et al., 2010). Experimental and control groups were randomly selected within the classes created in the schools.

Data Collection

In this research, Scientific Creativity Scale (SCS), Logical Thinking Group Test (LTGT), and Academic Achievement Test (AAT) were used.

Scientific Creativity Scale (SCS)

A scientific creativity scale was used to determine the students' scientific creativity scores at the beginning and end of the research. The scale was developed by Hu and Adey (2002). There were differences in some of the test items during the Turkish adaptation of the scale (Aktamış, 2007; Deniş Çeliker, 2012; Kadayıfçı, 2008). To use the scale, permission was obtained from Hu and Adey (2002) and Deniş Çeliker (2012), who also adapted the scale to Turkish. Deniş Çeliker (2012) calculated the scale's reliability to be 0.86. Hu and Adey (2002) wrote 48 questions, two for each dimension. By evaluating the opinions of 50 science educators, they reduced the number of questions to nine. The pre-application of the nine-question test was carried out with 60 students and evaluated, and the test took its final form with seven items. Each item in the test aims to measure more than one of the parts in the model. In this study, the scale's reliability was found to be 0.82.

Logical Thinking Group Test (LTGT)

Students are expected to determine logical thinking skills before and after the research. Therefore, the Logical Thinking Group Test was used. The scale was developed by Roadrangka, Yeany, and Padilla (1982). Then, Sert Çıbık (2006) used adopting. Necessary permissions were obtained from the author (Sert Çıbık, 2006) for the use of the scale. Reliability studies were conducted, and the scale's Cronbach Alpha internal consistency coefficient was calculated as 0.88. The scale consists of 21 items in total. The first 18 questions part of the test consists of multiple-choice questions. When students give correct answers to multiple-choice questions, they get a "1" point; when they give wrong answers, they get a "0" point. The last three questions in the test consist of open-ended questions. "1" point is given for correct answers, and "0" point is given for incorrect answers. The researchers scored the results obtained. The answer key in the original form of the test was used to evaluate open-ended questions. The test does not consist of a factored structure. In this study, A rubric was used in the scoring process. The scale's Cronbach Alpha internal consistency coefficient was calculated as 0.80.

Academic Achievement Test (AAT)

An academic achievement test was used to measure students' academic achievement differences. An academic achievement test developed by Kaya (2015) was used. As a result of different adaptations, validity and reliability studies were performed for the test. The academic achievement test, adapted for a validity study, was examined by two science teachers and two science educators, and the structure and scope validity were ensured. Also, it was evaluated whether the achievement test was acceptable for the target students, according to the expert's assessment. The reliability of the test was calculated using the KR-20 formula. The internal consistency coefficient KR-20 was calculated as 0.81. In this study, the internal consistency coefficient KR-20 was calculated as 0.86. Students get a minimum of 0 and 16 points from the solar system and beyond academic achievement tests.

Development of Modeling

The "Solar System and Beyond" unit comprises many subjects and concepts. It includes concepts that require students to have a high level of scientific creativity, and scientific and logical thinking skills. When the literature is reviewed, it can be seen that students have various misconceptions (Emrahoğlu & Öztürk, 2009; Şenel Çoruhlu & Çepni, 2015). Below are some misconceptions in the literature on the subject.

- The stars move, so they stay behind the Earth during the day and are invisible.
- The stars reflect the light they receive from the Sun.
- The stars are smaller than the Sun.
- The size of the Moon changes according to its phases of the Moon.
- If the Moon's rotation period were different from the rotation period of the Earth, the illuminated surface of the Moon would be less.

• The Sun revolves around the Earth.

• As the Earth revolves around the Sun, the Sun appears in different places from the Earth (Göncü, 2013; Şenel Çoruhlu & Çepni, 2015).

For this reason, it is aimed for the modeling planned to be developed to increase academic achievement and develop students' comprehension levels, scientific creativity, and logical reasoning. "Solar System and Beyond" unit student attainments were analyzed for the modeling the students were supposed to prepare. The planned modeling was presented to experts in the field, science educators, and teachers. The feedback indicates that the models suit students' levels and teaching concepts. As a result of the feedback received, the modeling students were supposed to make was decided upon. The identified models are then performed in groups by the students in the experimental group. All materials for models are provided to students. Students develop models in groups in the light of specified guidelines. The visuals of the models and modeling process are below (see. Figure 1).

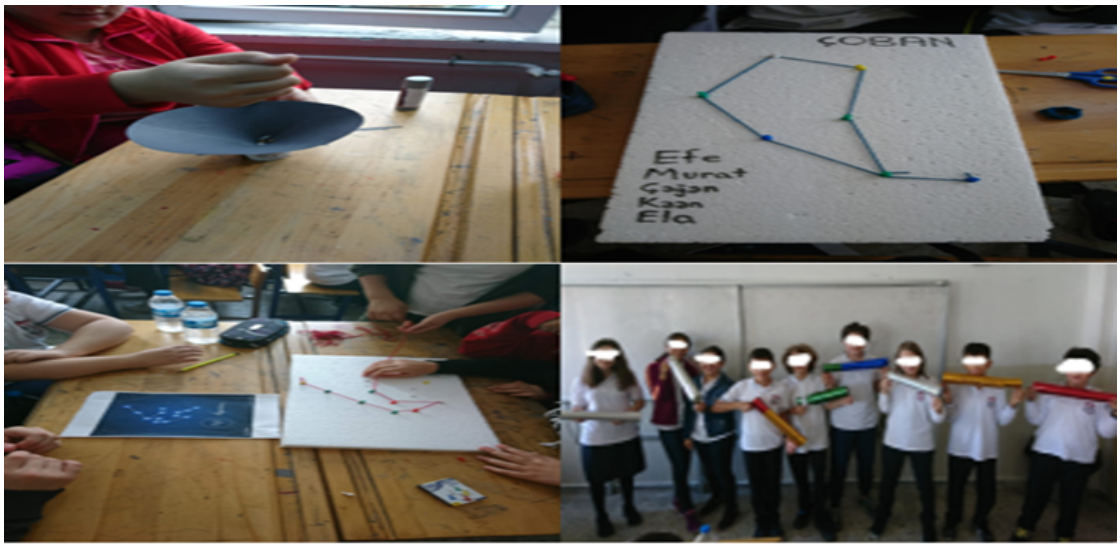

Figure 1. *Experimental group modeling process and model examples*

Designing Computer-Aided Teaching Materials

For computer-aided teaching applications of the "Solar System and Beyond" unit, it is aimed to choose between animations developed by Kaya (2015) and animations that are free to use. Animations considered for use were determined by field experts, science educators, and teachers. Animations intended for use were decided from the pilot application and student feedback. The experimental group participated in modeling and computer-aided learning activities based on the unit's progression of goals. The experimental group performs activities aimed at the solar system and beyond applications in the pre-developed computer class. The interfaces of the animations used and the visuals of the classroom environment during computer-aided teaching are given below (see. Figure 2).

Figure 2. *Interfaces of computer-aided teaching applications and materials*

Research Process

The research process was carried out sequentially with the planned steps. First, the materials used in modeling and computer-aided teaching were determined by considering student attainments. When the student attainments of the "Solar System and Beyond" unit are examined, students need to visualize many concepts in their minds. Therefore, it aims to develop students' scientific creativity and logical thinking skills to enable them to visualize these concepts more comfortably. For this reason, materials that aim to develop scientific creativity and logical thinking skills are used in modeling and computer-aided teaching. Before conducting the study, a pilot application was made to test the experimental process in addition to material and data collection tools. After the pilot application, the study was finalized based on the feedback from science educators, teachers, and students. The feedback consists of comments about the duration of the activities planned to take place. The duration of the lessons and the realization of the activities were reviewed. As a result, it was decided that the activities were carried out not individually but in groups. As a result, it was decided that the activities were carried out not individually but in groups. Especially plastic, cardboard, and similar materials were used.

In the experimental group, modeling, and computer-aided teaching were performed in addition to the science teaching program. The control group's lessons are based on the national curriculum (MEB,2018). The mutual features of the groups are stated as the information and practices in the coursebook and curriculum. Student attainments of the "Solar system and beyond" unit are shown in Table 1.

Table 1. Student attainments of the "Solar system and beyond" unit

Number System	Student attainments
F.7.1.1.1.	Can explain space technologies.
F.7.1.1.2.	Can express the causes of space pollution and estimate the possible results of this pollution.
F.7.1.1.3.	Can explain the relationship between technology and space research.
F.7.1.1.4.	Can explain the structure and functions of the telescope.
F.7.1.1.5.	Can make inferences about the importance of telescope in the development of astronomy.
F.7.1.1.6.	Can prepare and present a simple telescope.
F.7.1.2.1.	Can realize the star formation process.
F.7.1.2.2.	Can explain the concept of a star.
F.7.1.2.3.	Can explain the structure of galaxies.
F.7.1.2.4.	Can explain the concept of the universe.

In addition to the science curriculum, some modeling and computer-aided education activities below were applied to the students in the experimental group for the relevant learning goal. Unlike the control group, it is planned to carry out modeling and computer-aided education activities to teach the relevant learning goal. In addition, it is aimed at supporting the teacher of the course in the execution of the activities by the researchers. The experimental process applied to the experimental group is shown in Table 2.

Table 2. The experimental process applied to the experimental group.

Experimental group		
Implementation of Pretests		
First Week	Lesson 1	F.7.1.1.1. Can explain space technologies.
	Lesson 2	F.7.1.1.2. Can express the causes of space pollution and estimate the possible results of this pollution.
	Lesson 3	F.7.1.1.3. Can explain the relationship between technology and space research.
	Lesson 4	In the experimental group, it was planned to be carried out in the first week and the first four-hour lesson period following the above-mentioned science curriculum. In addition to the science curriculum, some modelling and Computer-Aided education activities were applied to the students in the experimental group for the relevant learning goal. - During the first and second lesson hours, various models related to space technologies were introduced to the students in the experimental group in addition to the control group. These models include space technology such as the space shuttle, astronauts, and artificial satellites. The design process of the models consists of models made by pre-service teachers within the scope of the astronomy course of a state university. The activity allowed students to study space technologies in groups using the method of physically modeling. Pre-service teachers designed models in light of achievements in the science curriculum. The process was conducted under the supervision of a science educator and a physical educator.

		Experimental group students performed the related activity in the 8-10 minutes of the lesson. - For the third and fourth lesson hours, activities were designed for the students to learn the relevant learning outcomes better with the Computer-Aided teaching method. In the last 25 minutes of the 80-minute course, students were given an animation study about the technologies that space technology adds to our daily lives and the spacecraft used in space. The students were asked to examine the animations that meet the relevant acquisitions on the smart board in the classroom with their colleagues. Each group consists of 3-4 students. Each student group has an average of 1-1.5 minutes. In the control group, the lessons continue in light of the contents contained in the textbook by the teacher.
Second Week	Lesson 5 Lesson 6 Lesson 7 Lesson 8	F.7.1.1.4. Can explain the structure and functions of the telescope. F.7.1.1.5. Can make inferences about the importance of telescope in the development of astronomy. F.7.1.1.6. Can prepare and present a simple telescope. In the experimental group, in addition to the control group, the second week focused on preparing a telescope model. Although the control group had the activity of preparing a telescope model for the last learning outcome, students did not prepare following the outcome and could not design a fully successful telescope model. In the experimental group, at the end of the fifth and sixth lesson hours, an animation explaining the historical development and importance of the telescope was presented with a smart board for 5-7 minutes. In addition, the students were asked to create two-dimensional models by giving the CVs and photographs of famous Turkish-Islamic astronomers in a mixed form, matching the information they learned in the lesson, and then sticking them on cardboard. This activity corresponds to a duration of approximately 10-13 minutes. The last lesson of the second week was reserved for the preparation of the telescope model as a modeling activity for the experimental group. The students were formed into groups of 3-4 people primarily for teamwork. Then, after the related materials were distributed to each student group, information about the process was given. After completing the telescope models in approximately 15-20 minutes, each student group was asked to introduce the telescope models which they developed. In the control group, the program was also planned by the teacher.
Third Week	Lesson 9 Lesson 10 Lesson 11 Lesson 12	F.7.1.2.1. Can realize the star formation process. F.7.1.2.2. Can explain the concept of a star. Different from the control group, various modeling, and Computer-Aided applications were planned for the students in the experimental group. For the formation of constellations and substantial constellations, we planned to perform a matching simulation of students in groups of 2-3. The activity was allocated approximately 1-1.5 minutes for each group. In addition, a modeling activity related to the constellations was planned with the students in the last lesson of the 3rd week. In this activity, students are divided into groups of 3-4 people. Styrofoam foam is distributed to the students for the constellation's activity. Afterward, students are given a visual containing various constellation. With the help of colored large-headed pins and threads, students are asked to create the constellations in the image. The activity period covers one lesson hour. In the control group, the program was also planned by the teacher.
Fourth Week	Lesson 13 Lesson 14 Lesson 15 Lesson 16	F.7.1.2.3. Can explain the structure of galaxies. F.7.1.2.4. Can explain the concept of the universe. In the last week, animations about the formation of the galaxy and the concept of the universe were presented to the students in 5-7 minutes via a smart board for the final learning outcomes of the unit. With this, a modeling activity was planned for the students regarding the concept of a black hole. The students were asked to perform the activity in groups of 3-4 people, approximately 20-25 minutes. In this event, cardboard and beads are distributed first. Students are asked to prepare the cardboard in the shape of a funnel and then toss the beads into this funnel. In this way, an activity related to the concept of a black hole is realized. In the control group, the program was also planned by the teacher.
Implementation of post-tests		

Research Ethics

This study is ethically appropriate with the 2018 decision number of the Social and humanities research ethics committee of Ordu University dated 11.09.2018 and numbered 03. The students' personal data were not shared with third parties during the study's experimental process. In addition, it aims to comply with the ethical rules by giving references and obtaining the necessary permissions for all measurement tools used in the study.

FINDINGS

In this section, the findings of the research are presented. The descriptive analysis results of the sub-dimensions that constitute the scientific creativity scale are presented in Table 3. Also, the normality test results for SCS are presented in Table 4.

Table 3. Pre -Post Test Results of SCS Sub-dimensions of Control and Experimental Groups

Question	Experimental Group				Control Group			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
	$\bar{x}$	SS	$\bar{x}$	SS	$\bar{x}$	SS	$\bar{x}$	SS
Unusual Uses	3.06	1.53	5.18	2.54	4.33	3.74	4.21	3.24
Discovering The Problem	3.87	2.44	6.84	2.82	5.00	3.01	5.30	3.21
Product Development	3.12	0.89	5.27	2.49	5.12	2.39	4.12	2.38
Scientific Imagination	3.18	1.40	5.45	2.59	4.75	1.87	5.09	1.80
Problem-Solving	1.84	0.79	2.03	0.58	2.18	1.10	2.48	1.12
Science Experiment	4.15	1.69	7.78	1.21	6.54	2.15	3.12	1.93
Product Design	7.6970	2.2006	13.909	1.5883	10.4848	3.1237	12.0303	2.8447

Table 4. Shapiro-Wilk Results of Control and Experimental Group's SCS Pre-Test Scores

Group	Statistics	df	p
Experimental Group	0.937	33	0.540
Control Group	0.930	33	0.036

As a result of the Shapiro-Wilk normality test, the experimental group did not show a normal distribution. Mann Whitney U test was performed because the data did not show normal distribution.

Table 5. Control and Experimental Group SCS Pre-Test Mann Whitney U Test Results

Group	N	Mean Rank	Sum of Ranks	U	z	p
Control Group	33	37.24	1129.0	421.00	-1.558	0.112
Experimental Group	33	29.76	982.0			
Total	66					

When Mann-Whitney U results were examined in Table 5, there was no significant difference between the student's pre-test scores (U:421.00; p>0,05). When the mean values are considered, they have a higher average regarding scientific creativity compared to the control group. However, more than this situation is needed for a statistically significant difference.

Table 6. SCS Wilcoxon Sign Test Results of the Experimental Group

Before Education-After Education	N	Mean Rank	Sum of Ranks	Z	p
Negative Ranks	6	9.00	54.00	-4.049	0.000
Positive Ranks	27	18.78	507.00		
Total	0				

According to the results obtained in Table 6, in the experimental group, there is a significant difference between the pre-test and post-test in terms of the scientific creativity scale scores of the students. (z=-4.049; p<0,05).

Based on the Science Curriculum, there was no significant difference between the pre-test and post-test Scientific Creativity scores of the students in the control group. Since the data do not show a normal distribution, Table 7 shows the results of the Wilcoxon signal test.

Table 7. SCS Wilcoxon Sign Test Results of the Control Group

Before Education-After Education	N	Mean Rank	Sum of Ranks	Z	p
Negative Ranks	16	13.63	218.00	-0.299	0.765
Positive Ranks	14	17.64	247.00		
Total	3				

Table 7 shows no significant difference between the scientific creativity scale scores of the control group students (z=-0.299; p>0,05). The research tested the significant difference between the experimental and control group post-test Scientific Creativity scores with the Modeling and Computer-Aided Learning methods.

Table 8. Control and Experimental Group SCS Post-test Mann Whitney U Test Results

Group	N	Mean Rank	Sum of Ranks	U	z	p
Control Group	33	25.27	834.00	273.00	-3.486	0.000
Experimental Group	33	41.73	1377.00			
Total	66					

Table 8 shows a significant difference between the groups due to Mann-Whitney U (U:273.00; p<0,05). However, when the means are examined, it is seen that the experimental group has more points and makes a significant difference. The results of the descriptive analysis of the sub-dimensions of the scientific creativity scale are presented in Table 3.

In the study, a significant difference was tested between the pre-test LTGT scores of the students in the experimental group and those in the control group. Also, the normality test results for LTGT are presented in Table 9.

Table 9. Shapiro-Wilk Scores of LTGT Scores of Controls and Experimental Groups Results

Group	Statistics	df	p
Experimental Group	0.949	33	0.121
Control Group	0.936	33	0.530

The scores obtained by the control and experimental groups from the LTGT pre-test show normal distribution, and the independent group's t-test results are presented in Table 10 for this purpose.

Table 10. Control and Experimental Group LTGT Pre-test Independent Samples t-Test Results

Group	N	$\bar{x}$	S	Sd	t	p
Control Group	33	3.6970	2.3114	64	-1.130	0.787
Experimental Group	33	3.0606	2.2630			
Total	66					

When Table 10 is examined, it is seen that there is no significant difference between the scores of the experimental and control groups from the LTGT pre-test. The research found a significant difference between the pre-test and post-test Logical Thinking Group Scores of the experimental group students studying with the Modeling and Computer-Aided Learning method. The LTGT scores of the experimental group showed normal distribution, and the dependent group's t-test was performed for this purpose.

Table 11. LTGT Pre-Post Test Dependent Samples t-Test Results of Experimental Group

Group	N	x̄	SS	Sd	t	p
Pre-Test	33	3.06	2.263	32	-4.735	0.000
Post Test	33	5.45	2.017			
Total	66					

According to Table 11, a significant difference was found between the LTGT scores of the experimental group. The research tested a significant difference between the pre-test and post-test Logical Thinking Group scores of the control group students. The control group's scores from the LTGT pre-post test showed a normal distribution, and the dependent groups were subjected to a t-test.

Table 12. Control Group LTGT Pre-Post Test Dependent Samples t-Test Results

Group	N	x̄	SS	Sd	t	p
Pre-Test	33	3.370	2.311	32	-0.391	0.698
Post Test	33	3.394	2.221			
Total	66					

According to Table 12, it is seen that there is no significant difference between the LTGT of the control group students. The study tested a significant difference between the experimental and control group students' post-test Logical Thinking Group scores. An Independent data t-test was performed because the data showed normal distribution.

Table 13. Control and Experimental Group LTGT Post-test Independent Samples t-Test Results

Group	N	x̄	SS	Sd	t	p
Control Group	33	3.9394	2.2212	64	2.901	0.005
Experimental Group	33	5.4545	2.0169			
Total	66					

According to Table 13, it was found that there was a significant difference between the groups' scores obtained from the LTGT post-test. Also, the normality test results for AAT are presented in Table 14.

Table 14. Shapiro-Wilk Results of Control and Experimental Group's AAT Pre-Test Scores

Group	Statistics	df	p
Experimental Group	0.969	33	0.448
Control Group	0.953	33	0.163

In the study, a significant difference was tested between the pre-test academic achievement scores of the students in the experimental group and those in the control group. The Mann-Whitney U test was performed because the data did not show normal distribution.

Table 15. Control and Experimental Group AAT Pre-Test Mann Whitney U Test Results

Group	N	Mean Rank	Sum of Ranks	U	z	p
Control Group	33	34.23	1129.50	520.50	-0.321	0.756
Experimental Group	33	32.77	1081.50			
Total	66					

When the Mann-Whitney U results were examined according to Table 15, it was found that there was no significant difference between the groups (U: 520.50; $p < 0.05$). However, when the averages are taken into consideration, it is seen that the mean of the control group is higher but does not make a significant difference. Since the data did not show normal distribution, the Wilcoxon sign test was performed. Wilcoxon signal test results are presented in Table 16.

Table 16. AAT Pre-Post Test Wilcoxon Sign Test Results of Experimental Group

Before Education-After Education	N	Row Average	Row Total	Z	p
Negative row	2	11.75	23.50	-4.598	0.000
Postive row	31	17.34	537.50		
Equal	0				

Table 16 shows a significant difference between the academic achievement test scores of the experimental group ($z = -4.598$; $p < 0.05$). The research found a significant difference between the pre-test and post-test Academic Achievement scores of the control group students.

Table 17. AAT Pre- Post Test Wilcoxon Sign Test Results of Control Group

Before Education-After Education	N	Mean Rank	Sum of Ranks	Z	p
Negative Ranks	3	7.17	51.50	-4.545	0.000
Positive Ranks	29	17.47	506.50		
Total	1				

Table 17 shows a significant difference between the scores of the control group students ($z = -4.545$; $p < 0.05$). In the research, a significant difference was found between the post-test Academic Achievement scores of the experimental group and the students in the control group. The data obtained from the Academic Achievement test were first tested for normality. AAT scores of the groups were not normally distributed, and the Mann-Whitney U test was performed for this purpose.

Table 18. Control and Experimental Group AAT Post-Test Mann Whitney U Test Results

Group	N	Mean Rank	Sum of Ranks	U	z	p
Control Group	33	24.23	799.50	238.500	-3.956	0.000
Experimental Group	33	42.77	1411.50			
Total	66					

Table 15-18 shows no significant difference between the groups' scores from AAT. ($U: 238.500$; $p < 0.05$). When the averages are taken into consideration, it is seen that the control group has a higher average, and this difference is significant.

DISCUSSION AND CONCLUSION

This study investigated the effects of modeling and computer-aided teaching on the creative thinking, logical thinking skills, and academic achievement of seventh-grade students. The correlation between creative thinking, logical thinking skills, and academic achievement has yet to be studied. The quantitative findings obtained during the study were analyzed and interpreted using various statistical methods. The scores of students from the scientific creativity scale were analyzed. Before the study, no significant difference was found between the scores of students from the SCS pre-test (Table 5). The result of no significant differences shows that the students had similar levels. There was no difference in the pre-test results between the experimental and control groups. In such cases, the experiment and control group are at a similar level (Korkut, 2005). The fact that the students have a similar level contributes to a more accurate measurement of the quality of pre-test and post-test scores of the experimental group compared to those within the group. A statistically significant difference exists between the experimental group's pre-test and post-test scientific creativity scores (Table 5). There is no statistically significant difference between the control group's pre-test and post-test scientific creativity scores (Table 7). Post-test scientific creativity scores of the groups were compared with statistically significant differences between the scientific creativity scale scores of the group's students (Table 8). When experimental group students were compared with the control group students, they were found to get higher scores on the scientific creativity scale. The amount of development in the scientific creativity levels of students was found to be higher in the experimental group, which received modeling and computer-aided teaching compared with the control group. Similarities were found in pre-test scores when the scientific creativity scale subscales were examined.

When the scientific creativity scale is examined, there are similarities between the groups regarding the pre-test results of the scientific creativity scale according to the descriptive results. Post-test scores of the groups from scientific creativity scale subscales were analyzed. Experimental group students were found to have higher arithmetic mean than control group students (Table 3). The main possible reason for this difference is that students'

modeling and computer-aided teaching materials enrich the learning process from various aspects. The foundations of scientific creativity consist of eight sub-dimensions (Demir, 2015). It is essential to use appropriate teaching materials to develop each sub-dimension. Computer-aided and modeling-assisted teaching develops students' scientific creativity by developing alternative, probability, and different thinking skills.

At the same time, scientific creativity is supported by the attainments that constitute the modeling and computer-aided teaching academic achievement test applied in astronomy. When the literature is reviewed, studies supporting the results of the present study can be found (Arslan, 2013; Demirhan, 2015; Ulukök, 2012). Studies show that computer-aided and modeling-based teaching contributes to developing many skills, especially scientific creativity. Students' preliminary and final test scores are qualified as proof of this condition. However, some studies contradict the present study, stating that computer-aided or modeling-assisted teaching does not affect students' scientific creativity (Bolu, 2017). Bolu (2017) researched the effect of modeling-based science education on students' creativity regarding the "Transmission of Electricity." As a result of the study, it was concluded that modeling-based science education did not cause a positive development in students' creativity levels regarding the "Transmission of Electricity." On the other hand, computer and modeling-assisted teaching increases students' scientific creativity (Arslan, 2013; Bolu, 2017). In addition to the findings of this study, some studies found no difference between the experimental and control groups regarding students' scientific creativity (Demirhan, 2015).

Especially in our age, transforming information into different forms increases the importance of computer and modeling-assisted teaching methods. Students must offer their learning methods and alternative solutions regarding their scientific creativity. Individuals with scientific creativity are more likely to develop other skill levels (Aktamış & Ergin, 2007).

Students' scores from the logical thinking skills scale were analyzed statistically. No statistically significant difference was found between the pre-test experimental and control groups' logical thinking skills scale scores (Table 10). The result of no significant difference between the groups shows similar levels (Korkut, 2005). Pre and post-test LTGT scores of the experimental group were compared within the groups, and statistically significant difference was found (Table 11). No statistically significant difference was found between the control group's pre and post-application logical thinking skills scale scores (Table 12). Post-test logical thinking skills scores of the groups were compared. There is a significant difference between groups regarding the experimental group (see. Table 13). Experimental group students were found to get significantly higher scores on the logical thinking scale when compared with the control group that was taught with the science curriculum. Compared with traditional methods, students taught with modeling and computer-aided teaching were found to have higher logical thinking skills. When the literature was reviewed, studies with significant differences in favor of the experimental group were found (Çığrık, 2009; Yıldıran, 2004). However, no studies were found in the literature investigating the effects of computer-aided and modeling-assisted teaching on logical thinking skills. However, there are studies in which it has been found that, in contrast to the meaningful effect included in this study, it has no effect or negative effect on logical thinking skills (Ballıel, 2014; Demir, 2004; Demirer, 2009; Gökçe, 2015; Kaplan, 2007). Gökçe (2015) researched the effects of computer-aided teaching on students' logical thinking skills about the "Acids-Bases" subject. No difference was found between the groups in terms of logical thinking skills. Ergün (2013) examined whether model-based activities affected students' logical thinking skills on atom and molecule subjects. The study results showed that model-based activities helped students with high logical thinking skills comprehend the particulate nature of matter in atom and molecule subjects. At the same time, they had lower rates of misconception regarding atom and molecule concepts when compared with students with low logical thinking skills.

The student's scores from the academic achievement scale were analyzed statistically. There were no statistically significant differences between the groups' pre-test academic achievement scale scores (Table 15). Pre and post-test academic achievement scale scores of the experimental group were compared. Statistically, a significant difference was found between the scores of the experimental group students. Statistically, a significant difference was found between the pre-test and post-test academic achievement scores of control group students (Table 17). The renewed lesson curriculum is expected to increase the control group's academic achievement.

For this reason, the comparisons of groups are made through arithmetic means (Pallant, 2016). Post-test academic achievement test scores of groups were compared. Significant differences were found between groups in favor of the experimental group (Table 18). The arithmetic means of the experimental group students were found to be higher than those of the control group. Academic achievement test dimensions were examined. When the students in the experimental group were compared with those in the control group, academic achievement test sub-dimension arithmetic means were higher. When literature is examined, it is seen that computer or modeling-

supported teaching increases academic success studies (Bilal, 2010; Bolu, 2017; Kölemen, 2018; Mor, 2016; Namlı, 2018; Pamuk, 2018; Türk, 2015; Ulusoy, 2011; Ünal, 2005; Zengin, 2019; Zorlu, 2016;).

Unlike the traditional method, computer and modeling-assisted teaching increase individuals' scientific creativity, logical thinking skills, and academic achievement. The reason for this difference between the groups is the modeling and computer-aided teaching in the experimental group. Since this teaching was carried out in addition to the control group, it contributed to students' skills. During the modeling process, the students are asked to control various variables and use more than one skill. For this reason, during the modeling process, students develop their investigative and questioning aspects and psychomotor skills (Demir, 2017). In addition, computer-aided teaching contributes to many students' skills since it includes various software and hardware elements. As seen from the study results, it also develops scientific creativity, logical thinking skills, and academic achievement. It provides significant opportunities for students to develop the skills they have. It contributes to alternative thinking instead of usual questions and answers. Using the two methods together positively affects students' creative thinking skills. As a result of the study, a statistically significant difference can be seen in the experimental group in which computer and modeling-assisted teaching was carried out. Although the result can be statistically generalized, the number of students in the experimental and control groups is relatively low. The theoretical foundations of the ARCS teaching model and the theoretical framework of the study are also common ground. Based on the ARCS instructional design model, it aims to increase the student's motivation, interest, and curiosity toward the course (Hsia, Lai & Su, 2022).

Suggestions

Difficulties and ideas were encountered during and after the study, and suggestions were made to the researchers for further studies. The province where the research is carried out can be changed in subsequent studies to obtain different results. At the same time, changes in the number of samples may reveal different dimensions of the research. After this study, which is limited to the seventh grade "Solar System and Beyond," different units and subjects can be studied. In addition, applications can be made at the seventh-grade level and in all science units and subjects starting from preschool. The data collection tools of the study were determined to reveal the different learning products of the students. In addition, it is recommended that teachers make plans for using time. Planning has an essential place in systematically carrying out planned classroom activities. At the same time, it is recommended that teachers learn various program languages and take in-service training to create products. Further studies can include experimental and control groups with more extended periods and more participants. Conducting studies involving experimental and control groups of individuals from different sociocultural and socioeconomic levels is also recommended.

Limitations

This research is limited to the opinions of 66 students in primary schools in Ordu city center on “Scientific Creativity Scale (SCS)”, “Logical Thinking Group Test (LTGT)”, and “Academic Achievement Test (AAT)” scales.

Statements of Publication Ethics

This study is ethically appropriate with the 2018 decision number of the social and humanities research ethics committee of Ordu University dated 11.09.2018 and numbered 03.

Researchers’ Contribution Rate

The contributions of the authors to this study are detailed in Table

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1’s name	☒	☒	☒	☒	☒	☒
Author2’s name	☒	☒	☒	☐	☒	☒
Author 3’s name	☒	☐	☒	☒	☒	☒

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Development of the Feedback Experience Scale for High School Students

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Abstract

The quality of feedback in education is important for the development of students. Therefore, the lack of a valid and reliable measurement tool revealing the amount and quality of the feedback students receive during the education process stands out. Within the framework of the study purpose, the Feedback Experience Scale (FES) was developed to fill this gap. The study group consisted of a total of 222 high school students in the first application and a total of 1041 high school students in the second implementation. The data were analyzed by Explaratory Factor Analysis using SPSS and by Confirmatory Factor Analysis using the AMOS program. Item analysis and reliability coefficient were found to perform reliability and validity analyzes of the scale. A two-factor scale with 17 items was developed after the analysis of the scale, which had 23 items and three factors before the implementation. Cronbach Alpha (α) reliability of the scale was .91. Internal consistency coefficients were .89 for the "what you do with the feedback" sub-factor and .63 for the "quantity and timing of feedback" sub-factor. According to the results, the scale is a measurement tool validly and reliably determining students' feedback experience.

Keywords: Feedback, feedback experience, scale development, high school students.

Ortaöğretim Öğrencileri için Geribildirim Deneyimi Ölçeği Geliştirme Çalışması

Öz

Eğitimde kullanılan geribildirimlerin kalitesi öğrencilerin gelişimi açısından önemlidir. Bu nedenle, öğrencilerin eğitim sürecinde aldıkları geribildirim miktarı ve niteliğini ortaya koyabilen geçerli ve güvenilir bir ölçme aracının eksikliği dikkat çekmektedir. Çalışmanın amacı kapsamında bu eksikliği gidermek için Geribildirim Deneyimi Ölçeği (GDA) geliştirilmiştir. Araştırmanın çalışma grubunu, ilk uygulama için 222 ortaöğretim öğrencisi; ikinci uygulama için 1041 ortaöğretim öğrencisi oluşturmaktadır. Veriler, SPSS kullanılarak Açıklayıcı Faktör Analizi ve AMOS programı kullanarak Doğrulayıcı Faktör Analizi ile analiz edilmiştir. Ölçeğin güvenirlik ve geçerlik analizleri için madde analizi yapılmış ve güvenirlik katsayısı hesaplanmıştır. Ölçeğin uygulama öncesi üç faktörlü 23 maddeden oluşan madde havuzundan yapılan analizler sonrasında, iki faktörlü 17 madde içeren bir ölçek formu oluşturulmuştur. Ölçeğe ait iç tutarlılık Cronbach alfa katsayısı .91 olarak belirlenmiştir. Analizler sonucunda elde edilen alt faktörler için iç tutarlılık katsayıları; 'geribildirim' .89 ve 'geribildirim miktarı ve zamanlaması' .63 olarak hesaplanmıştır. Elde edilen sonuçlara göre ölçeğin öğrencilerin geribildirim deneyimlerini geçerli ve güvenilir bir şekilde ortaya koyabilen bir ölçme aracı olduğu söylenebilir.

Anahtar kelimeler: Geribildirim, geribildirim deneyimi, ölçek geliştirme, ortaöğretim öğrencileri.

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INTRODUCTION

Increasing the quality of education or ensuring the maintenance of educational development is an important issue for educators, particularly but for the whole society in general. One of the most important elements that have the capacity to increase the quality of education is measurement and evaluation. Measurement and evaluation are considered as the numerical measurement of the learning outcomes in individuals and the judgment made according to the measurement results. However, if the outcomes individuals gain at the end of the learning process are turned into numerical expressions that are not so meaningful for them, they may not be able to predict the level of their own learning experience. Therefore, the concept of "assessment for learning" has gained importance in recent years instead of the concept of "assessment of learning" (Garcia, Garcia-Alvarez & Moreno, 2014; OECD, 2005).

Assessment is an extremely important process for learning because the individual, who receives feedback about his own learning and is aware of his learning experiences, can use all his energy by focusing on the task given to train himself rather than competing with others to be successful. For this purpose, the main activity of learning is informing students during the learning and teaching process in various ways, using various assessment techniques to check whether the lesson is comprehended or not. Assessment refers to the product assessment in learning environments made by measuring what students learn at the end of a unit and the formative assessment made based on process to determine students' learning needs (Liu & Carless, 2006; OECD, 2005). The formative assessment is an alternative to the type of assessment that students are responsible for not being out of the system in order to continue their future educational life. Formative assessment is based on determining the learning needs of students in the process and teaching them accordingly. According to Shute (2007), in this process, it is necessary to increase students' general skills such as comprehension and problem solving in the areas of knowledge, skill and certain content. Focusing on to what extent how successful the students are in line with the objectives by being responsible for their own learning throughout the teaching process, the main point of formative assessment is providing effective feedback.

If the student is not able to perform the expected performance, the feedback refers to the descriptive information given about the deficiencies and errors the student has in order to close the gap between their current performance (Sonmez, 2007; Tok, 2007). Feedback is used in the education process to determine whether the behaviors students are expected to attain are achieved or not (Hattie & Timperley, 2007). During the feedback process, students try to perform the desired performance by comprehending what is expected of them. This increases students' learning and motivation for the class.

Used to provide information about the learning outcome, corrective feedback helps students to self-assess and thus realize their potential. It also enables students to make self-assessment and feel a sense of accomplishment by realizing their own development (Gibbs & Simpson, 2004). The feedback provided helps students to be aware of their own competencies.

Many studies put forth the effectiveness of the feedback made during and after the learning process (Bergil & Atli, 2012; Black & William, 1998; Espasa & Meneses, 2010; Hu & Choo, 2016; Kleinknecht & Groschner, 2016; Roessger, Daley & Hafez, 2018; Woods & Welch, 2018). In their study, Higgins, Hartley, and Skelton (2002) students tried to learn the feedback that can help them understand the subject deeply by acting with intrinsic motivation even though they were aware of the importance of scoring. The study of Bose and Rengel (2009) revealed that if the students were not given sufficient individual feedback about their own learning, they could not progress because they could not determine at what stage they were in from the point of task-related learning goals, knowledge, and skill. Feedback provided to the students are important because they affect their participation in the class by increasing their motivation and because they help correct their mistakes.

The quality of feedback provided in education is important for the development of students' critical thinking skills or knowledge of something. In this context, the lack of a valid and reliable measurement tool measuring the feedback experiences of students by associating the amount and quality of feedback they received during the education process is remarkable. In order to overcome this shortcoming, this study aimed to develop the Feedback Experience Scale (FES). In the study, it was aimed to reveal the quality and amount of the feedback that the students received during the learning process. This study is important as it is a data source for students' current feedback experiences. Thus, it is believed that the scale will contribute to the teachers, relevant experts and program developers since the results obtained from the scale developed will determine whether or not the students received feedback during the evaluation process, and their views on the quality of the feedbacks if they received any, or their views on their beliefs regarding the effect of feedback on their own learning. In addition, the results

obtained from the scale can be a guide for in-service trainings to be developed for teachers by the Ministry of National Education.

METHOD

In the following section, the methodology of the present study is systematically delineated, aligning with the recognized three stages of scale development, encompassing eight steps as outlined by DeVellis (2012). These stages include design, development, and evaluation, each contributing to the comprehensive description of the study group, the nuanced development process of the FES scale, data collection instruments, and rigorous data analysis techniques. The process adheres to the principles and stages that DeVellis (2012) has detailed, emphasizing conceptual clarity, psychometric validation, and empirical justification. The step-by-step articulation of these phases ensures transparency and replicability, underscoring the study's contribution to the research on feedback experiences within the educational setting.

Design Phase

In the present study, the exploration of assessment and feedback experiences among high school students in grades 9 to 12 led to a focused and robust inquiry. The initial inspiration was drawn from the original Assessment Experience Questionnaire (AEQ) by Gibbs and Simpson (2003), a comprehensive instrument encompassing six distinct dimensions. However, the specific focus of our research led us to concentrate solely on three factors related to feedback: “what you do with the feedback”, “quality of feedback”, and “quantity and timing of feedback”. This decision was guided by the theoretical constructs underpinning our exploration and the aim to investigate the intricacies of feedback within the educational context. In the absence of an existing scale aimed directly at high school students' feedback experiences, researchers examined similar studies and created an item pool accordingly. The design phase commenced with the translation of relevant parts of the AEQ from English to Turkish, carried out by three domain experts. Multiple translated forms were consolidated into a unified version by two additional specialists. The process of creating the items of the FES scale started by initially presenting them to the experts. Based on the suggestions provided by the experts, adjustments were made to each item. Throughout this process, no statistical analysis was applied; instead, the items were validated by the experts before implementation and finalized. This rigorous process culminated in the creation of the Feedback Experience Scale (FES), tailored to resonate with the cultural and educational nuances of the population under study. The FES, focusing on feedback, the quality of feedback, and the amount and timing of feedback, formed the core of our research instrument and was crafted with diligence to align cohesively with the theoretical framework of our study.

Development Phase

In the development phase of this study, a meticulous process was followed to create a 23-item scale tailored to reflect the specific context and needs of the exploration of feedback experiences among high school students. Building upon the foundational work of Gibbs and Simpson's (2003) Assessment Experience Questionnaire (AEQ), the research team identified specific factors crucial for forming the Feedback Experience Scale (FES). A five-point Likert scale was utilized, with responses ranging from “strongly disagree (1)” to “strongly agree (5)”. The initial scale was created in alignment with the relevant literature and the research objectives, and was subsequently evaluated by two assessment and evaluation experts, along with a language expert. Necessary adjustments were made, retaining the 23-item form. Additional items related to the selected feedback factors were thoughtfully incorporated into the item pool, guided by previous research findings and theoretical perspectives. The resulting FES was crafted with diligence, maintaining a strong alignment with the theoretical constructs under investigation, and was administered in schools after obtaining the required permissions. This robust development process ensured that the scale resonated with the unique characteristics of the targeted educational context and population.

Evaluation Phase

The evaluation phase centers on the comprehensive statistical assessment of the AEQ's validity and reliability. In the pursuit of identifying the underlying structure of the scale, a series of factor analyses were conducted, including Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). These analyses provided a strong foundation for the scale's measurement properties, delineating its factor structure in alignment with theoretical expectations. To further validate the instrument, item-total correlations were scrutinized, and Cronbach's alpha internal consistency coefficient was calculated to evaluate reliability. These procedures were meticulously carried out, employing appropriate statistical techniques, to ensure the appropriateness and robustness of the scale in assessing the middle school students' feedback experiences. The

rigorous statistical assessment underpins the scale's applicability and contributes to the broader literature on feedback evaluation within educational contexts.

Study Group

In the study, the 23-item version of the FES was subjected to EFA and CFA procedures to investigate its construct validity. Criterion sampling, one of the purposeful sampling methods, was employed. The study group consisted of high school students attending public schools located in the Western Black Sea Region during the 2018-2019 academic year. In order to ensure the construct validity of the scale, 222 students were included in the study for EFA referred as study group 1 and 1041 students for CFA referred as study group 2. First study group were 222 9^{th} (62), 10^{th} (52), 11^{th} (61) and 12^{th} (47) grade high school students. 112 of the students were female, and 110 were male. In order to examine the consistency between the construct of the scale, which was performed by EFA, and the independent sample, data were collected from a different sample group of 1041 students, of which 470 were female, and 571 were male. Second study group consisted of 9^{th} (269), 10^{th} (280), 11^{th} (250) and 12^{th} (242) grade high school students.

Data Analysis

Before embarking on the detailed process of reliability and validity analysis, preliminary checks and assessments were conducted to ensure the integrity of the data. This began with a thorough examination to confirm the absence of missing data, ensuring a complete and robust dataset for further exploration. Additionally, the evaluation of skewness and kurtosis values was meticulously performed to confirm the normality of the distribution, a critical prerequisite for the application of factor analysis techniques. The EFA was conducted using SPSS version 20, and CFA was carried out with the AMOS statistical package. For all the analyses, the significance level was accepted as .05. An in-depth assessment of the mean and standard deviation of the items provided insights into the central tendency and dispersion of the responses, thus setting the stage for the subsequent stages of reliability and validity assessment. The data analysis was conducted in three primary sections, encompassing reliability, validity, and limitations, to provide a comprehensive evaluation of the Feedback Experience Scale.

Reliability Analysis: Within the scope of the reliability analysis of the Feedback Experience Scale, both item-total correlation and Cronbach Alpha values were examined.

Validity Analysis: The results obtained from two different factor analysis techniques, EFA and CFA, were reviewed for validity analysis.

EFA Technique: Principal axis factoring method was used for extraction of factors of the data, and the "varimax" rotation method was used for factor-item distributions. EFA is a statistical technique that aims to explain the measurement with a few factors by combining variables that measure the same structure or quality (Buyukozturk, 2018; Cecen, 2006). To determine whether the measuring tool is relevant for factor analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value and Bartlett's Test of Sphericity were examined. EFA was conducted with SPSS version 21.

CFA Technique: CFA was conducted with an independent group using AMOS statistical software to verify how well the proposed measurement model from EFA fit the empirical data (Byrne, 2001). The findings include:

- Adequate Fit Indicators: NFI, GFI, AGFI, IFI, and CFI values greater than 0.90 indicate adequate fit.
- RMSEA: Smaller than 0.05 indicates a good fit; below .08 indicates an acceptable fit.
- Chi-square to Degree of Freedom Ratio: Below 5 indicates a good fit, but in this study, the χ^2/df ratio was found to be 8.34, greater than 5. This high value was affected by the large sample size (χ^2=983.78, N=1041, sd=118, p= .00).

Limitations and Considerations:

Although the chi-square value is a basic measurement of the relevance between the model and data, there are limitations in its use. A high χ^2/df ratio may still indicate a good model fit if other fit indices are satisfactory (Kline, 2016). According to Hu and Bentler (1999), χ^2/df can be unreliable, especially in large samples. Therefore, relying on other fit indices like CFI, TLI, and RMSEA is recommended. In large samples (N>50), chi-square statistics will be ignored as it mostly rejects relevance between model and data (Bentler & Bonett, 1980; Joreskog & Sorbom, 1993; Kenny & McCoach, 2003).

FINDINGS

In this section, findings related to the validity and reliability works are presented.

Validity of the Feedback Experience Scale

Validity refers to the ability of a test to measure a desired variable without mixing it with another variable (Baykul, 2000; Kane, 2001). Validity in measurement is primarily made to determine whether the scale is appropriate for the characteristics to be measured. Whether the measurement is done in accordance with the rules and whether the measurements reflect the characteristic to be measured are the other issues that require validity in measurement (Mehrens & Lehmann, 1991; Sencan, 2005). In this study, EFA was used to reveal the construct validity for the FES that was intended to be developed. According to Table 1, KMO value of the scale was determined as 0.93. This value shows that the measurements have a sampling adequacy for factor analysis (Sencan, 2005). Bartlett's Test of Sphericity is a hypothesis test to reveal whether the m x m correlation matrix is an identity matrix. If the m x m correlation matrix is an identity matrix, it means that the m x m correlation matrix obtained from the variables is not relevant for factor analysis. According to Table 1, Bartlett's test of sphericity chi-square value was found significant. According to this result, the correlation matrix with m x m structure is not an identity matrix so that, the data set is adequate for factor analysis (BKTD= 1817.26; $p<0.05$).

Table 1. KMO and Bartlett's Test Statistics of the Feedback Experience Scale

KMO and Bartlett's Test	Values
Kaiser-Meyer-Olkin (KMO) Sampling Adequacy	.93
Bartlett's Test of Sphericity Approximate Chi-Square Value	1817.26
Degree of Freedom (df)	136
Significance Level (Sig.)	.00

In the factor analysis process, principal axis factoring was performed as a factor extraction method, and also varimax rotation operation was performed in order to simplify the distribution of items under factors. After the factor extraction, there are 17 items left on the scale. The first factor of the FES namely "what you do with the feedback" has 14 items (g1, g2, g3, g4, g5, g6, g7, g8, g9, g10, g11, g12, g13, g14), and the second factor namely "quantity and timing of feedback" has three items (g15, g16, g17). Factor loadings of the items in FES are shown in Table 2.

Table 2. Factor Loadings of the Items in FES

No	Feedback Experience Scale Items	Factors	
		What You Do with Feedback	Quantity and Timing of Feedback
g1	"The feedback makes me aware of the missing information I have on the subject."	.76	
g2	"The feedback shows me how to do better the next time."	.76	
g3	"The feedback makes me aware of my mistakes."	.75	
g4	"The feedback helps me to understand things better."	.74	
g5	"The feedback guides the learning process."	.71	
g6	"The feedback is effective in improving the quality of learning."	.71	
g7	"The feedback helps me in improving whatever I need to improve in a task (assignment)."	.68	.33
g8	"Once I have read the feedback I understand why I got the mark I did."	.60	
g9	"The feedback essentially helps me understand how well I did compared to others."	.59	
g10	"I carefully read the feedback and try to understand what it says."	.59	
g11	"I use feedback while correcting my assignment."	.57	
g12	"Getting feedback after exam makes me learn."	.53	
g13	"The feedback prompts me to go back over material covered earlier in the course."	.48	
g14	"The feedback helps me with the subsequent assignments."	.43	
g15	"I get feedback in many courses each semester."		.72
g16	"In many courses, I receive feedback on my level of success."		.68
g17	"The feedback comes very quickly."		.64

As seen in Table 2, factor loadings of "what you do with feedback" ranged between .43 to .76. Similarly, factor loadings of "quantity and timing of feedback" ranged between .64 to .72.

According to Table 3, the reliability coefficient of the two sub-factors of the FES is 0.89 and 0.63 respectively. The first factor of the measurement tool was named as "what you do with feedback", and the eigenvalue of this factor is 7.65. The percentage of variance explained for the first factor was found 44.98%. The second factor was named as "quantity and timing of feedback", and the eigenvalue of this factor is 1.48. The percentage of variance explained for the first factor was found as 8.72%.

Table 3. Reliability Coefficients of the Feedback Experience Scale Sub-factors

	What You Do With Feedback (1st Factor)	Quantity and Timing of Feedback (2nd Factor)
Cronbach Alfa (α)	0.89	0.63
Eigenvalues of Factors	7.65	1.48
Explained Variance Percentage	44.98	8.72
Explained Cumulative Variance Percentage	44.98	53.69

It is seen that the two-factor structure of the FES explains 53.69% of the feedback experience. When the psychometric properties of the scale are examined, it can be said that the scale is a valid and reliable measurement tool for determining the feedback experiences of students at high school.

Confirmatory Factor Analysis

After the EFA process, the last version of the scale was conducted to CFA on a different sample group. For the validity of CFA results, fit indices of the model must meet the required cutoff criteria's.

The RMSEA value between 0 and 0.05 suggests a good fit value, and value between 0.05 and 0.08 means an acceptable fit (Brown & Cudeck, 1993; Byrne & Campbell, 1999). The RMSEA value of the CFA model is found to be 0.08, which means an acceptable fit between model and data. The other fit statistics calculated in this analysis such a s CFI, NFI and IFI were found respectively 0.86, 0.84 and 0.85, although these values were close to .90, they were all below this value. According to the calculations, the GFI value being higher than 0.85 and the AGFI value being higher than 0.80 can be accepted as justification for the fit of the model with the data (Anderson & Gerbing, 1984; Cole, 1987; Gulbahar & Buyukozturk, 2018; Marsh, Balla & McDonald, 1988). For this study, the values of GFI and AGFI were found to be 0.89 and 0.85, respectively. The relevant fit indices CFI, GFI, NFI, and TLI are important indicators commonly used to evaluate model fit. However, if all of these indices fall below .9, the model may be considered to exhibit an unacceptable fit. In such cases, researchers may work on alternatives such as restructuring the model or considering some variables in the data set. However, in many cases, it may not be possible for the values of these fit indices to be exactly .9 or above. In a study conducted by Hu and Bentler (1999), it was shown that the model fit could still be acceptable even if the values of these indices were below .90. Therefore, it may be more appropriate to consider other factors in addition to the fit indices when making a decision rather than simply rejecting a model based solely on fit indices.

Figure 1. *Confirmatory Factor Analysis Model*

In the Confirmatory Factor Analysis conducted to validate the Feedback Experience Scale, the resulting diagram, depicted in Figure 1, confirms a two-dimensional structure of the scale, with factor loadings ranging between 0.40 and 0.69. The final version of the scale demonstrates acceptable fit indices, and notably, all factor loadings were found to be statistically significant at the 0.05 level.

Reliability Scores of Feedback Experience Scale

After the validity studies of a scale, reliability analyses should be conducted. In this section, first of all, the descriptive findings of the feedback experience scale for secondary school students were examined. The findings regarding the mean, standard deviation and item-total correlation values of the items are shown in Table 4. Additionally, the item-total correlation coefficients of all items are given in Table 4. Item-total correlation is given because it explains the relationship between the scores obtained from the test items and the total score of the test. Positive and high item-total correlation indicates that the items sample similar characteristics. In general, it can be said that items with an item-total correlation below .20 should not be included in the test (Buyukozturk, 2018).

Table 4. Descriptive Statistics for the Items in the Feedback Experience Scale

No	Feedback Experience Scale Items	Mean	Standard deviation	Item-total Correlation
g10	"I carefully read the feedback and try to understand what it says."	3.84	.98	.59
g14	"The feedback helps me with the subsequent assignments."	3.72	2.26	.42
g13	"The feedback prompts me to go back over material covered earlier in the course."	3.38	1.09	.54
g11	"I use feedback while correcting my assignment."	3.72	1.08	.60
g1	"The feedback makes me aware of the missing information I have on the subject."	3.91	1.03	.69
g5	"The feedback guides the learning process."	3.78	1.06	.68
g9	"The feedback essentially helps me understand how well I did compared to others."	3.47	1.06	.59
g4	"The feedback helps me to understand things better."	3.76	.97	.71
g2	"The feedback shows me how to do better the next time."	3.75	1.04	.74
g8	"Once I have read the feedback I understand why I got the mark I did."	3.78	1.11	.62

g6	"The feedback is effective in improving the quality of learning."	3.63	1.06	.73
g3	"The feedback makes me aware of my mistakes."	3.92	1.04	.70
g7	"The feedback helps me in improving whatever I need to improve in a task (assignment)."	3.61	1.13	.73
g16	"In many courses, I receive feedback on my level of success."	3.00	1.19	.49
g17	"The feedback comes very quickly."	2.82	1.08	.43
g15	"I get feedback in many courses each semester."	3.04	1.20	.45
g12	"Getting feedback after exam makes me learn."	3.69	1.16	.57

According to Table 4, the item-total correlation for 17 items varies between .42 and .74. As can be seen, all of the values are exceeded the recommended cut off point of 0.3 (Field, 2013). This result indicates that the Feedback Experience Scale is associated with the measured properties and thus enhances the reliability of the scale. Additionally, it demonstrates that all items were selected appropriately for the purpose of the scale and reflect the measured properties.

The examination of the means and standard deviations of the items in the Feedback Experience Scale reflects students' overall thoughts on various feedback experiences. Looking at the means of the items, it can be seen that most statements are within the range of 3-point values. This indicates that students tend to think that feedback is generally useful and plays an important role in the learning process.

Regarding the standard deviations, values slightly above "1" are observed for most items. This shows that students' responses to these statements exhibit a more central tendency, meaning that most students give similar responses to these items. However, the standard deviation of 2.26 for the item "The feedback helps me with the subsequent assignments" suggests that responses to this item have a wider distribution. This may indicate that students' thoughts on this issue may be more diverse.

DISCUSSION & CONCLUSION

The primary aim of this research was to devise a reliable and valid scale that measures and evaluates the feedback experiences of Turkish high school students in grades 9 to 12. It specifically emphasizes the quality, quantity, timing, and interaction of feedback a fundamental aspect of student learning that enhances understanding, challenges overcoming, and attainment of learning goals (Black & Wiliam, 1998; Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006; Shute, 2008). Despite the prominence of feedback in education, the literature reveals a conspicuous gap in assessing both the effects of the feedback process on student achievement and the students' experiences in this process, especially in Turkey. This study endeavors to address this lacuna by meticulously crafting a valid instrument for teachers, administrators, experts, and policymakers, thereby enriching our grasp on student needs and strategizing to render the feedback process more effective and purpose-driven.

Feedback's role in education extends beyond mere evaluation and can profoundly impact learning permanence (Hattie & Timperley, 2007). Various studies have explored feedback's nature, including examinations of teacher comments (Brookhart & Moss, 2009; Chase & Houmanfa, 2009; Mutch, 2003) and comparisons between basic and detailed feedback (Chase & Humanas, 2009). Literature emphasizes timely, specific, accurate, and purposeful feedback that contributes positively to student performance (Burnett & Mandel, 2010; Irons, 2008; Lee, 2017; Noor, Aman, Mustaffa & Seong, 2010; Poulos & Mahony, 2008). Indeed, feedback's influence reaches beyond content, affecting students' overall learning experience (Askew & Lodge, 2000; Butler & Winne, 1995; Guven, 2004; Higgins, Hartley, & Skelton, 2002; Ilgen, Fisher & Taylor, 1979; Lipnevich & Smith, 2008; Nicol & Macfarlane Dick, 2006; Panasuk & Lebaron, 1999; Peterson & Irving, 2008; Poulos & Mahony, 2008). In this broad literary context, the current study aims to develop a tool for measuring and evaluating the multidimensional aspects of feedback experiences.

Also, the study conducted by Akkuzu & Uyulgan (2014) focused on developing a feedback scale to measure prospective teachers' thoughts and affective reactions. Two factors, namely professional development and anxiety, highlight the multifaceted nature of feedback. The emphasis on professional development resonates with the current study's focus on enhancing student learning, while the exploration of anxiety adds a unique dimension, reflecting specific concerns for prospective teachers.

The focus on feedback in this study presents an interesting parallel with the dimensions "What You Do with Feedback" and "Quantity and Timing of Feedback" identified in our research. Akkuzu & Uyulgan's (2014) dimension of professional development may articulate the complexity of how feedback affects learning and

personal growth, and how it aligns with the ability to overcome challenges. Likewise, the anxiety dimension can aid in understanding students' emotional reactions to the timing and amount of feedback.

Additionally, another research by Onlu, Abdusselam & Yilmaz (2022) identified three dimensions: mastery, positive affect, and negative affect. The emphasis on mastery aligns with our focus on feedback as a means of overcoming challenges and attaining learning goals. The recognition of positive and negative affect underscores the affective reactions and the overall learning experience that are congruent with our exploration of the "Quantity and Timing of Feedback" dimension.

In this rigorous academic endeavor, the Feedback Experience Scale (FES) was subjected to validity and reliability analyses, correlating the multi-dimensional aspects of feedback experienced during the education process. Six items were excluded, resulting in a robust 17-item scale with two factors, utilizing a 5-point Likert scale. A higher total score on the scale signifies a more positive feedback experience, aligning with the principles of timely, specific, accurate, and purposeful feedback. The Cronbach Alpha (α) reliability was found to be .91, while the Exploratory Factor Analysis (EFA) affirmed the construct validity, unveiling the structure encapsulating students' feedback experiences.

This scale stands as a novel contribution to the existing body of knowledge, tailor-made for the Turkish context. Educators can leverage the FES to pinpoint areas requiring refinement. For instance, a deficiency in feedback details could prompt a more comprehensive approach. Administratively, the scale could inform policies or training programs, possibly culminating in standardized feedback guidelines or teacher development modules across various educational institutions. Additionally, the FES might find applicability across diverse learning landscapes, such as online education or vocational training. Hypothetical case studies could elucidate how an educational district utilized the scale to overhaul feedback practices, delineating resultant enhancements. Consideration of the cultural and social milieu is paramount, as feedback mechanisms often mirror regional societal norms, values, and traditions (Boud & Molloy, 2013). Specialized studies exploring these interconnections are encouraged, offering fertile ground for further research.

Moreover, employing methodologies such as Item Response Theory (IRT) and cross-validation with other psychometric tools could enrich the instrument's reliability and validity, creating a more vibrant understanding of feedback. This methodological triangulation aligns theoretical underpinnings with pragmatic applications, fostering a more adaptive feedback environment for students across varied learning contexts.

In conclusion, the developed scale stands as an innovative tool to gauge students' feedback experiences, taking into account an array of demographic variables. This study sets a foundational precedent for future research, illuminating feedback's role across educational stages and contributing significantly to our comprehension of feedback's vital function in education. The meticulous work conducted herein promises to facilitate educational stakeholders in assessing and enhancing feedback quality, thereby propelling the field toward a more informed and student-centered approach.

Statements of Publication Ethics

The ethics committee report of this research was obtained from Bulent Ecevit University Human Research Ethics Committee (Date: 29/03/2019, Protocol number: 540).

Researchers' Contribution Rate

All authors have participated sufficiently in the work to take public responsibility for the content, research design, analysis, methodology, data collection, resources, discussion, conclusion, writing - review & editing.

Conflict of Interest

There are no conflicts of interest in this study.

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APPENDIX

Appendix A. Items of the Turkish Form of Feedback Experience Scale

No	Feedback Experience Scale Items
1	Geribildirimler konu hakkında eksik bilgilerimin farkına varmamı sağlar.
2	Geribildirimler çalışmamın bir dahaki sefere nasıl daha iyi yapabileceğimi gösterir.
3	Geribildirimler hatalarımın farkına varmamı sağlar.
4	Geribildirimler bana bir şeyleri daha iyi anlamam konusunda yardım eder.
5	Geribildirimler öğrenme sürecinde yol göstericidir.
6	Geribildirimler öğrenmenin kalitesinin arttırılmasında etkilidir.
7	Bir çalışmada (ödevde) neyi geliştirmem konusunda geribildirimler bana yardımcı olur.
8	Geribildirimi okuduğum zaman neden o puanı aldığımı anlarım.
9	Geribildirimler, temelde diğerlerine göre ne kadar iyi yaptığımı anlamamı sağlar.
10	Geribildirimi dikkatlice okur ve ne söylediğini anlamaya çalışırım
11	Ödevimde düzeltme yaparken geribildirimleri kullanırım.
12	Sınav sonrasına geribildirim almam öğrenmemi sağlar.
13	Geribildirim, derste kullanmış olduğum materyallere tekrar göz atmam için beni yönlendirir.
14	Geribildirimler sonradan verilen ödevlerde bana yardımcı olur.
15	Her dönem birçok derste geribildirim alırım.
16	Birçok derste, başarı düzeyim konusunda geribildirim alırım.
17	Geribildirimlerin bana dönüşü oldukça hızlıdır.

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Assessment of Students' Preferred Proof Schemes in the Context of the Analysis Course

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Abstract

This study investigated the proof schemes preferred by prospective teachers in the analytics courses. This study is a case study focused on qualitative data. In this study, an open-ended questionnaire was applied to 12 prospective teachers. They were asked to describe the most memorable proof covered in the analytics 1 and analytic 2 courses. Evaluation of these answers showed that the most memorized proof scheme was the transformational proof scheme. First-year students used their preferred proof method without any structured form. Because they had adequate prior knowledge, they utilized the transformational proof scheme, although this scheme demands upper-class level and academic solid understanding. In conclusion, prospective teachers may show a tendency to display a high-level proof scheme by combining their prior knowledge of the proof with the highest level of memorability.

Keywords: Proof schemes, proof, mathematics education.

Öğrencilerin Analiz Dersi Kapsamında Tercih Ettikleri İspat Şemaları Üzerine Bir İnceleme

Öz

Bu araştırmada öğretmen adaylarının analiz dersinde tercih ettikleri ispat şemaları incelenmiştir. Nitel araştırma yaklaşımın benimsendiği bu çalışma bir durum çalışmasıdır. Araştırmada, 12 öğretmen adayına açık uçlu soru formu uygulanmıştır. Uygulama kapsamında öğrencilere analiz 1 ve analiz 2 dersi kapsamında akıllarında en çok kalan ispat sorulmuş ve yanıtlarındaki ispat şemaları incelenmiştir. Buna göre öğretmen adaylarının akıllarında en çok kalan ispat şeması dönüşümsel ispat şeması olmuştur. Dönüşümsel ispat şeması üst sınıf düzeyi ve yüksek akademik bilgi düzeyi gerektiren bir yaklaşım olmasına karşın, bu çalışma kapsamında birinci sınıf öğrencilerinin dönüşümsel ispat şemasını tercih etmesinin sebebi öğrencilerin herhangi bir yapılandırılmış format olmadan, kendi tercih ettikleri ispatı yapmaları ve dolayısı ile yeterli ön bilgiye sahip olmaları ile açıklanabilir. Sonuç olarak öğretmen adayları akılda kalıcılık düzeyi en yüksek ispatı ön bilgileri ile birleştirerek üst düzey bir ispat şeması sergileme eğilimi gösterebilirler.

Anahtar kelimeler: İspat şemaları, ispat, matematik eğitimi.

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INTRODUCTION

Mathematics is not just a result-oriented science but also relies on process and casualty. Mathematics is a discipline of proof, which is its main difference from any other discipline. Axioms, definitions, theorems and their proofs build the scaffold of this scientific discipline (Heinze & Reiss, 2003). Mathematical proof is the core of mathematics and constitutes the center of this discipline (Almeida, 2003; Knuth, 2000; Saeed, 1996; Tall, 1995) because mathematics is involved in revealing relations, predictions, relating the concepts, validation of statements and generalization of new knowledge (Schabel, 2005). It elicits connection forms different than notorious habits of arithmetic and algebra (Barnard & Tall, 1997).

Due to the significance and role of proof in mathematics courses, it is a time-consuming subject, especially in higher mathematics education. The foremost purpose of advanced mathematics courses is to provide students with the ability to prove and is considered an assessment of students' competency and performance on mathematical proofs (Weber, 2001). In addition, higher mathematics university students struggle with mathematical proof, although it is of paramount importance and is emphasized in undergraduate education (Harel & Sowder, 1998; Dreyfus, 1999; Almeida, 2000; Jones, 2000; Weber, 2001). Many studies were conducted to account for the underlying reason of struggle for mathematical proof. In the studies we have reviewed several studies that investigate the approach of teachers, prospective teachers and students towards proof, their internalization of proof and processes of proving (Cusi & Malara, 2007; Housman & Porter, 2003; Knuth, 2002; Sarı et al., 2007). The majority of these studies were focused on the proof schemes that investigate the approaches toward the proof process.

Harel and Sowder (2007) defined the term proof scheme to describe the idea of proof of a person or community. A proof scheme is an argumentation method that one utilizes to convince oneself and others of the correctness or falsity of a mathematical situation. There are many classifications of proof schemes in the literature (Balacheff, 1987; Harel & Sowder, 1998; Miyazaki, 2000). Harel and Sowder (2007) indicated that they related the concept of proof schema with other taxonomies (Balacheff, 1988; Bell, 1976), and they formed their own conceptual framework with the help of sources about the roles and functions of proof (Balacheff, 1988; Bell, 1976; Hersch, 1993) when definitions and taxonomies were insufficient. According to Harel and Sowder (1998), "proof scheme" is the founding member of this framework which is formed with the help of aforementioned sources. This study includes proof schemes described by Harel and Sowder (1998), as it provides comprehensive context.

Harel and Sowder (1998) classified proof schemes as follows:

1. External Conviction Proof Schemes: In this scheme, one convinces oneself and others using something external. Students who utilize these proof schemes understand the original and persuade others using external sources. These sources may emerge in several ways, including an authority based on a book or a teacher (authoritarian proof scheme), the form or appearance of an argument (habitual proof scheme), or the meaningless manipulation of symbols (symbolic proof scheme).

1.1. Authoritarian Proof Scheme: One convinced by rhetoric's of teacher or any other authority. This type of learned helplessness come out as "I don't remember," "I need to check it from the book."

1.2. Ritual Proof Scheme: Here, persuasiveness stems from the form of the evidence, not the content. It can be said that students investigating the validity of an argument exhibit features of the habitual proof scheme when they decide under the influence of the structure of the argument and the routine formats of the proof instead of the accuracy of the argument (Martin & Harel, 1989). For example, when students accustomed to the traditional curriculum try to structure their proofs, they utilize only inductive argumentation by sticking to the inductive stages that they learned in school. However, when they structure it without the logical deduction between "P(k) for n=k and P(k+1) for n=k+1;" they may show reactions related to the habitual proof scheme. According to Sowder and Harel (1998), student who exhibits reactions demonstrating the external habitual proof scheme may doubt that their proofs might not be sufficient, because their arguments are structured in a way that does not contain enough mathematical notation or calculation, even if they form reliable arguments.

1.3. Symbolic Proof Scheme: Persuasiveness in symbolic proof is achieved by manipulation of symbols without knowing its meaning. When students handle symbols without referring to their quantities in that situation in a meaningless way, they show features that show the symbolic proof scheme. In this case, it can be said that the exact thinking of the students is based on external sources. The better nature of symbolic ratiocination is the well-known power of symbols, especially in algebra. For example, in linear equations of four operations, one may not have to relate each step of the meaning process concerning the context of the problem. One exhibiting features of

the transformational proof scheme, described later, can elaborate correct symbolic reasoning in many situations (Sowder & Harel, 1998).

2. Empirical Proof Schemes: Students who display features related to this proof scheme validate or reject assumptions based on physical evidence or sensory experience (Harel & Sowder, 1998). Empirical proof schemes might be either inductive or perceptual and it is divided into inductive proof scheme and perceptual proof scheme.

2.1. Inductive Proof Scheme: Students utilizing this proof scheme take one or more examples into consideration, convincing proofs to point out the general truth. Arguments are based on special situations and examples.

2.2. Perceptual Proof Scheme: Students that exhibit this scheme use their foresight to sense the truth and false but they cannot find strong evidence. Also, they utilize drawings to convince others. They are able to find solutions to geometry problems with the help of one or more drawings. However, these students cannot do transformations and lack the insight to see the results of those transformations while using this proof scheme (Harel & Sowder, 1998). Students generally draw conclusions devoid of inductive inferences and based on insufficient cognitive thinking; however, they find those conclusions persuasive for themselves and others.

3. Analytical Proof Schemes: Students who exhibit features of these proof schemes validate the assumptions through logical deduction and they also go beyond the application of propositions that are formed by specific logical rules deduced from cases accepted as correct without proof (Harel & Sowder, 1998). This scheme is either transformational or axiomatic.

3.1. Transformational Proof Scheme: In this proof scheme, one convinces oneself or others by a deductive process. In this process, students takes generalizable cases into consideration, they apply result-oriented cognitive operations and switch between definitions, theorems, and figures. This scheme has three features: generalization, operational thinking, and logical deduction. Students exhibiting features of this scheme provide justifications related to general aspects of cases. Logical deductions are aimed at inserting the assumptions into analytical frameworks. Transformational observations related to this scheme include goal-oriented operations and anticipation of their results. This process is executed to leave certain relations unchanged. When a change is encountered, students predict its possible results and try to seek balance by applying necessary operations (Sowder & Harel, 1998). For example, general structure counting in this scheme includes exact thinking without finding a pattern. Essentially, the aforementioned transformation is to see the structure behind the pattern, which is hard to see. The transformations that students utilize in that regard can be limited by the perception of mathematical content or units of defense. Thus, a transformational proof scheme can be described as a delimited analytic proof scheme (İskenderoğlu, 2016). In other words, transformational proof schemes can be evaluated as a base for axiomatic proof schemes (Sowder & Harel, 1998).

3.2. Axiomatic Proof Scheme: This scheme possesses the features of transformational proof schemes and in addition students realize that mathematical systems are based on cases that are approved without proof (Housman & Porter, 2003). In the data bases of mathematics, the subsequent results are deduced from previous ones. A careful arrangement is made by only undefined terms, assumptions, theorems and definitions (Sowder & Harel, 1998). Students exhibiting features of this proof scheme are aware that the starting point of a mathematical justification is undefined terms and axioms, and they have the ability to work comfortably with such a system (Harel & Sowder, 1998; Sowder & Harel, 1998).

Several studies were conducted in this field to demonstrate the proof schemes of prospective mathematic teachers who are studying either in a primary school or middle school program (İskenderoğlu, 2010; Sarı et al., 2007; Şengül & Güner, 2013; Weber, 2010).

According to Hart (1994), to correctly demonstrate students' proof processes and grounds of mistakes they made in this process, we need to construct cognitive based studies to investigate their thought processes (Weber, 2001). One of the most significant lessons in university level curriculum of mathematics is the analysis course (Hartter, 1995). However, the literature lacks a sufficient number of studies on proof studies in the analysis field. On the other hand, a detailed classification of pre-existing proof scheme that students utilize will provide different and vital contribution to the literature. Results of such a study exclusively on analytic field will provide educators information about students' preferences and attitude for proof scheme and its subject. An education that considers students' preferences for proof scheme will be more beneficial than the contemporary education.

This study investigated the most memorable proofs for prospective mathematic teachers after analysis 1 and analysis 2 courses and which proof scheme they were evaluated under

METHOD

In this special case study, a mixed method was used. The document analysis was conducted with descriptive scanning in the quantitative dimension and document analysis on the proof problems in the qualitative dimension. This study is an example of the holistic multiple-case design type among case study designs because this design houses multiple cases that can be regarded as holistic on their own. Each case is interpreted holistically in itself and then compared to one another. A deep investigation into one or more cases is the main feature of case studies. In other words, this study design holistically investigated all the factors related to a specific case [e.g., context, individuals, events and processes] and focused on how those factors and relevant cases affected each other (Yıldırım & Şimşek, 2000). Thus, it evaluated and attempts to make sense of the behaviours of an individual in the context in which it occurred. In our study, proof preferences of prospective teachers were evaluated by the same holistic approach.

Prospective teachers were asked to describe the proofs that they remember the most, and these proof schemes were divided into characteristically groups by analysis of their content, according to the proof scheme inventory. The proof schemes that the prospective teachers had in the proving process were evaluated using Harel and Sowder's (2007) terminology and comments were made. Proof schemes that prospectives possessed during the process of proofing were evaluated and commented on with the terminology of Harel and Sowder [2007]. Each proof that students utilized was coded according to this categorization and proof schemes were tried to be determined. While determining the proof schemes, each scheme was coded. Codings are presented in Table 1.

Table 1. The Characteristics of Participants

Proof Schemes	(Sub)-schemes	Proof scheme Indicators
Extinctional Proof Schemes	Authoritarian Proof Scheme	Tries to construct the proof according to what they have learned in the courses and fail to complete the proof
	Ritual Proof Scheme	Providing superficial proofs by sticking to stereotypes
	Symbolic Proof Scheme	Meaningless manipulation of symbols
Experimental Proof Schemes	Inductive Proof Scheme	Proofs are based on special occasions, and its examples
	Perceptual Proof Scheme	Proofs based on insufficient exact thinking and are thought to be persuasive
Analytic Proof Schemes	Transformational Proof Scheme	Switching between definitions, theorems, shapes and inserting exact thinking into an analytical framework
	Axiomatic Proof Scheme	Generalization by accepting undefined terms and axioms as a starting point

While evaluating the data, two expert academicians were consulted for validity studies. During qualitative data analysis, mostly general content was analysed. Organizing, summarizing and interpreting the collected data are among the basic processes of the analysis (Büyüköztürk et al., 2012). Answers from prospective teachers were given under the categories with frequency and percentage values, and examples of proof schemes were included in the findings section and analyzed by qualitative method.

The sample of this study was determined using the easy sampling method, which is one of the non-probability sampling types. The study group of this research consisted of 12 prospective teachers studying in the Department of Primary School Mathematics Teacher Education, who were available and volunteered.

Research Ethics

All ethical procedures were performed in this study. Ethical permission of the research was approved by Izmir Demokrasi University Social and Human Sciences Ethics Committee. Ethics committee document number is 2022/04-03.

FINDINGS

Proof schemes that prospective teachers remembered the most after courses of analysis 1-2 were included in the following table.

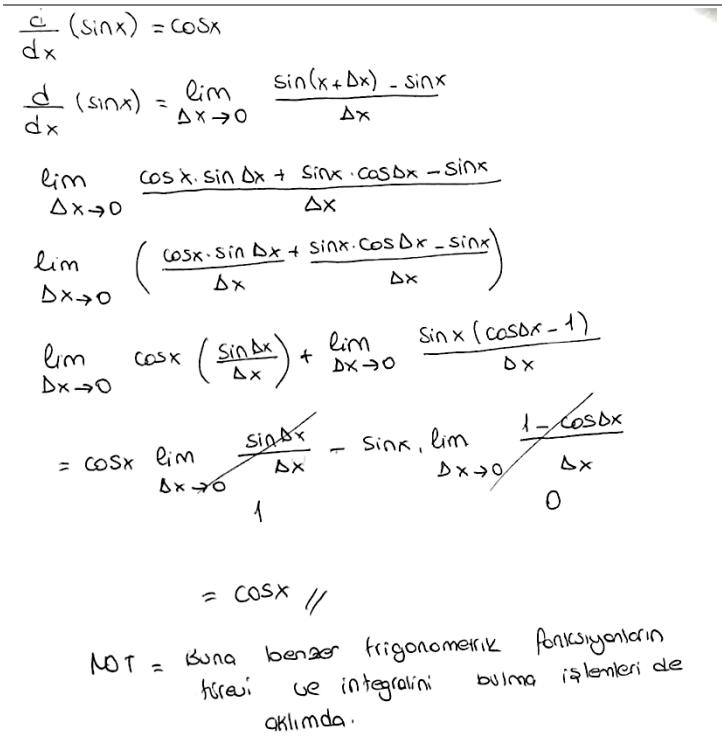
Table 2. Proof Schemes of Prospective Teachers

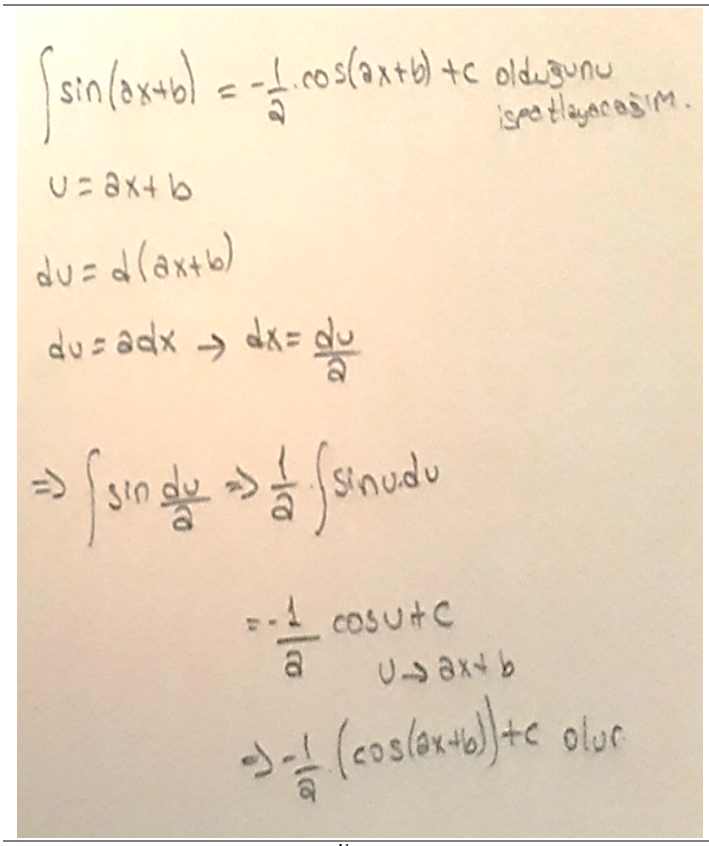
Proof Schemes	(Sub)-schemes	f
Extinctional Proof Schemes	Authoritarian Proof Scheme	-
	Ritual Proof Scheme	-
	Symbolic Proof Scheme	-
Experimental Proof Schemes	Inductive Proof Scheme	-
	Perceptual Proof Scheme	-
Analytic Proof Schemes	Transformational Proof Scheme	12
	Axiomatic Proof Scheme	-

As seen in table 2, indicators of external proof scheme, experimental proof scheme and their subgroups were not evaluated. All of the proof schemes related that were the most remembered ones by the prospective teachers were analyzed as Transformational Proof Scheme which is a sub-category of the analytical proof scheme.

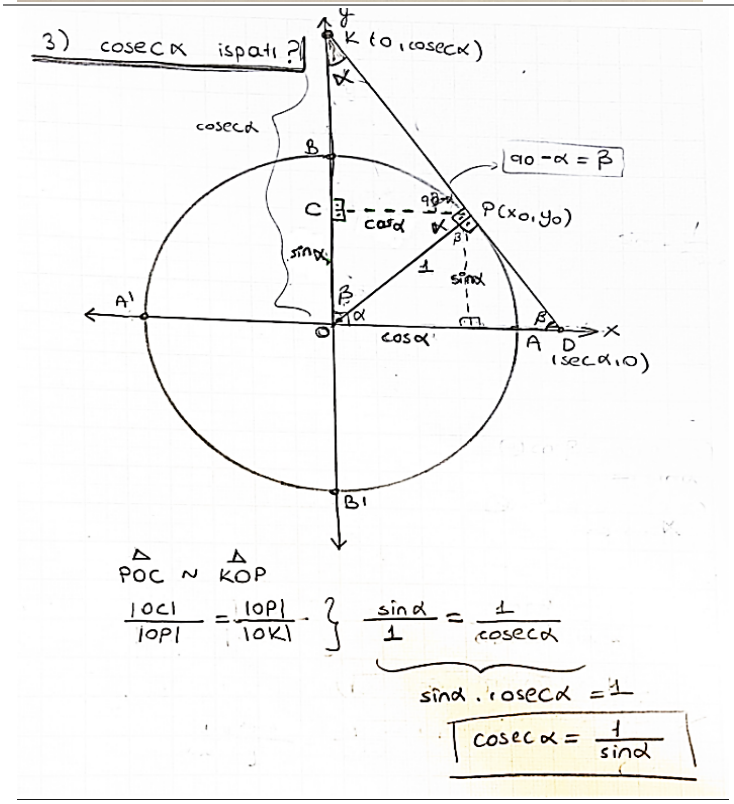
In Table 3 below, some of the most striking proof examples that prospective teachers remembered the most are given, and the proof schemes are explained according to the indicators in Table 1.

Table 3. Exploring the Proof Scheme by Prospective Teachers

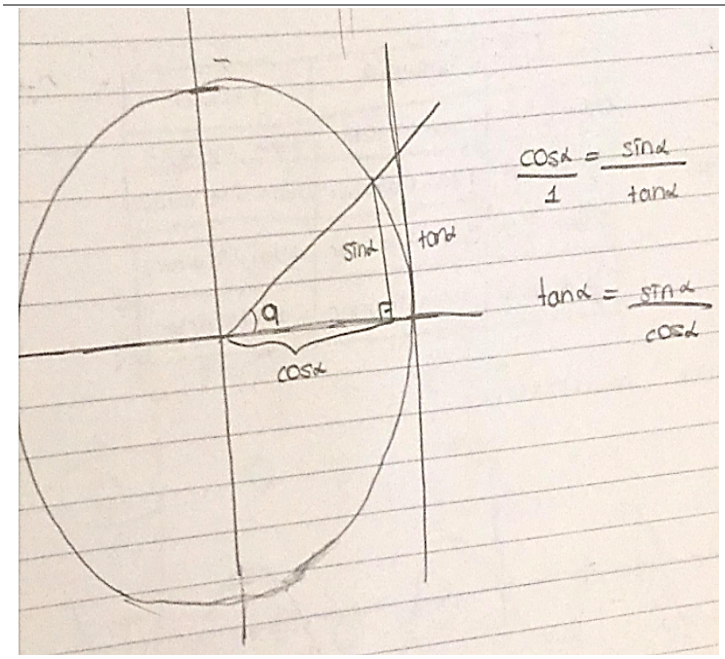
Proof Scheme by Prospective Teachers	Indicators of Proof Schemes
	The trigonometric sum formula, as well as the operation features of trigonometric functions, were employed in this proof. The analytical proof methodology, as indicated by Harel and Sowder (1998), is used to make the transition between definitions and properties. (transformational proof scheme)



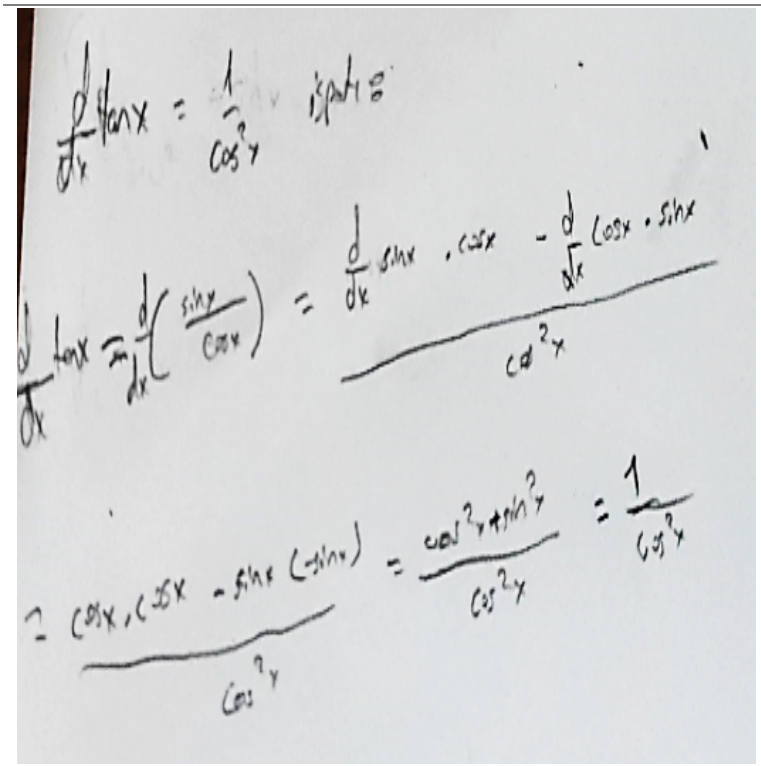
A differential calculation was performed in this proof. In addition to the properties of the trigonometric function, the properties of the integration process are utilised. This is the chart of analytical evidence. (transformational proof scheme)



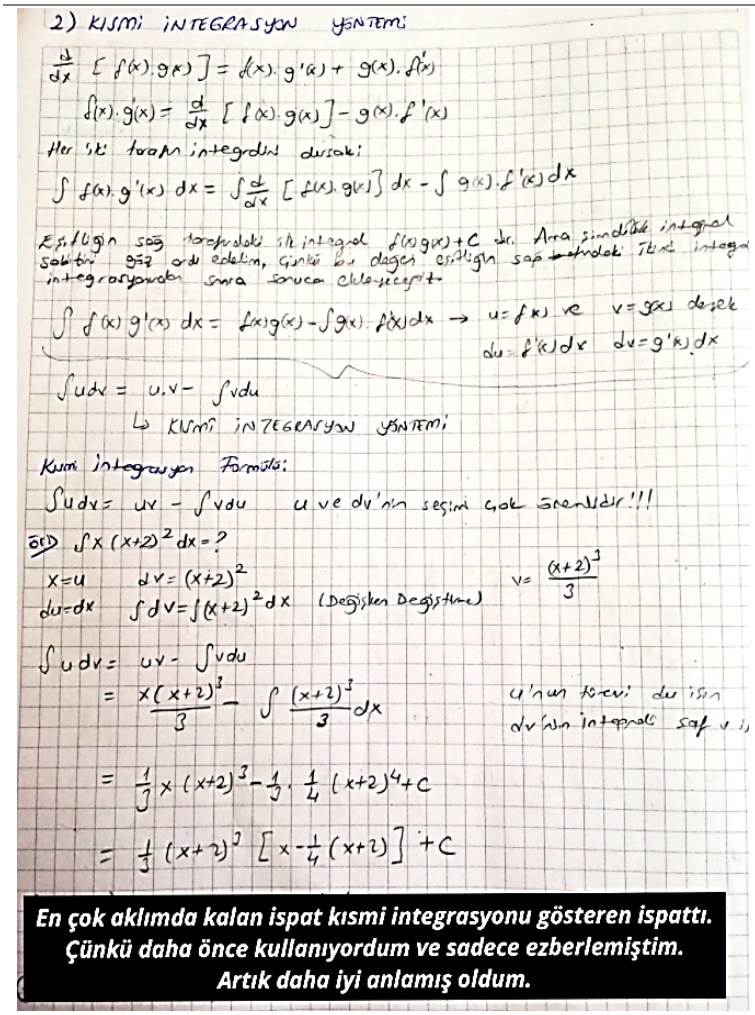
This proof involves a visual process as well. Simultaneously, the theorem of triangle similarity was applied, and a transition was made between theorems. This is the chart of analytical evidence. (transformational proof scheme)



This proof has a very simple visual content. The proof relied heavily on unit circle characteristics and triangle resemblance. This is the chart of analytical evidence. (transformational proof scheme)



In this proof, the operational properties of the derivative and the trigonometric function properties are used together. This is the analytical evidence chart. (transformational proof scheme)



Among the proofs made, this is the only proof that does not belong to the subject of trigonometry. In this proof, the operational properties of the derivative and the basic properties of the differential calculus are used together. This proof is an analytical proof scheme. (transformational proof scheme)

(Student also wrote the following footnote under the proof)

(The proof I remember the most was the proof of partial integration; as I had just memorized it previously. Now I understand better.)

Evaluation of proofs preferred by prospective teachers showed that answers were mostly on trigonometry. Only one student proved the partial integration formula of the integral subject.

DISCUSSION & CONCLUSION

This study investigates the proof schemes that students considered when they are asked to write their most remembered proof type after analytic course 1 and 2. Results showed that the most remembered proof type was analytic proof scheme. Under the title of analytic proof scheme, proofs on trigonometry were the featured the most by the prospective teachers.

Previous studies in this field highlighted the tendency of students to use the proofs in low-level cognitive categories (Coe & Ruthven, 1994; Cusi & Malara, 2007; Harel & Sowder, 2007; Ören, 2007). When the relevant literature is examined, it can be stated that students or teacher candidates mostly showed reactions that exhibit features of external and experimental proof schemes, and as the grade level and academic achievement level increased, proof schemes that require high-level cognitively were observed, which can be attributed to expanding on knowledge. In this study, although prospective teachers were only first grade, they were able to exhibit analytic schemes that require higher cognitive level skills. Since the participating prospective teachers are still first grade student, experimental and extrinsic proof schemes were expected from them rather than analytical proof schemes at the metacognitive level. Because, in different studies in the literature only a minority of prospective teachers exhibited analytical proof scheme, and as they reach upper grade levels they were able do proofings' suitable to analytical proof scheme. For example, a study showed significant difference between the proof schemes used by first and last grade mathematics teacher candidates (Şengül & Güner, 2013). It was determined that first grade prospective teachers mostly used experimental proof schemes and last-year prospective teachers mostly used analytical proof schemes. In a different study on proof schemes (İskenderoğlu, 2010), which was aimed to reveal

the different kinds of proof schemes that prospective teachers use on functions and how the preferences of proof schemes change as the grades differ. Result of this study, revealed that as the grade level of teacher candidates increases, there is an increase in the use of analytical schemes, which are considered the highest level of proof schemes.

In a similar study which also attempts to reveal the features of the proofs chosen by prospective teachers for certain topics and proposals, it was seen that prospective teachers had different proof schemes according to their academic success (Doruk & Kaplan, 2017). In that study, academic achievement level was taken as the independent variable, not the grade of the student. Thus, an indirect relationship between knowledge and proof schemes was determined. Another study that tried to determine the proof schemes utilized by prospective teachers at the fourth grade on trigonometry, showed that the answers were mostly under – the category of analytical proof scheme (Pektaş & Bilgici, 2019). As stated in studies on proof schemes, there is a hierarchical structure (Harel & Sowder, 1998). Thus, it is an expected situation for fourth-grade students to have an analytic proof scheme approach. In this study, other studies in the literature, prospective teachers were asked to do proofing on the subject that they remember the most instead of structured questions or previously dictated subjects. In other words, students decided which subject to focus on their own. Therefore, it is expected that participants will report with high-level cognitive characteristics on their preferred subject that they have learned best and most meaningfully. Therefore, although their knowledge does not match the fourth-grade level, they used the high-level cognitive level proof scheme. As a result, it is possible to say that analytical proof schemes are the desired schemes for the use of students since it is thought to be at the center of mathematical exact thinking. Students utilize this scheme not just for exact thinking but also when adapting previous knowledge to a new situation. Prospective teachers decided which proof scheme to utilize without any constructed question. Results showed that prospective teachers mostly preferred to use analytical proof scheme. This high level of cognitive functioning can emerge only in cases where permanent and associative learning is present. To achieve such learning ability prospective teachers should have sufficient foreknowledge and permanent knowledge. In conclusion, proofs in our study were at the level of analytic proof scheme can be interpreted as independent of grade but related to the fact that subjects learned as a result of casual meaningful and permanent education leads to higher cognitive level.

In addition, the fact that prospective teachers utilize an analytical proof scheme for trigonometry subjects in this study also indicates that they had sufficient prior knowledge about trigonometry. This situation can be explained by that students took trigonometry lessons in middle school where they often encountered proofs related to trigonometry. Thus, this can be interpreted as follows: sufficient prior knowledge on a subject is needed to exhibit analytical proof scheme on that subject. Mathematics is a science based on casualty; thus, doing mathematical proof is of paramount importance. Hence, efficient understanding of linked topics and mathematical concepts is a prerequisite for prospective teachers and students to be successful in doing mathematical proofs. Writing a conclusion is the final part of the research paper, drawing everything together and tying it into initial research. Writing a conclusion involves summing up the paper and giving a very brief description of the results, although you should not go into too much detail about this. The discussion should relate the presented results to those of previous own or other studies, interprets them and draw conclusions. It can outline working hypotheses, theories, and applications. Some suggestions should be made for many target groups, such as implementers, researchers, and educators, in accordance with the findings of this study. Suggestions can also be given under a separate title.

Investigating the capacity of mathematic teachers to do mathematical proof does not illustrate the process of proofing. Thus, studies that incorporate the process of doing proof together with proof schemes can be included in undergraduate education, to provide teachers, researchers and educators with guidance on how to design education for proof learning.

Also, proof schemes that students preferred to utilize can be explored in further depth and the reason of their preferences can be explored. Investigating the factors that may be effective in the evidence schemes preference of prospective teachers (such as the lessons they have taken before, their attitude toward mathematics and their level of motivation) is thought to contribute to increasing the level of proof-making skills that prospective teachers can experience.

Statements of Publication Ethics

This research was reviewed by the Izmir Demokrasi University Social and Humanities Ethics Committee and it was decided that the research was ethically appropriate. Meeting date and ethical decision number: 08/04/2022- 2022/04-03

Researchers' Contribution Rate

This manuscript is a single researcher manuscript. The study was conducted and reported by the corresponding author. The researcher's contribution rate is 100%.

Conflict of Interest

There is no conflict of interest for this study.

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The Effect of PEARL "Emotional Empathic Proximal Learning-Educational Environment" on the Social-Emotional Development of Children Aged 3-4 Years

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Abstract

The interaction of mind and environment are important in the formation of learning, based on the theories of scientists such as Piaget, Vygotsky, Bandura and Montessori. The mind's potential is shaped, diversified and revealed by the environment. This study was produced from the results of the Erasmus+ K201 project coded 2018-1-IT02-KA201-048515, named PEARL "Emotional Empathic Proximal Learning-Educational Environment". This article aims to reveal the effect of PEARL "Emotional Empathic Proximal Learning-Educational Environment" on the social-emotional development of children aged 3-4. The study was conducted with the non-selective semi-experimental research model with the final test control group. The characteristics of this experimental model are the creation of randomly determined experimental and control groups and the determination of the effectiveness of the applied model by the final test. Children from Italy, Turkey, Spain and Lithuania, which are PEARL project partners, participated in the research. 195 children were recruited for robotic activities and 207 for non-robotic activities in schools where the project partners volunteered in their countries. The PEARL Education Model was applied to the children participating in the study before the assessment. After the applications, each child was assessed using the Child Observation Forms by their teachers with the help of video recordings captured. The mean score of the Child Observation Form was obtained by averaging the total and individual country scores. It has been detected that the average in all robotic group children is higher than the average in the non-robotic group. These practical findings confirm the project hypothesis – "Group activities enriched with robotic coding activities develop children's social skills, cooperation skills, and ability to understand and express emotions".

Keywords: early childhood education, early childhood, robotic coding in early childhood, social emotional development.

Pearl "Duygusal, Empatik ve Proksimal Öğrenme Eğitim Ortamı"nın 3-4 Yaş Çocukların Sosyal Duygusal Gelişimlerine Etkisinin İncelenmesi

Öz

Öğrenmenin oluşmasında, Piaget, Vygotsky, Bandura ve Montessori gibi bilim insanlarının teorilerinden de hareketle zihin ve çevre etkileşimi önemlidir. Zihnin potansiyeli çevre ile şekillenmekte, çeşitlenmekte ve açığa çıkmaktadır. Bu çalışma 2018-1-IT02-KA201-048515 kodlu, Erasmus+ K201 projesi olan PEARL "Duygusal, Empatik ve Proksimal Öğrenme Eğitim Ortamı" isimli projeden üretilmiştir. Bu çalışma PEARL Duygusal, Empatik ve Proksimal Öğrenme Eğitim Ortamı'nın 3-4 yaş aralığındaki çocukların sosyal ve duygusal gelişimi üzerindeki etkisini incelemektedir. Araştırma, son test kontrol gruplu seçkisiz yarı deneysel araştırma modeli ile gerçekleştirilmiştir. Araştırmaya, PEARL proje ortakları olan İtalya, Türkiye, İspanya ve Litvanya'dan çocuklar katılmıştır. Proje ortakları ülkelerinde gönüllü olan okullarda, robotlu etkinliklere, toplam 195, robotsuz etkinliklere ise 207 çocuk alınmıştır. Araştırmada, PEARL projesinde çocukları değerlendirmek amacı ile geliştirilen "PEARL Çocuk Gözlem Formu" kullanılmıştır. Tüm robotlu grup çocuklarının ortalamasının robotsuz grup ortalamasından daha yüksek olduğu saptanmıştır. Uygulama sonucunda elde edilen bu bulgular ile proje hipotezi -"Robotik kodlama etkinlikleri ile zenginleştirilmiş grup etkinlikleri, çocuklarda sosyal becerileri, işbirliği yapma becerilerini ve duyguları anlama ve ifade etme becerilerini geliştirir."- doğrulanmıştır.

Anahtar kelimeler: okul öncesi eğitim, okul öncesi dönem, okul öncesi dönemde robotik kodlama, sosyal duygusal gelişim.

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INTRODUCTION

The learning process emerges through the interaction of the mind and environment. The individual makes an effort to explain a new situation s/he has encountered with the schemes s/he created in the past. If an existing scheme explains a new situation, this means reinforcing the previous learning rather than a new learning process. If existing schemes cannot explain a new situation, a new scheme is needed, and the learning process begins. The individual goes through the stages of assimilation, accommodation, and equilibration, respectively during the learning process (Bacanlı, 2011). When new knowledge reaches the equilibration stage, learning is realized. The individual configures information with environmental effects and his/her mental processes (Beilin, 1994; Cole &Wertsch, 1996; Erdem &Demirel, 2002; Vygotsky, 1978). Experiences in early childhood are important in acquiring and structuring information.

It is well known that early childhood education is crucial and unique for the development of an individual. The first 36 months of life is the period when the brain makes the most connections (synapses). Between the ages of two and three, milestones occur in communication and emotional development, as well as in cognitive and motor development. In the sensorimotor stage from birth to age two, babies receive information through their senses by touching, looking, and listening. In the sensorimotor stage from birth to age two, babies receive information through their senses by touching, looking and listening. A baby may not be able to make sense of a particular toy at first, but may represent the object in his/her mind as s/he begins to look, feel, and manipulate it frequently (Kurt, 2020). Piaget states that from the age of one, children begin to develop their sensory-motor skills before their language develops (Piaget, 1965). Yet, in the presence of a new object, without knowing how to speak, the child knows how to assimilate and incorporate this new object into each of her already developed schemes (Bruce et al. 2006).

Vygotsky theorized that interaction with others has a major impact on cognitive development (Hockenbury & Hockenbury, 2011). He believed that a child's mind develops when interacting with others (Bernstein et al., 2008). During this interaction, children use language to ask questions and others respond to them, which contributes to the development of children's cognitive abilities (Babakr, Mohamedamin & Kakamad, 2019; Cacioppo & Freberg, 2013). Albert Bandura, in his social learning theory, developed the idea that human behaviour occurs through interaction between the person and his/her environment. He suggests that learning is a cognitive process that takes place in a social context, primarily through observation, reinforcement, or direct teaching. Montessori, on the other hand, adopts a philosophy emphasizing that every child should be given their sovereignty and freedom. She emphasizes that the five senses should work actively in learning (Koh & Frick, 2010).

Brain and environmental interaction are important for learning, based on the theories of scientists such as Piaget, Vygotsky, Bandura, and Montessori. The potential of the mind is shaped, diversified, and revealed by the environment. Therefore, the most important task of educators is to create deliberate environments in education, to support all areas of mind-oriented improvement, and thus to enhance the environment. Accordingly, the PEARL project, in which this study was produced, is subject to Piaget's Theory of Cognitive Development, Vygotsky's Sociocultural Theory, the Montessori Method, and Bandura's social learning theory. Piaget and Vygotsky configure information from the constructivist approach.

The constructivist approach clarifies what information is and how it is learned (Erdem & Demirel, 2002). It allows the child to experiment with the information s/he got involved in through his/her mechanisms rather than memorizing (Perkins, 1999). Children's active participation in their learning processes and constructing knowledge by experiencing ensures that the learning is permanent (Cole & Wertsch, 1996). Concrete experiences and well-designed materials facilitate for children to construct knowledge. In addition, advisory teachers who have a good understanding of the scaffolding method aim to support the child's developmental potential. Mora Teruel (2018) states that if the events are emotionally meaningful, attention, memorization, and other cognitive processes will improve.

The educational environment encourages the emergence and expression of emotions. There is no learning without emotion. Miller (2002) and Pintrich (2003) stated that learning does not solely mean "cold cognition" of reasoning and problem-solving; They stated that learning and information processing are affected by emotions, that is, “warm cognition” is also important in learning.

With the increasing importance of socially and emotionally supported education programs developed in light of these approaches in recent years, early childhood educators focused on developing socially and emotionally supported education programs. PEARL education is one of these programs. The learning environment

proposed as part of the PEARL model focuses on empathy so that children who engage in activities together can share their feelings and accept diversity. Hence, it creates an educational style that draws attention to diversity. Furthermore, the model cares about the collaborative learning environment. The distribution of roles in collaborative tasks allows children to adopt different perspectives, consider their abilities and challenges and those of their peers, and come to create a final product or achieve a goal or perform a task with the contributions of all. The PEARL model suggested that using robots in education would also be effective. Robots allow children to experiment with materials. It leads to the emergence of emotions, motivation, empathy, and well-being (Deniz et.al,2022).

For these reasons, this study aims to develop and promote an innovative, high-quality and inclusive education model that increases the impact of early childhood education on the physical, mental, emotional, and global well-being of individuals and groups, while promoting positive social values in society, academic institutions, teacher training institutions. The PEARL project, which was conducted to create a network that includes educational institutions, aimed to examine the social-emotional development of children aged 3-4.

METHOD

Method section may include research design, the study group or participants of the study, data collection tools, data analysis.

Research Objectives

The PEARL project aims to develop and test an innovative, high-quality and European-level replicable educational model suitable for developing emotional and empathic skills by supporting zone of proximal development areas of children between the ages of 0-6. Within the framework of this general objective;

• The sub-objectives of the project include establishing an international network of experts and organizations in close cooperation with academia, educational institutions, and teacher training agencies to promote innovative and quality education in early childhood.

• Building a new curriculum for teachers to put into practice an experimental educational model to develop the necessary skills in early childhood.

• Preparing a White book for public institutions and decision-makers at the national and European level on educational approaches and models tested in children aged 0-6.

This study aimed to examine the effect of the PEARL “emotional, empathetic and proximal learning educational environment” on the social-emotional development of 3-4-year-old children.

Research Design

The study was conducted with the non-selective semi-experimental research model with the final test control group. The characteristic of this experimental model is the creation of randomly determined experimental and control groups and the determination of the effectiveness of the applied model by the final test (Büyüköztürk et al., 2016).

Study Group

The research was conducted with children from Italy, Turkey, Spain, and Lithuania, which were PEARL project partners, in the schools which were volunteered from the PEARL Project Partners. For robotic activities; 25 children from Italy, 40 children from Turkey, 60 children from Spain and 70 children from Lithuania participated in the study. For non-robotic activities; 25 children from Italy, 47 children from Turkey, 65 children from Spain and 70 children from Lithuania participated in the study. When there were children with special needs in schools, they were asked to participate in the experimental groups. Thus, robotic activities were held with a total of 195 children, and non-robotic activities were held with a total of 207 children in all countries. The experimental and control groups for the groups aged 3-4 were formed as follows:

• Application of the activity with a robot to a group of 5 children (Experimental Group)

• Application of the activity without a robot to a group of 5 children (Control Group)

Data Collection

“PEARL Child Observation Form” was used to evaluate the effectiveness of the PEARL Education Model.

The Pearl Child Observation Form:

In order to evaluate the effectiveness of the PEARL Education Model, measurement tools that serve to collect quantitative data were developed by the research team. "PEARL Child Observation Form" was prepared

by the Gazi University project team in Turkey, which is one of the project partners. To write the items to be included in PEARL Child Observation Form, discussions were done with researchers in the project partner countries. Project objectives and in the literature (Beilin, 1994; Cole & Wertsch, 2002; Erdem & Demirel, 2002; Ömeroğlu et al, 2015; Santrock, 2011a; Santrock, 2011b; Vygotsky, 1978) were taken into consideration, and categories were determined. These categories are as follows:

- communication,
- group communication,
- collaboration,
- expressing emotions,
- self-expression,
- cooperation,
- coping with challenges,
- creating strategies,
- following the instructions,
- achieving a purpose,
- understanding and managing positive and negative emotions.

The following steps were followed in order to ensure the scope and content validity and reliability of the categories created for the Observation Form and the items created in this context.

- The categories which were determined and listed above were presented to the project partners in order to get feedback whether it was suitable with the project's objectives. Online meetings were planned with the partners so that they can give feedbacks to the categories. The overall feedback of the project partners was to add a category about educational emotions which were well-being, motivation, expressing emotions and prosocial behaviours. Researchers from Turkey had taken notes and they finalised the categories of the form.

- After categories had been finalised, Gazi University project team started to work on the items of the form. Items were prepared by taken into consideration of the categories and the literature. In addition, children's development at 3-4 of age was given importance. Therefore, drafted version of child observation form was created. After that, the expert opinions of the other project partners were taken. For validity and reliability of the form, a literature review is done about the project's objectives.

- After items of the form is written, the items are sent to the experts. The items are revised depending on the expert opinion.

- Before, the project's application, a pilot study was conducted, and two experts filled the child observation form. Project group came together and controlled the data of the two experts. Depending on the data collected by the two experts, some of the items were revised or eliminated.

- Then, adjustments were made to the form, taking into account the feedback of the project partners on adding items related to educational emotions (well-being, motivation, expressing emotions and prosocial behaviour) in the observation forms.

In addition, demographic questions about the child's age and country were added to each form with the opinions of the project partners.

Observation forms were prepared for 3-4 years of age;

- Child Observation Form applied to a group of 5 children who did the activity without a robot
- Child Observation Form applied to a group of 5 children who did the robotic activity

Two observation forms were created for both robotic activities and non-robotic activities. 45 items included the robotic activity form, 40 items is included in the non-robotic activity form. Some items in the forms are intended for positive-desirable, and some are intended for negative-undesirable behaviors. All items in each form are graded with a Likert type between the scores of "0" and "10". The absence of behavior is evaluated as "0", and fulfilment at the highest level is evaluated as "10". For example;

For the item "The child invites his/her teacher to join the game."; If the score 0 (zero) is marked for the item, the child has never invited his/her teacher to the game. On the contrary; If the score of 10 (ten) is marked, it means that the child has invited his/her teacher to the game pretty frequently.

The Pearl Education Activities

The PEARL education model is based on Piaget's approach to learning, Vygotsky's area of proximal development, Montessori's use of materials, and the Constructivist Approach's concepts of active learning and knowledge structuring. The theories of Piaget and Vygotsky form the constructivist basis of the PEARL model. As mentioned previously; "The constructivist approach explains what knowledge is and how it is learned" (Erdem & Demirel, 2002). It does not support the child's memorization of literate but supports the construction of the information with its mechanisms in the process in which s/he is involved by experiencing (Perkins, 1999). It ensures that children actively participate in their learning processes and learn the structuring through experience and knowledge (Cole & Wertsch, 2002). Concrete experiences and well-designed materials make it easy for children to construct knowledge. In addition, educators who have a good understanding of the scaffolding method also aim to support the developmental potential of the child. In the PEARL Educational Model, it is essential to ensure that all children, regardless of their abilities, reach their developmental potential by being included in the education process. The Montessori approach adopts a philosophy that argues that every child should be empowered to their dominance and freedom. It is a child-oriented approach that allows children to learn at their own pace. The Montessori Approach emphasizes that the five senses should work actively in learning (Koh & Frick, 2010). The PEARL Education Model also prioritizes learning by doing and experiencing for children.

The activities for the PEARL Training Model were prepared in a few stages. At the first stage, the project partners held online meetings and discussed the features that educational activities should carry. In the light of the literature (Beilin, 1994; Cole & Wertsch, 2002; Erdem & Demirel, 2002; Ömeroğlu et al, 2015; Santrock, 2011a; Santrock, 2011b; Vygotsky,1978) and within the framework of the theories on which the project is based, it was determined as the first feature that the activities should be prepared by the children and conditions of the country involved in the project. The active participation of children in the activities and providing an opportunity for teacher guidance were among the priorities. In addition, the importance of implementing activities both in a group environment and individually was emphasized (Deniz et. al, 2022).

After determining the main characteristics of the activities, each country that is a partner of the project prepared examples of activities for each age group of children with its team. These prepared activities were presented to the opinion online. At this stage, each country evaluated the activities prepared by the other partner countries in terms of compliance and applicability to the basic criteria by examining the effectiveness. As a result of the evaluation, the activities with the highest score according to the scoring of all partners were selected to be applied in the project. The activities prepared by the Spanish and Lithuanian teams were re-submitted to the revision of the teams for application in the project. The revisions were discussed at online meetings and the activities were finalized.

Two separate versions of the 3-4 age group events are "robotic and non-robotic activities". The theme of the event does not differ according to these two versions. In the activity where the robot is not used, the activity process continues routinely and ends. In the activities where the robot is used, the robot is included in the activity process in the last part of the activity; at the beginning of the activity, children are expected to perform the tasks that they perform themselves, this time through the robot. For example, in the 3-4-year-old activity non-robotic, children try to create sentences of three words with pictorial cards. In the 3-4-year-old activity with a robot, after studying with sentence cards, a robot platform consisting of picture sentence cards is revealed, and children are asked to code the robot and collect the picture cards related to the specified sentence on the platform via the robot.

At PEARL educational activities, Clementoni-produced Robot Doc is used to teach children Robotics and coding skills. Robots are known to help cultivate digital thinking skills (Bers, Flanney, Kazakoff, & Sullivan, 2014). The PEARL Education Model also teaches robots to learn about group sharing, social and communication skills, empathy, creativity, personal expression, and so forth. In this project, robots are used to develop prosocial skills and values.

Implementation Process of Pearl Educational Activities

Before the implementation started, the schools are chosen by the partner countries with convenient sampling. Schools in Turkey and Italy are private schools, and the schools in Lithuania and Spain are public schools with this way variety of the population is tried to be provided. The teachers in the schools in Italy, Turkey, Spain and Lithuania, which are the partner countries of the project, were trained online at an international level on the purpose and process of the project, the observation forms, the activities to be implemented, and the filling of the observation forms. In addition, detailed information meetings were held on the project by providing training to teachers at the national level on the Zoom. After the training, the activities and materials (such as robots) to be used in the application were shared with the teachers.

Children aged 3-4 years in Italy, Turkey, Spain and Lithuania were included in the application. In the project partner countries, the robots were used in the activities developed as part of the PEARL Education Model in the experimental groups; And the same activities were adapted as robot-free variations for the control groups. The teachers, who received the activities and materials, applied some of the five-person groups they created robotics and some non-robotics in their schools. Teachers recorded their practices as videos. During the implementation and evaluation process, the researchers in the project team were in contact with the teachers by e-mail and telephone. With ongoing communication, teachers' questions were answered and their experiences were shared.

After the application was completed, all the teachers participating in the application created many activities under the PEARL Education Model, using their practical experience. These created activities were edited by the experts involved in the project and shared online at an international level for the benefit of program makers, practitioners, and other professionals in the field of pre-school education.

Data Analysis

After the implementations were completed, each child was evaluated with the Child Observation Forms developed within the scope of the project, by watching the video recording by their teacher. The child observation forms filled in by the teachers were hand-delivered by the researchers. The data were evaluated descriptively using the SPSS programme. The mean score was obtained by taking the average of the child observation form scores for each country and in total, and presented as the mean score in the Table 1.

FINDINGS

In this section, the mean scores of 4-years-old children from the observation form items are given in the Table 1.

Table 1. Distribution of child observation form item score means of children in 3-4 age group by country

	Italy		Turkey		Spain		Lithuania		Total	
	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic
The child is interests in participate in the activities	8.0	7.6	8.9	8.4	9	8.9	8.2	8.2	8.6	8.3
The child is anxious when starting the activity	1.4	2.6	2.5	2.3	8.6	8.4	4.0	3.9	4.4	4.4
The child does not lose motivation during the activity	6.5	4.6	6.6	6.8	7.6	8.1	7.0	7.2	7.0	7.0
The child has difficulties following the teacher's directions	4.3	3.3	2.6	2.4	3.2	4.4	4.2	4.6	3.6	3.8
The child endeavours to stay the activity	6.1	6.7	7.6	7.8	8.3	8.4	7.5	7.3	7.6	7.6
The child wants to quit the activity when confronts a difficulty during the activity	2.1	2.8	2.7	3.2	2.2	2.4	3.4	3.9	2.8	3.2
The child is willing to deal with the difficulty confronted during the activity	6.6	6.7	6.5	6.1	7.4	7.1	6.6	6.3	6.8	6.5
The child becomes upset when having difficulty during the activity	3.4	3.0	4.4	3.9	2.4	2.7	4.1	4.6	3.7	3.7
The child becomes happy when dealt with difficulty during the activity	6.0	4.6	8.5	7.9	7.3	7.7	3.2	2.1	5.9	5.3
The child expresses negative feelings with a gesture, facial expression, and voice when	5.3	6.0	6.6	6.7	3.8	3.7	5.4	6.4	5.3	5.8
The child gets angry when having difficulty during the activity	3.1	3.3	2	1.8	2.2	2.2	3.6	4.9	2.8	3.2
The child becomes happy after finishing the activity	8.3	8.0	9.3	8.3	9.2	8.7	7.6	7.5	8.5	8.0
The child expresses positive feelings with a gesture, facial expression, and voice when feels happy during the activity	7.9	7.7	8.7	8.2	8.3	8	7.8	8.4	8.2	8.2

	Italy		Turkey		Spain		Lithuania		Total	
	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic
The child asks for others' help when having difficulty during the activity	5.3	4.7	6.5	5.8	3.5	3.2	4.4	3.4	4.9	4.2
The child is willing to experience new activities	7.5	7.3	7.9	6.6	8.8	8.6	7.8	8.3	8.0	7.8
The child shows willingness to complete the activity	7.7	7.2	8.1	6.8	8.4	8.3	5.0	6.8	7.0	7.2
The child gets angry when making a mistake	2.7	3.2	1.7	1.5	1.8	2.3	3.0	4.3	2.3	3.0
The child smiles often during the activity	6.8	5.1	7.3	6.2	7.3	6.8	6.5	7.1	6.9	6.5
The child gets excited when produces new ideas or things during the activity	6.3	6.6	7.9	7.5	7.6	7.4	5.5	7.3	6.7	7.3
The child shows sadness when making a mistake	5.1	6.1	5.5	4	2.4	3.4	4.4	4.8	4.3	4.4
The child leaves the game when gets angry	2.5	2.2	3.2	2.5	1.2	1.5	1.9	2.7	2.1	2.3
The child shows courage when starting a new activity	6.9	6.4	7.9	7	7.9	7.5	7.1	7.7	7.5	7.3
The child practices willingly the roles given during the activity	7.5	7.2	8.4	7.9	8.9	8.3	7.2	7.2	8.0	7.7
The child tries different ways to solve the issue when having difficulty during the activity	6.2	4.9	7.3	6.6	5.5	6.3	6.0	6.6	6.2	6.3
The child gets anxious when confronts a difficulty	2.4	4.0	3.5	3.1	4.5	4.9	4.6	6.3	4.0	4.8
The child is happy in group work.	7.3	7.1	8.3	7.7	8.5	8	7.1	7.6	7.8	7.7
The child gets angry when The child cannot fulfil his role in the group.	3.4	3.4	2.6	1.7	2.2	2.5	3.2	5.3	2.8	3.4
The child angers his friends because of his misbehaviour in the group.	1.3	2.8	2	2	1.8	1.7	2.3	3.4	1.9	2.5
The child focuses on the materials (robot) used in the activity	7.4		8.7		8.7		7.7		8.2	
The child enjoys using materials (robot) used in the activity	7.6		9.1		9.2		7.8		8.5	
The child gets excited with the material (robot) used in the activity	7.2		9.4		9		7.5		8.3	
The child creates new games with the material (robot) used in the activity	5.0		7.1		4.5		5.7		5.7	
The child passionately shares with the teacher experiences s/he had with the robot	5.9		8.9		7.3		6.7		7.3	
The child expresses others' positive/negative feelings	6.7	5.7	7.4	7.1	7.4	7.2	7.6	8.0	7.4	7.3
The child displays behaviours that disturbs the flow of the activity	3.0	2.4	2.4	1.8	3	3.4	3.1	4.5	2.9	3.2
The child complains about classmates during the activity	2.8	3.3	7.7	5.6	6.4	5.2	5.6	5.8	6.1	5.3
The child communicates positively with the children in the group at the activity.	1.5	3.5	1.5	1.1	1.8	1.4	2.2	4.0	1.8	2.5
The child has difficulty communicating with the children in the group at the activity.	1.6	2.3	1.8	2	2.1	2	3.0	4.0	2.3	2.8
The child collaborates with friends in the group	6.7	5.8	7.6	7.1	8.1	7.3	6.2	6.5	7.1	6.8
The child cooperates with classmates	6.5	6.2	7.9	7.8	8.4	7	6.6	6.1	7.4	6.8
The child enjoys helping classmates during the activity	6.1	5.7	7.9	7.3	7.7	7.1	6.9	6.3	7.3	6.7
The child stays calm when solving issues with others	6.8	6.9	6.8	7.1	8	7.6	6.5	5.4	7.0	6.6
The child cares about classmates who are upset	4.4	4.8	6.2	4.4	5.3	6	5.4	5.9	5.5	5.4

	Italy		Turkey		Spain		Lithuania		Total	
	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic	Group Robotic	Group Non-robotic
The child displays reluctance in participating in the group work.	1.6	2.6	1.8	1.2	1.6	2.5	2.2	2.2	1.8	2.1
The child provides support to other children while they perform their role in the group work	5.6	5.6	7.4	5.8	6.8	6.7	6.1	5.9	6.5	6.0
Total points average	5.2	5	6.1	5.2	5.9	5.6	5.5	5.7	5.7	5.5

In Table 1, the mean scores of children in the 3-4 age group by country are given for the items they receive from the PEARL Child Observation Form. According to countries, graphs for mean score comparisons for each item are shown in Figure 1-12. The graphs are chosen to show how PEARL Educational Model is impacted both robotic and non-robotic groups. Therefore, the most meaningful items and result are chosen and they are presented below.

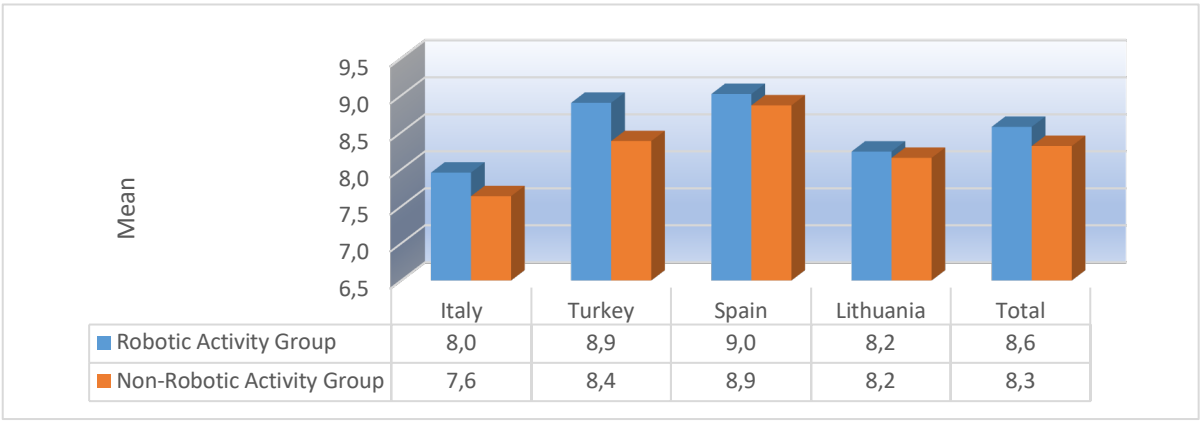


Figure 1. *Country-specific distribution of "The child is interests in participate in the activities" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child is interests in participate in the activities" by countries, it is seen that while the children in Spain have the highest mean score in the administration "Non-robotic", the children in Italy have the lowest mean score. In the administration "Robotic", it has been determined that while the children in Spain have the highest mean score, the children in Italy have the lowest mean score.

The mean score difference between the group robotic and the group non-robotic is determined to be the highest in Turkey and the least in Lithuania for the robotic activity group. When examining the total scores of all children in all countries, the mean score of the ones robotic is higher than the mean score of those non-robotic.

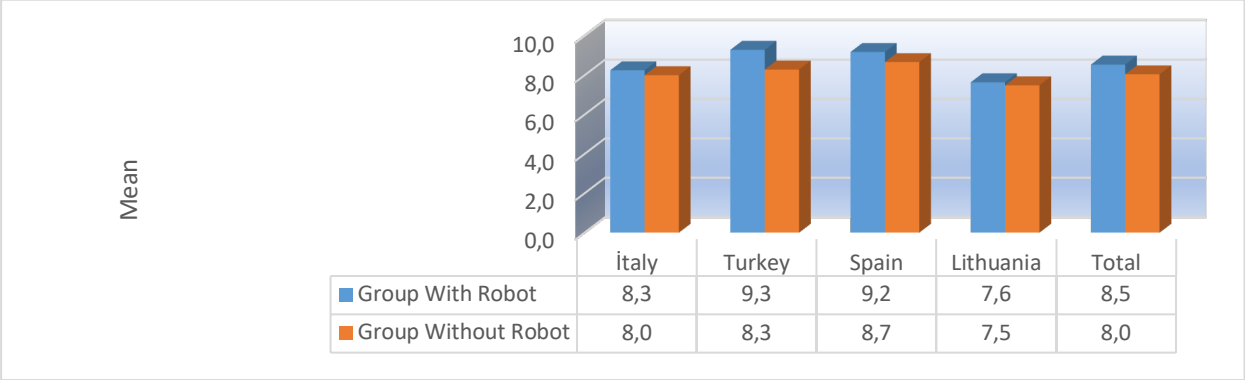


Figure 2. *Country-specific distribution of "The child becomes happy after finishing the activity" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child becomes happy after finishing the activity" by countries. As it is seen that while the children in Spain have the highest mean score in the administration "Non-robotic", the children in Lithuania have the lowest mean score. In the administration "Robotic", it has been determined that while the children in Turkey have the highest mean score, the children in Italy have the lowest mean score.

The mean score difference between the group robotic and the group non-robotic is determined to be the highest in Turkey and the least in Spain in favor of the group robotic. When examining the total scores of all children in all countries, the mean score of the ones robotic is higher than the mean score of those non-robotic.

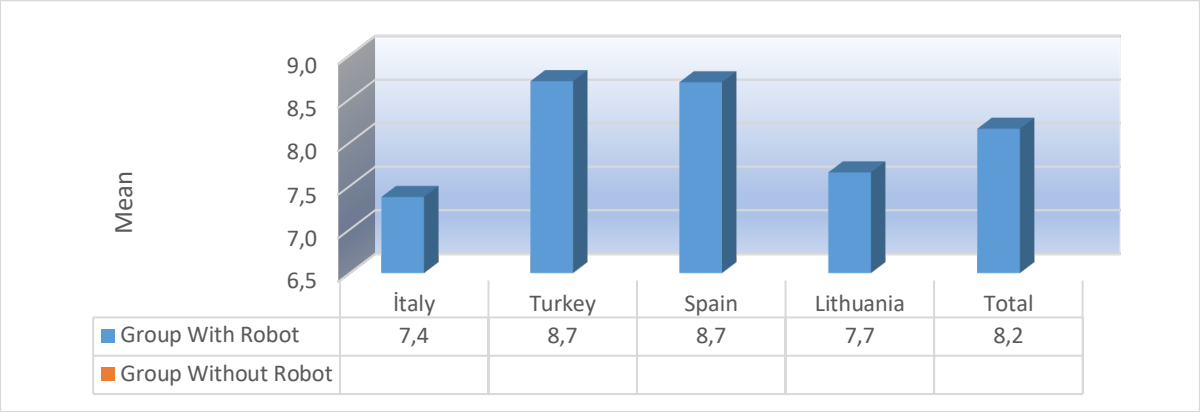


Figure 3. *Country-specific distribution of "The child becomes happy after finishing the activity" item scores for 3–4 age group children.*

When the mean scores of the item "The child becomes happy after finishing the activity" are examined according to the countries, it is observed that the children in Turkey and Spain have the highest average in the "with-robot" application, while the children in Italy have the lowest average.

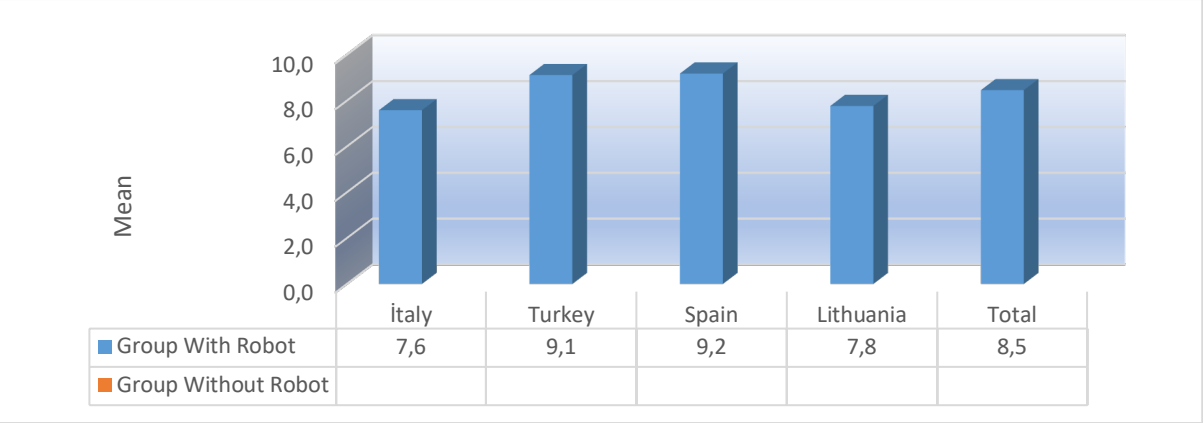


Figure 4. *Country-specific distribution of "The child enjoys using materials (robot) used in the activity" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child enjoys using materials (robot) used in the activity" by countries, it is seen that while the children in Spain have the highest mean score in the administration "Robotic", the children in Italy have the lowest mean score.

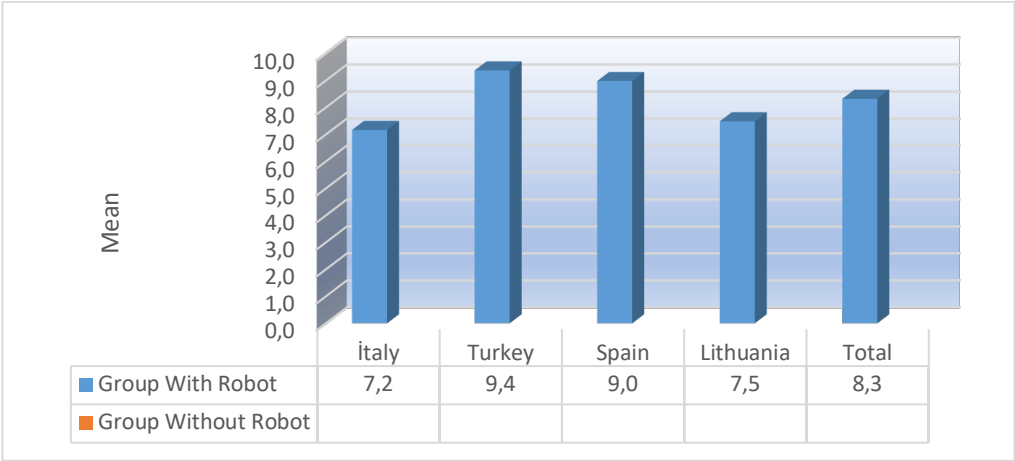


Figure 5. *Country-specific distribution of "The child gets excited with the material (robot) used in the activity" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child enjoys using materials (robot) used in the activity" by countries, it is seen that while the children in Spain have the highest mean score in the administration "Robotic", the children in Italy have the lowest mean score.

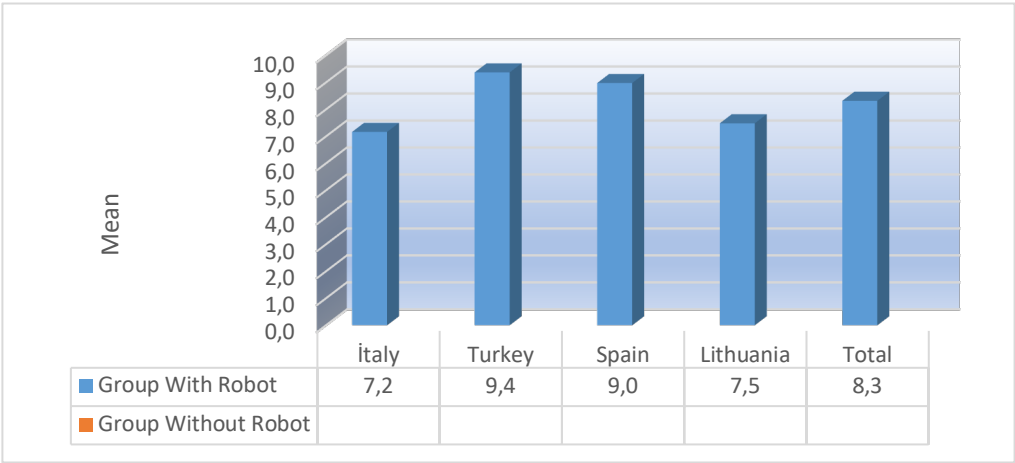


Figure 6. *Country-specific distribution of "The child creates new games with the material (robot) used in the activity" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child creates new games with the material (robot) used in the activity" by countries, it is seen that while the children in Turkey have the highest mean score in the administration "Robotic", the children in Spain have the lowest mean score.

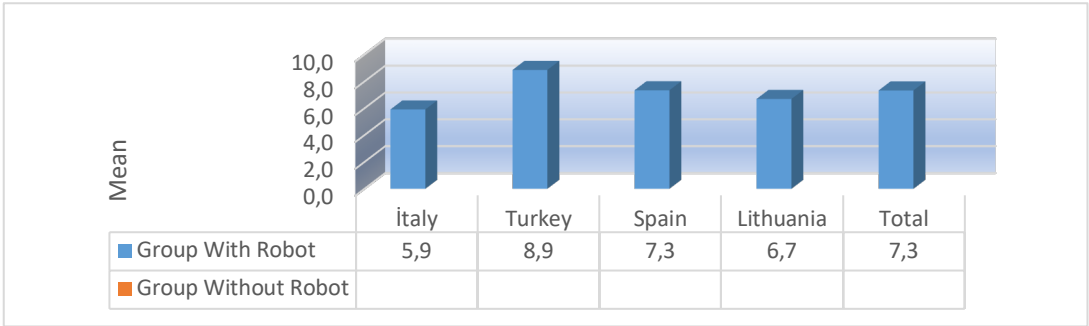
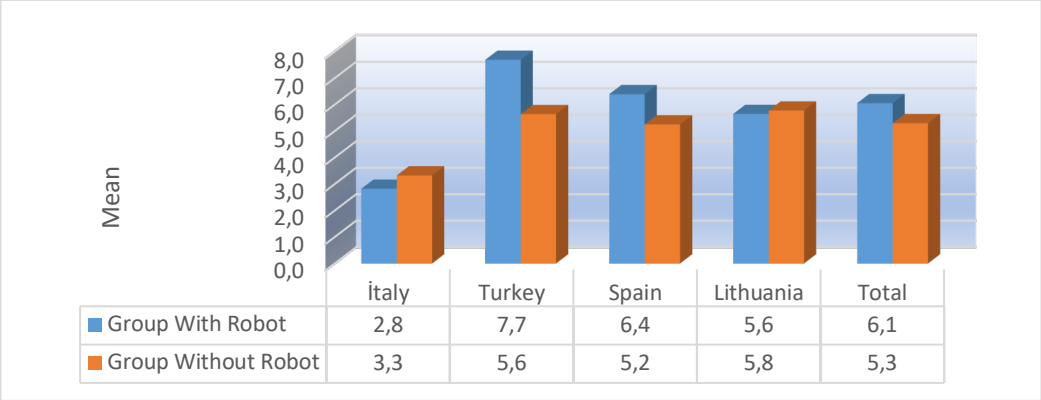


Figure 7. *Country-specific distribution of "The child passionately shares with the teacher experiences The child had with the robot" item scores for 3–4 age group children.*

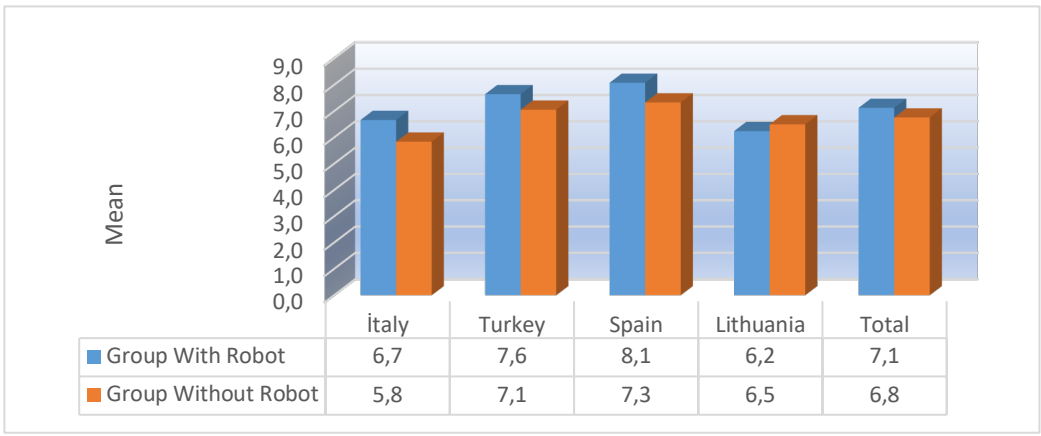
When examining the mean scores of the item "The child passionately shares with the teacher experiences the child had with the robot" by countries, it is seen that while the children in Turkey have the highest mean score in the administration "Robotic", the children in Italy have the lowest mean score.



	İtaly	Turkey	Spain	Lithuania	Total
Group With Robot	2,8	7,7	6,4	5,6	6,1
Group Without Robot	3,3	5,6	5,2	5,8	5,3

Figure 8. *Country-specific distribution of "The child expresses others' positive/negative feelings" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child expresses others' positive/negative feelings" by countries, it is seen that while the children in Lithuania have the highest mean score in the administration "Non-robotic", the children in Italy have the lowest mean score. In the administration "Robotic", it has been determined that while the children in Italy have the lowest mean score, the children in Lithuania have the highest mean score at an equal rate have the highest mean score in the administration "Robotic", the children in Italy have the lowest mean score.

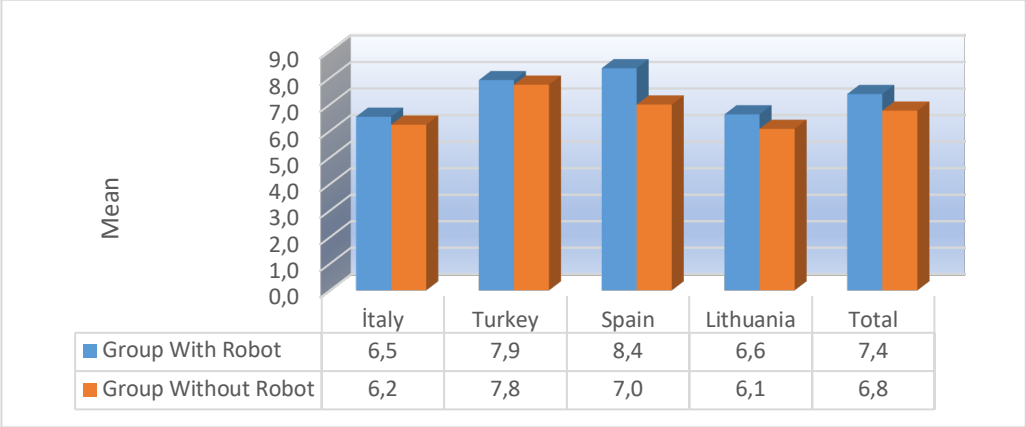


	İtaly	Turkey	Spain	Lithuania	Total
Group With Robot	6,7	7,6	8,1	6,2	7,1
Group Without Robot	5,8	7,1	7,3	6,5	6,8

Figure 9. *Country-specific distribution of "The child cooperates with classmates" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child cooperates with classmates" by countries, it is seen that while the children in Spain have the highest mean score in the administration "Non-robotic", the children in Italy have the lowest mean score at the equal rate. In the administration "Robotic", it has been determined that whereas the children in Spain have the highest mean score, the children in Lithuania have the lowest mean score.

The mean score difference between the robotic group and the non-robotic group is determined to be the highest in Italy and the least in Lithuania for the robotic group. When examining the total scores of all children in all countries, the mean score of the ones robotic is higher than the mean score of those non-robotic.

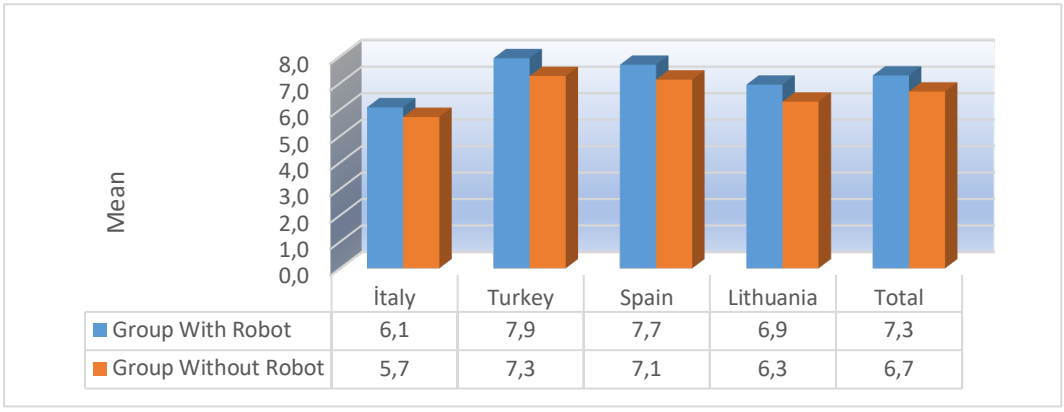


	İtaly	Turkey	Spain	Lithuania	Total
Group With Robot	6,5	7,9	8,4	6,6	7,4
Group Without Robot	6,2	7,8	7,0	6,1	6,8

Figure 10. *Country-specific distribution of "The child fulfils his/her role in the group work (The child collaborates with friends in the group)" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child fulfils his/her role in the group work" by countries, it is seen that while the children in Turkey have the highest mean score in the administration "Non-robotic", the children in Lithuania have the lowest mean score at the equal rate. In the administration "Robotic", it has been determined that while the children in Spain have the highest mean score, the children in Italy have the lowest mean score.

The mean score difference between the group robotic and the group non-robotic is determined to be the highest in Lithuania and the least in Spain for the group robotic. When examining the total scores of all children in all countries, the mean score of the ones robotic is higher than the mean score of those non-robotic.

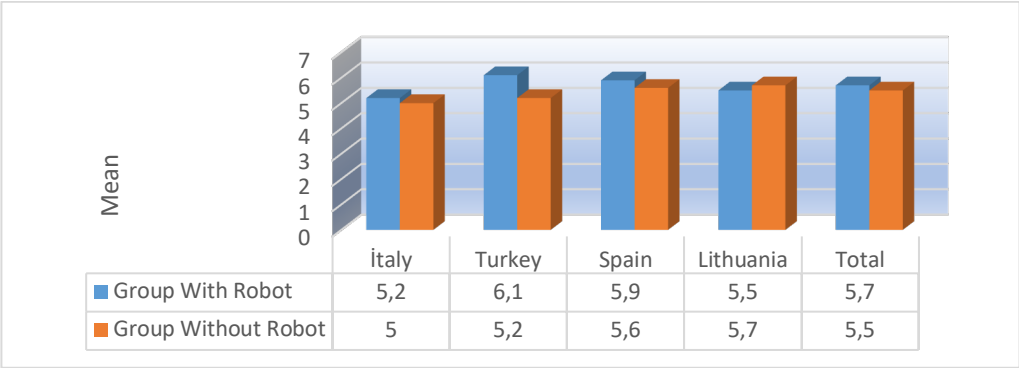


	İtaly	Turkey	Spain	Lithuania	Total
Group With Robot	6,1	7,9	7,7	6,9	7,3
Group Without Robot	5,7	7,3	7,1	6,3	6,7

Figure 11. *Country-specific distribution of "The child enjoys helping classmates during the activity" item scores for 3–4 age group children.*

When examining the mean scores of the item "The child enjoys helping classmates during the activity" by countries, it is seen that while the children in Turkey have the highest mean score in the administration "Non-robotic", the children in Italy have the lowest mean score at the equal rate. In the administration "Robotic", it has been determined that while the children in Turkey have the highest mean score, the children in Italy have the lowest mean score.

The mean score difference between the robotic group and the non-robotic group is determined to be the highest in Lithuania and the least in Turkey in favor of the non-robotic group. When examining the total scores of all children in all countries, the mean score of the ones robotic is higher than the mean score of those non-robotic.



	İtaly	Turkey	Spain	Lithuania	Total
Group With Robot	5,2	6,1	5,9	5,5	5,7
Group Without Robot	5	5,2	5,6	5,7	5,5

Figure 12. *The graphic regarding the distribution of total mean scores obtained by the children aged 3-4 from the items of Child Observation Form by countries.*

When examining the total mean scores obtained by the children aged 3-4 from the items of Child Observation Form by countries, it is seen that while the children in Lithuania have the highest mean score in the administration "Non-robotic", the children in Italy have the lowest mean score. In the administration "Robotic", it is observed that while the children in Turkey have the highest mean score, the children in Italy have the lowest mean score.

The mean score difference between the group robotic and the group non-robotic is determined to be the highest in Turkey and the least in Italy in favor of the group robotic. When examining the total scores of all children in all countries, the mean score of the ones robotic is higher than the mean score of those non-robotic.

DISCUSSION & CONCLUSION

Discussion

The study was conducted with children in Italy, Turkey, Spain, and Lithuania. When the total mean scores of the children aged 3-4 years old from the Child Observation Form items were analyzed, it was determined that the children in Lithuania had the highest average and the children in Italy had the lowest average in the application non-robotic. In the application robotic, it was observed that the children in Turkey had the highest average, and the children in Italy had the lowest average. For groups robotics, the mean score difference between groups with and non-robotics is the highest in Turkey and the lowest in Italy.

All children who joined the application robotic received over seven points from the matters "The child is interests in participate in the activities, The child does not lose motivation during the activity, The child endeavors to stay the activity, The child becomes happy after finishing the activity, The child expresses positive feelings with a gesture, facial expression, and voice when feels happy during the activity, The child is willing to experience new activities, The child shows willingness to complete the activity, The child shows courage when starting a new activity, The child practices willingly the roles given during the activity, The child is happy in group work, The child focuses on the materials (robot) used in the activity, The child enjoys using materials (robot) used in the activity, The child passionately shares with the teacher experiences The child had with the robot, The child expresses others' positive/negative feelings, The child collaborates with friends in the group, The child cooperates with classmates, The child enjoys helping classmates during the activity, The child stays calm when solving issues with others, The child gets excited with the material (robot) used in the activity" in PEARL Child Observation Form. When the total scores of the children in the countries were examined, it was determined that the average of the group robotics was higher than that of the group non-robotics.

The PEARL Education Model places peer relationships and the development of empathic feelings at the center of the model and group interaction. Children collaborate with their peers when they encounter difficulties by their developmental level. Concerning peers, the child can take on different roles, cooperate in small groups, learn the perspective of others and develop sharing skills. Group relationship provides both emotional and cognitive development, and solving problems together is internalized by children.

The PEARL "Emotional Empathic and Proximal Learning-Educational Environment" is a project that aims to develop and test an educational model, it is innovative and replicable at an international level and aims at the very first phase of childhood, which is 0 – 6 years. When the purpose of the project is taken into consideration, as seen from the research findings, children aged 3-4 years participating in an activity with a robot in a group

environment are more willing to engage in activities, feeling excited about working with a robot, reflecting their emotions using body and verbal language, and have more problems than children participating in non-robotic activities. It was determined that they scored higher in the skills of solving in easy and positive ways, fulfilling their responsibilities, cooperating with their friends, and interacting in a shared way. With these findings obtained as a result of the application, it can be said that the project hypothesis "Group activities enriched with natural materials and robotic coding activities improve social skills, abilities to cooperate and to understand and express emotions in children" has been proved.

Examining Piaget's theory, the learning process occurs through the interaction of the mind and environment. During this process, the individual tries to explain the new situation with the schemes he or she created in the past. If existing schemes explain a new situation, reinforcement of previous learning happens instead of learning. If existing schemes cannot explain a new situation, a new scheme is needed. Thus the learning process is initiated. In the learning process, individuals go through the processes of assimilation, adjustment and balancing, respectively (Bacanlı, 2011). When new information becomes balanced, learning takes place. Individuals structure information with environmental impact and their mental processes (Beilin, 1994). PEARL's Education model has also enabled children to structure the knowledge they have gained through their interactions with their environment (organizing teachers and classroom environments, integrating materials such as robots into events, and so forth) (Beilin, 1994; Cole & Wertsch, 2002; Erdem & Demirel, 2002; Vygotsky,1978).

According to Vygotsky, the individual constructs knowledge by interacting with people in the child's social environment. The person knows that the child can construct his/her own. In the zone of proximal development, on the other hand, there is the knowledge that an individual can construct accompanied by a peer or an adult (Vygotsky, 1978). Through the scaffolding method, the individual can also construct knowledge that the child cannot construct on his/her own. The PEARL Educational Model emphasizes the importance of the zone of proximal development, argues that peer communication and effective teacher support are required for children to fulfil their potential.

Conclusion

This study is conducted within Erasmus+ KA201 project PEARL "Emotional Empathic and Proximal Learning-Educational Environment" that aims to develop and test an educational model, which is innovative and replicable at an international level and aims at the very first childhood, 0 – 6 years. Thus, the study examines PEARL Emotional, Emphatic and Proximal Learning Environment's effect on the social-emotional development of children age 3-4. The study results are summarized below.

• Group activities with children ages 3-4 enriched with robotic coding activities, develop children's social skills, cooperative skills, and ability to understand and express emotions. The hypothesis is confirmed.

• An international network of experts and organizations has been established in close cooperation with academia, educational institutions, and teacher training institutions to promote innovative and quality education in early childhood.

• New activities aimed at teachers have been created to launch an experimental education model in early childhood to develop the necessary skills.

• Teachers shared many activities they prepared in line with the PEARL Education Model on the international platform through the digital network established.

Recommendations

According to the results of the study, which aimed to reveal PEARL Emotional, Emphatic and Proximal Learning Environment's effect on the social-emotional development of children aged 3-4 years, the recommendations are listed below:

• An innovative, high-quality and repeatable European-level education model could be developed to enhance emotional and empathetic skills by supporting proximal development areas of children aged 3-4. The model developed is based on structured learning in the education of children aged 3-4, using educational materials such as robots to support the proximal development of children and provide teacher guidance in collaboration, sharing and empathic development.

• An international network of experts and organizations may be established in close cooperation with academia, educational institutions and teacher education institutions to encourage innovative and quality education

in early childhood. This educational model can be shared with children both in-person and online to enrich the model and ensure equal opportunity, inclusion and sustainability by reaching all children.

• A new teacher-oriented curriculum could be created, using the established academic network, to deliver an experimental teaching model in collaboration with international experts and organizations to develop the necessary skills in early childhood.

Limitations

The study had also some limitations. One of the limitations of the study was that the study was conducted during the Covid-19 pandemic. Therefore, it became impossible to work face-to-face with partners in other counties. Therefore, all of the meetings and training course are done online. Therefore, the Covid-19 pandemic had limited face-to-face interaction among the project partners. Another limitation of the study is that the data collection tool is first written in Turkish, then it is translated in English. All of the countries translated the PEARL Child Observation Form in their language. Therefore, this may have had effect on the results of the study. In addition, the reliability study PEARL Child Observation Form were not conducted. Thus, the results of the study would not be generalized.

Statements of Publication Ethics

Authors of the research declare that they obeyed the principles of publication ethics. Ethical Committee Permissions are gotten from Gazi University Ethical Committee Commission on 12.25.2020 date and meeting 22 (E-77082166-604.01.02-75142)

Abbreviations

PEARL, Emotional Empathic Proximal Learning-Educational Environment

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1	☒	☒	☒	☒	☒	☒
Author 2	☐	☒	☐	☐	☒	☒
Author 3	☒	☐	☒	☒	☒	☒
Author 4	☐	☐	☐	☒	☒	☒
Author 5	☒	☐	☒	☐	☒	☒

Conflict of Interest

This study does not have any conflict of interest of authors.

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The Effect of Preschool Teachers' Emotion Regulation Skills and Levels of Cognitive Flexibility on Classroom Management

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Abstract

The aim of this study is to examine the effects of emotion regulation skills and cognitive flexibility levels on preschool teachers' choice of classroom management strategies. 211 preschool teachers participate in the research, which uses the relational survey model, one of the quantitative research methods. Emotion Regulation Difficulty Scale, Cognitive Flexibility Inventory, Classroom Management Strategies Scale are used in the research. As a result of the research, it is determined that preschool teachers' emotion regulation and cognitive flexibility levels are high and that they can control their emotions better when their professional experience increases and that the cognitive flexibility of experienced ones who are new to the profession is better. In addition, it is seen that preventive and problem-oriented strategies are at a high level in classroom management and that their supportive strategies are at a moderate level. In addition, it is determined that awareness levels from emotion regulation difficulties and control levels from cognitive flexibility are effective on supportive and problem-oriented classroom management strategies, but not on preventive strategies.

Keywords: Preschool, classroom management, cognitive flexibility, emotion regulation.

Okul Öncesi Öğretmenlerinin Duygu Düzenleme Becerileri ile Bilişsel Esneklik Düzeylerinin Sınıf Yönetimine Etkisi

Öz

Bu araştırmanın amacı, okul öncesi öğretmenlerinin sınıf yönetimi stratejileri tercihlerinde duygu düzenleme becerileri ile bilişsel esneklik düzeylerinin etkisini incelemektir. Nicel araştırma yöntemlerinden ilişkisel tarama modeli kullanılan araştırmaya 211 okul öncesi öğretmeni katılmıştır. Araştırmada Duygu Düzenleme Güçlüğü Ölçeği, Bilişsel Esneklik Envanteri ve Sınıf Yönetimi Stratejileri Ölçeği kullanılmıştır. Araştırma sonucunda, okul öncesi öğretmenlerinin duygu düzenleme ve bilişsel esneklik düzeylerinin yüksek olduğu, mesleki tecrübeleri arttıkça duygularını daha iyi control edebildikleri, mesleğe yeni başlayanların ise bilişsel esnekliklerinin daha iyi olduğu belirlenmiştir. Ayrıca sınıf yönetiminde önleyici ve soruna yönelik stratejileri yüksek düzeyde, destekleyici stratejileri ise orta düzeyde kullandıkları ve duygu düzenleme güçlüklerinden farkındalık düzeyleri ile bilişsel esnekliklerinden control düzeylerinin destekleyici ve soruna yönelik sınıf yönetimi stratejileri üzerinde etkili olduğu, ancak önleyici stratejiler üzerinde etkili olmadığı tespit edilmiştir.

Anahtar kelimeler: Okul öncesi, sınıf yönetimi, bilişsel esneklik, duygu düzenleme.

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INTRODUCTION

Classroom management is the process of the teacher taking account of the individualistic differences and the nature of the classroom interactions of the children by making them feel trust and belonging providing appropriate educational environments for learning and providing motivation (Tal, 2010). In a classroom consisting of well-motivated students, learning-teaching activities are more effective, problem behaviours that can be seen in the classroom are reduced, classroom management is easier and student participation is expected to be at a higher level (Özkan, 2005). Children are more successful in transference the knowledge and ability they have gained in these classes to live, adapting to social environments, and their relationships with family and peer groups (Akgün et al., 2011). In classrooms with a high level of classroom management skills and, as an outcome of it, a positive classroom climate, it is indicated that children's academic skills example language, mathematics, literacy and social skills such as self-regulation are enabled and that academic success increases (Burchinal et al., 2010; Downer et al. ., 2007; Mashburn, et al., 2008), and that the incidence of problem behaviour is reduced or even prevented (Flores & Jacoby, 2017; Marzano & Marzano, 2003; Norris, 2003; Pianta & Hamre, 2009; Snyder et al., 2011). İn other words, it is stressed that problem behaviours and teacher burnout (Evers et al., 2004; Flores & Jacoby, 2017) and a decrease in academic achievement (Allyon & Roberts, 1974; Frick et al., 1991) are commonly observed in a classroom with inadequate classroom management skills. Goals such as maintaining uninterrupted education, ensuring effective instructor-child interaction, and achieving the goals of children's compliance with the rules and self-regulation process increase the importance of teachers and classroom management especially in pre-school classes (Zembat & İlçi Küsmüs, 2020).

A warm, affectionate relationship between theinstructor and the child and effective classroom management, in which consistent and stable classroom rules are applied, affects the teacher's emotion regulation skills (Buettner et al., 2016). Preschool teachers are faced with many situations in which they may show signs of emotion regulation difficulties while applying their daily routines: Such as heavy workloads, behavioural problems of students (Friedman-Krauss et al., 2014; Zhai et al., 2011), working for low wages (Hall -Kenyon et al., 2014), parent-teacher, teacher-manager relationship (Rentzou, 2012). These difficulties reason to feel preschool teachers to intense stress, difficulty in communicating effectively with children and teachers' emotional difficulties and even depression (Curbow et al., 2000). It is emphasized that preschool teachers with emotion regulation difficulties and depressive indications at negative classroom climate and classroom management which have ineffective teacher-child interaction in such a classroom atmosphere are inevitable (Gerber et al., 2007; Hamre & Pianta, 2004; Jeon et al., 2014; Whitaker et al., 2015). Because preschool teachers who have difficulty in emotion regulation have difficulty in establishing effective teacher-child interaction and managing behavioural problems and at the same time they show signs of professional burnout (Buettner et al., 2016). Difficulty in sensation regulation and intense stress strain the personal resources of preschool teachers, negatively affect their functional skills and daily routines (Montgomery & Rupp, 2005), their capacity to tolerate children decreases, and they encounter more problems in classroom management regarding students' behaviours (Chang, 2009). Studies have emphasized that emotionally indecisive and stressed primary school teachers show less tolerance to challenging behaviours (Kokkinos et al., 2005), similarly preschool teachers become more desensitized by displaying fewer sensitive behaviours in their interactivities with kids, and kids exhibit more negative sensations and display aggressive behaviours (Buettner et al., 2016; de Schipper et al., 2009; Rentzou, 2012). As a result, preschool teachers, who have difficulty in emotional regulation and work stress, will reflect their emotional dilemma to the classroom environment and prepare an environment for children to have low participation and social-emotional inadequacy and decrease academic achievement (Ota et al., 2012; Siekkinen et al., 2013; Sutton et al., 2009). What is expected from a teacher who has coped with emotion regulation difficulties is to make learning environments more enjoyable by reflecting and expressing positive sensations rather than negative sensations in the classroom surroundings, contributing to the child's development of a positive attitude towards school (Turner et al., 2003).

However, teachers need to have the ability to find immediate solutions to successive daily problems, to be able to rapidly attention and reaction to changes in students and the classroom environment. Preschool teachers who have such coping skills can prevent the problems from growing (Oishi et al., 2018). Therefore, teachers need to respond to the needs of each student (Yaşar-Ekici & Balcı, 2019), adapt to different and unusual situations and develop alternative perspectives towards these situations (Çuhadaroğlu, 2013) and contribute to the academic success of students (Çelikkaleli, 2014). Cognitive flexibility, which is defined as the ability to switch between thoughts and find alternative solutions to problems (Crone et al., 2004, Dennis & Wander Wal, 2009), as organising meaningfully related situations by reformatting them, as transferring attention away from a single source to another

source (Stahl & Pry, 2005), as the ability to adapt thoughts and behaviours (Barbey et al., 2013), as gaining competence to adapt to multiple options by recognising options before deciding on behaviour (Bilgin, 2009), allows us to choose a different strategy by abandoning an unhelpful cognitive strategy when faced with a problem (Scott, 1962). Individuals with an advanced level of cognitive flexibility can be described as focusing their attention fully on a subject, thinking analytically, flexible in adapting to change (Schouten et al., 2000), are responsible, and have high self-confidence (Martin & Rubin, 1994; Martin & Anderson, 1998), can show excessive tolerance to conflicts (Chung et al., 2012).

Based on this information, it is thought that emotion regulation and cognitive flexibility skills may be effective on preschool teachers' classroom management skills. However, in previous research generally, it is seen that there are research related between teachers' classroom management skills and gender (Kaplan, 2018; Yeşilyurt & Çankaya, 2008; Zembat et al., 2017) and working year (Dinçer & Akgün, 2015; Yıldırım, 2016; YaşarEkici et al., 2017; Zembat & İlçiKüsmüş, 2020), teacher's age (Dinçer & Akgün, 2015; Yıldırım, 2016; Metin et al., 2017; Zembat & İlçi Küsmüş, 2020), education level (Ata & Akman, 2016; Zembat & İlçi Küsmüş, 2020), self-efficacy perceptions (Demir, 2015; Demir & Şahin Ası, 2018) and burnout levels (Adıgüzel, 2016). No research has been found examining the effect of teachers' emotion regulation skills and cognitive flexibility levels. Therefore, the purpose of this study is to examine the effects of emotion regulation skills and cognitive flexibility levels on preschool teachers' choice of classroom management strategies. For this aim, answers to the following questions were sought.

1. What is the relationship between preschool teachers' difficulties in emotion regulation, cognitive flexibility and classroom management strategies?
2. Do preschool teachers' emotion regulation difficulties, cognitive flexibility, and classroom management strategies differ according to gender, educational status, age and professional seniority?
3. Is there a significant relationship between preschool teachers' emotion regulation difficulties, cognitive flexibility, and classroom management strategies?

Do preschool teachers' emotional regulation difficulties and cognitive flexibility determine their classroom management strategies?

METHOD

In the following section, the methodology of the present study is systematically delineated, aligning with the recognized three stages of scale development, encompassing eight steps as outlined by DeVellis (2012). These stages include design, development, and evaluation, each contributing to the comprehensive description of the study group, the nuanced development process of the FES scale, data collection instruments, and rigorous data analysis techniques. The process adheres to the principles and stages that DeVellis (2012) has detailed, emphasizing conceptual clarity, psychometric validation, and empirical justification. The step-by-step articulation of these phases ensures transparency and replicability, underscoring the study's contribution to the research on feedback experiences within the educational setting.

FINDINGS

Research Model

The relational survey model, a quantitative research technique, is used in this study to analyse the relationship between the variables. The relational screening model is a model that seeks to ascertain the direction and magnitude of change in two or more variables (Karasar, 2012). It is regarded reasonable to carry out a relational study to look at how preschool teachers' struggles with emotion control and their cognitive flexibility affect their use of classroom management techniques.

Research Ethics

Informed consent was received from each participant, and the university (19/01/2022-29/17) granted ethics approval for the current study. The participants were told the goals of the study, the steps that would be taken to carry it out, and how long it would take. They were also told that participation in the study was entirely voluntary. Without incurring any consequences, they had the right to revoke their consent and stop taking part at any moment. The teachers who freely took part in the study were labelled as K1, K2.

Population and Sample

Preschool teachers employed by Turkish pre-school educational institutions constitute the population of this study. The sample for the study is chosen using an easily accessible sampling approach that saves the researcher time, money, and labour (Büyüköztürk et al., 2016). The population in this study is formed using the idea of sample accessibility. Preschool teachers employed by the pre-school education institution were contacted during the fall semester of the 2021–2022 academic year by WhatsApp and phone. Teachers who agreed to participate in the study willingly filled out a Google form used for data collection. Table 1 lists the demographics of the preschool teachers who took part in the study.

Table 1. Demographic Information Regarding Pre-school Teachers Who Have Participated in the Research

Variables		n	%
Gender	Female	198	93,8
	Male	13	6,2
Educational Attainment	Undergraduate	187	88,6
	Post-graduate	24	11,4
Age	22 – 32	38	18
	33 – 38	43	20,4
	39 – 44	71	33,6
	45 and over	59	28
Professional Seniority	1-10 years	72	34,1
	11-20 years	124	58,8
	20 years and over	15	7,1

According to Table 1, 93,8% of the pre-school teachers participating in the research are female and 6,2% are male. 88,6% of the participants have undergraduate education, 11,4% have graduate education and 18% are 22-32; 20,4% 33-38; 33,6% were 39-44; 28% of them are in the age group of 45-over. In addition, 34,1% of teachers are 1-10; 58,8% of them have a working period of 11-20 and 7,1% have a working time of 26 years or more.

Data Collection Tools

In this study, “Personal Information Form, Emotion Regulation Difficulty Scale, Cognitive Flexibility Inventory, and Classroom Management Strategies Scale” were used as data collection tools.

Personal Information Form (PIF): The KBF form showing the gender, age, educational status, and professional seniority of the preschool teachers in the study group was prepared by the researchers.

Emotion Regulatory Difficulty Scale (ERDS): In 2010, Rugancı and Gençöz translated the ERDS, which was created by Grazt and Roemer (2004). The ERDS uses a 5-point Likert Type scale with a total of 36 items and 6 sub-dimensions (1: almost never, 2: rarely, 3: sometimes, 4: often, 5: almost always). A minimum of 36 and a maximum of 180 points can be earned in the original scale. It demonstrates that the difficulty in emotion regulation grows along with the scale score. Rugancı and Gençöz (2010) did confirmatory factor analysis first to look at the factor structure of the scale in the study of adaptation to Turkish, but they were not included in the Turkish version of the scale because the tenth item in the scale had a low load value and decreased the internal consistency coefficient (0,06). Since it did not demonstrate enough association with the scale, 35 items were analysed. The internal consistency coefficient (Cronbach's Alpha) for the Turkish version of the ERDS ranged between 0,75 and 0,90 for its sub-dimensions and was 0,94 for the entire scale. Additionally, the test-retest reliability coefficient was calculated to be 0,83 in the entire scale and between 0,60 and 0,85 in its sub-dimensions (Rugancı & Gençöz, 2010).

Cognitive Flexibility Inventory (CFI): CFI created by Dennis and Vander Wal (2010), measures a person's capacity to generate alternative, harmonious, appropriate, and balanced thinking in challenging circumstances. The scale, which has 20 items, has two subscales. The alternatives subscale's Cronbach's alpha value in its original version was 0,91 for both the first and last measurements. The Cronbach's alpha values of the control subscale were 0,86 in the first measurement and 0,84 in the final measurement. In the adaptation study of Gülüm and Dağ (2012), a similar two-factor structure was attained. The factor analysis led to the identification of two sub-dimensions; the "alternative (1, 3, 5, 6, 8, 10, 12, 13, 14, 16, 18, 19, 20)" and the "control (2, 4, 7, 9, 11, 15, 17)". The "Alternatives" sub-dimension consists of statements that the individual can come up with other solutions to challenging situations or that there may be alternative explanations for real-world issues and human behaviour. The 'control' sub-dimension consists of statements about the ability to control challenging situations. For instance, “I consider many options before making a decision.” is an item that can be found in the alternative dimension of

the scale, and "I have difficulty in making decisions when faced with difficult situations." can be seen in the control dimension. While the Control subscale (7 questions) had a Cronbach's alpha value of 0,85 and an explained variance of 13,27%, the Alternatives subscale (13 items) had a Cronbach's alpha value of 0,89 and a variance of 36,57%. Despite the fact that Cronbach's alpha value for the entire scale is .90, the total percentage of variance that the entire scale can explain is 49,8%. The inventory has a range of scores, with 20 being the lowest and 100 being the most. Reverse coding is used for the scale's items 2, 4, 7, 9, 11, and 17.

Classroom Management Strategies Scale (CMSS): The "classroom management strategies scale" developed by Büyüktaşkapu-Soydan, Durmuşoğlu-Saltalı, and Öztürk-Samur (2022) was used. The relevant scale consists of three sub-dimensions, 13 sub-dimensions that are related to these three sub-dimensions, and 89 items. Within the first sub-dimension of the scale, the "preventive strategies scale", seven sub-dimensions are program and routines (questions 1 to 11), transitions between activities (questions 12 to 16), organizing the classroom environment (questions 17 to 21), encouraging participation in activities (questions 22 to 27), teaching behaviour expectations (questions 28 to 34), supportive dialogues (questions 35 to 41) and giving direction (questions 42 to 48) and 48 items. Six sub-dimensions within the second sub-dimension "supportive strategies scale" are social skills and emotional competence (questions 49 to 54), understanding and expressing emotions (questions 55 to 60), problem solving (questions 61 to 66), friendship skills (questions 67 to 73, supporting children with persistent problem behaviours (questions 74 to 76) and family education and participation (questions 77 to 83) and 35 items. There are 6 items (between the 84th and 89th questions) in the "problem-oriented strategies scale" dimension, which is the third sub-dimension. The scale includes a five-point Likert-type evaluation ranging from strongly disagree (1) to strongly agree (5). The variance explained according to the exploratory factor analysis was 72.62%. The Cronbach Alpha reliability coefficient for the reliability of the scale was found as α=0,98. As a result of confirmatory factor analysis, acceptable fit values were reached with χ^2= 11272,586, RMSEA=0,059, SRMR=0,069, CFI=0,843 and TLI=0,837.

Data Analyses

Before analysing the data collected for this research, it was examined whether there was missing data and it was concluded that there was no missing data. Outliers were examined by looking at the total, standard Z scores and box plots for predictor and predicted variables. 24 data with a Z score greater than +3 and less than -3 were determined and were not included in the analysis because they were seen as extreme values. In addition, the kurtosis and skewness coefficients were examined for the normal distribution of the data and it was determined that the data showed a normal distribution. By subtracting 24 data from 235 data, analyses related to the research questions were made using 211 data.

FINDINGS

In this section, the results of the analysis of the data obtained regarding the research questions are given respectively. In the first sub-problem of the study, the descriptive statistics results of the answers given by the pre-school teachers to the question "What is the level of emotion regulation difficulties, cognitive flexibility and classroom management strategies of preschool teachers?" are given in Table 2.

Table 2. Descriptive Statistics Results on Pre-school Teachers' Emotion Regulation Difficulty, Cognitive Flexibility and Classroom Management Strategies

Scale	Scale and Dimensions	Number of Items	Score Interval	$\bar{X}$	Ss	Coefficient of Skewness
Scale for The Difficulty of Emotional Regulation (ERDS)	ERDS	35	35-175	64,68	16,59	0,829
	Explicity	5	5-25	8,53	2,66	0,571
	Awareness	5	5-25	9,72	2,86	0,396
	Refusal	6	6-30	10,18	4,03	0,998
	Strategies	8	8-40	14,27	5,06	0,870
	İmpulse	6	6-30	10,24	3,49	0,833
	Objectives	5	5-25	11,72	3,87	0,531
Inventory of Cognitive Flexibility (CFI)	CFI	20	20-100	84,06	9,99	-0,608
	Control	7	7-35	27,70	4,64	-0,534
	Alternative	13	13-65	56,36	6,55	-0,587
Scale for Classroom Management Strategies (CMSS)	CMSS	89	89-445	395,73	31,61	-0,415
	Preventive	48	48-240	214	16,91	-0,261
	Supportive	35	35-175	151,50	13,89	-0,581
	Problem Oriented	6	6-30	27	2,78	-0,588

In Table 2, descriptive statistics regarding the independent variables of emotion regulation difficulty and cognitive flexibility and the dependent variable of classroom management strategies are given. While the average of the scores obtained from the CMSS, which includes the most items, is the highest ($\bar{x}$ =395,73, Ss=31,61), and the average of the scores obtained from the 35-item ERDS is the lowest ($\bar{x}$=64,68, Ss=16,59). The average of the scores obtained from the CFI, which includes 20 items, is 84.06, and the standard deviation is 9,99. It is seen that the skewness and kurtosis values of all scales and sub-dimensions used in this study are between -1,5 and 1,5, and the assumption of normality is met (Tabachnick & Fidell, 2013).

In order to evaluate preschool teachers' levels of emotion regulation difficulties, cognitive flexibility and classroom management strategies, the lowest score they can get from the sub-dimensions of the scales was subtracted from the highest score and the result was divided into three and the low, medium and high levels of the participants were determined. In this respect, openness, awareness and goals, which have an equal number of items in the emotion regulation difficulty scale, are low 5-11,66; medium 11,67-18,33; high is 18,34-25 points. In addition, 6-14 low, 15-23 medium and 24-30 high score levels were determined in the sub-dimensions of rejection and impulse, which have the equal number of items of ERDS. In the strategies sub-dimension of ERDS, 8-18,66 was low; 18,67-29,33 medium; 29,34-40 is high. The score ranges in the control dimension of the cognitive flexibility inventory were 7-16,33 for the low level; 16,34-15,67 for intermediate level and 25,68-35 for high level. In the alternative dimension of CFI, 13-30,33 low, 30,34-47.67 moderate and 47,68-65 high level were determined. Finally, 48-112 low, 113-117 moderate, and 178-240 high levels in the preventive dimension of CMSS, while 35-81,6 low, 81,7-128,3 moderate and 128,4-176 high levels in the supportive dimension. The ranges calculated in the problem-oriented sub-dimension of the CMSS are 6-16 for low level, 15-23 for medium level and 24-30 for high level. According to the level ranges determined for the sub-dimensions of each scale used in this study, it was determined that the participants had low levels in the dimensions of openness, awareness, refusal, strategies and impulse of ERDS. It was also determined that it had a moderate level in the goals sub-dimension and a high level in all sub-dimensions of the cognitive flexibility inventory. It has been determined that CMSS uses preventive and problem-oriented strategies at a high level. In addition, in the sub-dimension of supportive strategies, it is seen that it is close to the middle level with an arithmetic mean of 151,50 and 13,8. Considering these values, it can be said that they use supportive strategies at a moderate level.

In the second sub-problem of the research, the question results of “Do preschool teachers' emotion regulation difficulties, cognitive flexibility and classroom management strategies differ according to gender, educational status, age and professional seniority?” based on LSD test are given in Table 3 for age and Table 4 for seniority.

Table 3. The Comparison of Pre-school Teachers' Total Scores and Sub-scores of ERDS, CFI and CMSS in Terms of Age

Scales	Age	n	$\overline{X}$	Ss	F	p	Significant Difference
ERDS	22-32	38	71,50	18,58	4,357	0,005	22-32/45 and over
	33-38	43	71,25	13,43			33-38/45 and over
	39-44	71	65,63	18,07			
	45 and over	59	61,37	14,71			
Explicity (EX)	22-32	38	9,36	3,19	3,734	0,012	22-32/39-44
	33-38	43	9,13	2,49			22-32/45 and over
	39-44	71	8,30	2,45			33-38/45 and over
	45 and over	59	7,81	2,45			
Awareness (AW)	22-32	38	10,18	3,14	5,170	0,002	33-38/22-32
	33-38	43	12,93	2,85			33-38/45 and over
	39-44	71	11,84	3,25			39-44/22-32
	45 and over	59	11,54	3,27			45 and over/22-32
Refusal (RE)	22-32	38	10,97	4,38	1,182	0,318	
	33-38	43	10,48	3,79			
	39-44	71	10,15	4,33			
	45 and over	59	9,47	3,52			
Strategies (ST)	22-32	38	15,71	5,07	3,456	0,017	33-38/45 and over
	33-38	43	15,37	4,42			
	39-44	71	14,05	5,46			
	45 and over	59	12,83	4,64			
Impulse (IM)	22-32	38	11,21	4,02	3,592	0,015	22-32/45 and over
	33-38	43	11,00	3,20			33-38/45 and over
	39-44	71	10,15	3,51			
	45 and over	59	9,18	3,04			
Objectives(OBJ)	22-32	38	14,05	4,22	8,148	0,000	22-32/33-38, 22-32/39-44
	33-38	43	12,32	3,35			22-32/45 and over
	39-44	71	11,11	3,86			33-38/39-44,
	45 and over	59	10,52	3,31			33-38/45 and over
CFI	22-32	38	86,60	9,88	2,926	0,035	22-32/33-38
	33-38	43	81,27	10,50			45 and over/33-38
	39-44	71	82,92	9,34			
	45 and over	59	85,83	9,98			
Control (CO)	22-32	38	58,44	6,48	4,214	0,006	22-32/33-38
	33-38	43	53,74	7,18			22-32/45 and over
	39-44	71	56,04	6,11			
	45 and over	59	57,30	6,10			
Alternative (AL)	22-32	38	28,15	4,17	1,500	0,216	
	33-38	43	27,53	4,44			
	39-44	71	26,88	4,48			
	45 and over	59	28,52	5,15			
CMSS	22-32	38	397,65	26,66	1,287	0,280	
	33-38	43	387,76	33,29			
	39-44	71	399,43	33,79			
	45 and over	59	395,86	30,26			
Preventive (PR)	22-32	38	210,26	15,23	1,258	0,290	
	33-38	43	206,55	18,06			
	39-44	71	212,83	17,87			
	45 and over	59	211,11	15,73			
Supportive (SU)	22-32	38	160,31	11,72	0,772	0,511	
	33-38	43	156,09	14,59			
	39-44	71	159,46	14,31			
	45 and over	59	158,12	14,19			
Problem Oriented (PO)	22-32	38	27,07	2,47	6,364	0,000	22-32/33-38
	33-38	43	25,11	2,71			39-44/33-38
	39-44	71	27,14	2,86			45 and over /33-38
	45 and over	59	27,11	2,56			

When Table 3 is examined, it is seen that there is a statistically significant difference the ages of the pre-school teachers in all ERDS ($F_{(3,207)} = 4,357$, $p<0,01$) and in all sub dimensions such as openness ($F_{(3,207)} = 3,734$, $p<0,05$), awareness ($F_{(3,207)} = 5,170$, $p<0,01$), strategies ($F_{(3,207)} = 3,456$, $p<0,05$), impulse ($F_{(3,207)} = 3,592$, $p<0,05$) and goals ($F_{(3,207)} = 8,148$, $p<0,01$). In addition, statistically significant differences were found in all CFI ($F_{(3,207)} = 2,926$, $p<0,05$) and total control sub dimension ($F_{(3,207)} = 4,214$, $p<0,01$) and problem-oriented classroom management strategies ($F_{(3,207)} = 6,364$, $p<0,01$) and the age groups of preschool teachers. However, it is not found that statistically significant differences between dependent variables such as preschool teachers' refusal to accept ($F_{(3,207)} = 1,182$, $p>0,05$), CMSS ($F_{(3,207)} = 1,287$, $p>0,05$), preventive ($F_{(3,207)} = 1,258$, $p>0,05$), supportive (F

$_{(3,207)}$ = 0,772, p>0,05) according to their age. LSD test was performed to find out between which groups the differences between the age groups were. According to these test results, it is seen that the averages of the 22-32 age group ($\bar{x}$ =71,50) and 33-38 age group ($\bar{x}$ =71,25) are higher than those aged 45 and over ($\bar{x}$ =61,37) in ERDS. In the openness dimension, it was determined that the average of the participants between the ages of 22-32 was higher than those aged 39-44 and 45 years and older. In the awareness dimension, it is seen that the average of 33-38 age range is higher than 22-32 and 45 years old and above. It was also determined that the mean of the 39-44 age group was higher than the 22-32 age group and finally the 45 and older age group compared to the 22-32 age group. In the dimension of strategies, it can be stated that the average of 33-38 years old is higher than 45 years old and over. In the dimension of impulse, the average of 22-32 and 33-38 age range is higher than 45 years and over. In the objectives dimension, it was determined that the averages of individuals aged 22-32 were higher than those aged 33-38, 39-44 and 45 years and older. And finally, it can be stated that the averages of 33-38 are higher than those of 39-44 and 45 and above. Finally, it was determined that the age ranges of pre-school teachers in the whole of the CFI were 22-32 aged and 45 and above were higher than those of 33-38. In the control dimension, it is seen that the averages of 22-32 are higher than those aged 33-38 and 45 and over. In the problem-oriented dimension of classroom management strategies, the averages of 22-32 compared to 33-38, 39-44 compared to 33-38, and 45 years and older compared to 33-38 were determined to be higher.

Table 4. The Comparison of Pre-school Teachers' ERDS, CFI and CMSS Scores in Terms of Professional Seniority

	Seniority	n	$\overline{X}$	Ss	F	p	Significant Difference
ERDS	1-10 years	72	69,13	16,70	3.913	0,021	1-10/21years and over
	11-20 years	124	66,48	16,95			11-20/21years and over
	21 years and over	15	56,00	11,88			
Explicity (EX)	1-10 years	72	8,88	2,76	5,723	0,004	1-10/21 years and over
	11-20 years	124	8,58	2,59			11-20/21 years and over
	21 years and over	15	6,40	1,72			
Awareness (AW)	1-10 years	72	11,59	3,32	0,128	0,880	
	11-20 years	124	11,68	3,22			
	21 years and over	15	12,06	3,41			
Refusal (RE)	1-10 years	72	10,31	4,15	2,550	0,081	1-10/21 years and over
	11-20 years	124	10,37	4,02			11-20/21 years and over
	21 years and over	15	7,93	2,78			
Strategies	1-10 years	72	15,01	4,74	3,888	0,022	1-10/21 years and over
	11-20 years	124	14,24	5,27			11-20/21 years and over
	21 years and over	15	11,06	3,47			
Impulse (IM)	1-10 years	72	10,76	3,55	2,974	0,053	1-10/21 years and over
	11-20 years	124	10,16	3,47			
	21 years and over	15	8,40	2,69			
Objectives (OBJ)	1-10 years	72	12,55	3,88	3,339	0,037	1-10/11-20
	11-20 years	124	11,43	3,84			1-10/21 years and over
	21 years and over	15	10,13	3,41			
CFI	1-10 years	72	85,29	9,57	1,218	0,298	
	11-20 years	124	83,16	10,04			
	21 years and over	15	85,60	11,45			
Control (CO)	1-10 years	72	57,00	6,22	0,852	0,428	
	11-20 years	124	55,87	6,68			
	21 years and over	15	57,33	7,07			
Alternative (AL)	1-10 years	72	28,29	4,20	1,163	0,315	
	11-20 years	124	27,29	4,79			
	21 years and over	15	28,26	5,31			
CMSS	1-10 years	72	392,52	30,11	0,893	0,411	
	11-20 years	124	396,65	33,17			
	21 years and over	15	403,66	24,61			
Preventive (PR)	1-10 years	72	208,62	16,37	1,086	0,340	
	11-20 years	124	211,23	17,69			
	21 years and over	15	215,00	11,72			
Supportive (SU)	1-10 years	72	157,65	13,12	0,435	0,648	
	11-20 years	124	158,76	14,54			
	21 years and over	15	161,20	12,28			
Problem Oriented (PO)	1-10 years	72	26,25	2,84	1,802	0,168	
	11-20 years	124	26,88	2,79			
	21 years and over	15	27,46	2,19			

As seen in Table 4, the professional seniority type of pre-school teachers is found a statistically significant difference is observed in all ERDS ($F_{(3,207)} = 3,913$, $p<0,05$) and sub-dimension of openness ($F_{(3,207)} = 5,723$, $p<0,05$), non-acceptance ($F_{(3,207)} = 2,550$, $p<0,05$), strategies ($F_{(3,207)} = 3,888$, $p<0,05$), impulses ($F_{(3,207)} = 2,974$, $p<0,05$) and goals ($F_{(3,207)} = 3,339$, $p<0,05$). It is seen that this difference is generally in favour of those with a professional seniority of 1-10 years. In terms of dependent variables CFI ($F_{(3,207)} = 1,218$, $p>0,05$), control ($F_{(3,207)} = 0,852$, $p>0,05$), patency ($F_{(3,207)} = 1,163$, $p>0,05$), CMSS ($F_{(3,207)} = 0,893$, $p>0,05$), preventive ($F_{(3,207)} = 1,086$, $p>0,05$), supportive ($F_{(3,207)} = 0,435$, $p>0,05$) and problem-oriented ($F_{(3,207)} = 1,802$, $p>0,05$), no statistically significant differences were found between the professional seniority of teachers.

The correlation coefficient results for the question in the third sub-problem of the study "Is there a significant relationship between preschool teachers' emotion regulation difficulties, cognitive flexibility and classroom management strategies?" are given in Table 5.

Table 5. The Relations between Pre-school Teachers' ERDS and CFI and CMSS Scores

	SDER	EX	AW	RE	ST	IM	OBJ	CFI	CO
CMSS	-0,180**	-0,182**	-0,241**	-0,093	-0,132	-0,120	-0,092	0,236**	0,287**
Preventive	-0,169*	-0,176*	-0,200**	-0,071	-0,111	-0,110	-0,137	0,207**	0,250**
Supportive	-0,159*	-0,164*	-0,254**	-0,091	-0,130	-0,105	-0,031	0,241**	0,291**
Problem Oriented	-0,189**	-0,144*	-0,272**	-0,132	-0,152	-0,120	-0,067	0,234**	0,307**

*p<0,01 **p<0,05

When Table 5 is examined, no statistically significant relationship was found between the sub-dimensions of rejection, strategy, impulse, and purpose of the preschool teachers' ERDS and the alternative sub-dimension of CFI, the whole of the CMSS, and the preventive, supportive, and problem-oriented sub-dimensions. Therefore, the dimensions of rejection, strategy, impulse and purpose of ERDS and the alternative sub-dimension of CFI were not included in the analysis. A moderate and high level of correlation was found between the whole ERDS and the openness and awareness sub-dimensions, the whole CFI and control sub-dimensions, and the whole CMSS and sub-dimensions.

The results of the analysis regarding the question of the fourth sub-problem of the study "Do preschool teachers' emotional regulation difficulties and cognitive flexibility determine their classroom management strategies?" are given in Table 6.

Table 6. The Effect of Pre-school Teachers' ERDS and CFI Scores to CMSS Scores

Variables		*Preventive* *[R=0,28;R^2=0,078]* *F(3;207)=5,848; p=0,001*	*Supportive* *[R=0,32;R^2=0,104]* *F(3;206)=7.982; p=0,00*	*Problem Oriented* *[R=0,33;R^2=0,114]* *F(3;207)=8,872; p=0,00*
Explicity	β	-0,317	-0,006	0,036
	t	-0,645	-0,015	0,452
	p	0,520	0,988	0,652
Awareness	β	-0,647	-0,703	-0,146
	t	-1,520	-2,040	-2,130
	p	0,130	0,043	0,034
Control	β	0,416	0,427	0,098
	t	1,964	2,483	2,868
	p	0,051	0,014	0,005

When Table 6 is examined, the openness and awareness dimension of the emotion regulation difficulties of preschool teachers and the control sub-dimension of cognitive flexibility were found to be significant as a whole of the classroom management strategies such as preventive ($F_{(3,207)} = 5,848$, $p<0,05$), supportive ($F_{(3,206)} = 7,982$, $p<0,05$), and the problem-oriented strategies ($F_{(3,207)} = 8,872$, $p<0,05$) thanks to multiple regression model. Teachers' emotional regulation difficulties for openness and awareness, and their cognitive flexibility in control dimension, together with their preventive strategies, constitute 8% (R^2=0,078) of the total variance. This also explains 10% of the total variance for supportive strategies (R^2=0,104) and problem-oriented strategies for 11% (R^2=0,114) of total variance. According to the standardized regression coefficient (β), the relative importance of the independent variables on preventive, supportive and problem-oriented strategies is control, awareness and openness for each independent variable. When the t-test results regarding the significance of the regression coefficients are examined, it is seen that only awareness and cognitive flexibility, which are among the emotional

regulation difficulties of the teachers, are a significant influence on the supportive ($p<0,05$) and problem-oriented ($p<0,05$) strategies of the classroom management strategies. However, it can be said that preventive strategies ($p>0,05$), which are among the classroom management strategies, are not affected by emotional regulation difficulties, openness and awareness, and cognitive flexibility by control variables.

DISCUSSION

It has been detected that early childhood teachers have low emotional regulation difficulties and high cognitive flexibility levels. Çuhadaroğlu (2013) determined that the cognitive flexibility levels of instructors and instructor candidates are high. Yaşar Ekici and Balcı (2019) found that their emotional reactivity levels decrease when the cognitive flexibility level of early childhood teacher candidates increases. These results coincide with the finding that while the cognitive flexibility levels of the teachers' participation in our research are high, their emotion regulation difficulties are low.

In our research, it was determined that early childhood teachers use preventive and problem-oriented strategies at a high level and supportive strategies at a moderate level in classroom management. Türk et al. (2019) reveal that preschool teachers focus on behaviour management and prevention of undesirable behaviours in their classroom management practices. In addition, it has been determined that preschool teachers in many countries prefer models that focus on traditional teacher-child interaction and give control to teachers [see, for example, Balli, 2011 (USA); O'Neill & Stephenson, 2012 (Australia); Akar et al., 2010 (Turkey)] and use reward and punishment methods in classroom management (Balli, 2011; Ozmon & Craver, 2008; Şahin-Sak et al., 2018). However, researchers now focus on emotionally supportive classroom management education (Hu et al., 2016; Dicke et al., 2015).It has been detected that preschool teachers' awareness levels, which are among the emotional regulation difficulties, are effective on supportive and problem-oriented strategies from classroom management strategies, but it has no effect on preventive strategies. It is considered that since the strategies for the problem are the strategies applied at the time of the problem and the supportive strategies applied after the problem, it is thought that the teacher's emotion regulation skills are affected. Because preventive strategies are strategies that are determined and implemented long before a problem occurs, they are thought to be unaffected by emotion regulation skills. Other studies supporting our research findings were also found in the literature: Kara and Dikici Sığırtmaç (2022) revealed that there is a positive relationship between teachers' emotion regulation skills and classroom management skills. Gerber et al., (2007) emphasized that there is a relationship between teachers' emotional well-being, classroom management skills and classroom quality. It was emphasized that the recognition of the emotional and psychological health of those who provide child care and education is important for the quality of care and education of children. Similarly, Amato and Keith (1991) underlined that negative interactions between children and adults are important for the development of children's social-emotional functions. The fact that the emotional health of those who provide child care and education is not good has also revealed that these people tend to spend less time with children (Arnold et al., 1998; Hamre and Pianta, 2004). Jeon et al., (2014) emphasized that emotionally fatigued teachers do not have enough energy in classroom management, child care and providing learning opportunities. Buettner et al., (2016) stated that high emotional load is associated with teachers' negative reactions and lower levels of participation in the profession.

It has been detected that preschool teachers' cognitive flexibility and control levels are effective unsupportive and problem-oriented strategies from classroom management strategies. In addition to, it was stated that it had no effect on preventive strategies. The effect of the control sub-dimension, which reflects the thoughts of teachers that difficult situations can be controlled, on supportive and problem-oriented strategies in classroom management reveals that preschool teachers perceive the difficult situations they encounter in the classroom as events that can be coped with. Oishi et al., (2018) underline that teaching is a profession associated with a wide variety of stress factors and that early childhood teachers need to acquire realistic and adaptive stress coping behaviours that rely on high cognitive flexibility in order to define problems correctly and give appropriate answers. Teachers need to have the ability to quickly solve successive daily problems, quickly notice the changing atmosphere of students and the classroom, and react instantly to them. Therefore, it is important that teachers' cognitive flexibility skills are developed. Bilgin (2017) underlined that as individuals' cognitive flexibility levels increase, their self-control skills are better and they are more open to development, and they exhibit more emotionally inconsistent behaviours when their cognitive flexibility scores decrease. Camcı-Erdoğan (2018) study reveals that pre-service teachers' problem-solving skills increase when their cognitive flexibility levels increase. Similarly, other studies reveal that people with problem-solving and cognitive flexibility skills develop a self-confident, objective and impartial perspective and can think creatively.

It was determined that teachers over the age of 45 and with more than 21 years of experience had fewer emotion regulation difficulties. According to this finding, it can be said that they can better control their emotions when the professional experience of preschool teachers increases. Akgün and Yılmaz (2021) revealed that there is an important difference in the emotion regulation behaviour of early childhood teachers according to their professional seniority and that the emotion regulation behaviours of early childhood teachers with professional seniority of 20 years and above are higher than those of teachers with professional seniority between 1-5 and 6-10 years. As individuals mature with age, they can look at events from a wider perspective, produce more different solutions to troubled situations, and accommodate new situations more easily.

It is indicated that preschool teachers between the ages of 22-32 have the highest scores in the cognitive flexibility control sub-dimension. According to this finding, it can be said that the cognitive flexibility control sub-dimension of preschool teachers who have just started their profession is better. Since the 'Control' sub-dimension of the cognitive flexibility scale determines the opinions of the teachers about the control of difficult situations, it can be said that teachers who are new to the profession have a higher level of cognitive flexibility that they can control difficult situations. Temel (2021) revealed that teachers who are just at the beginning of their professional life have a higher level of understanding of the complexity of challenging situations or events. Ateş and Sağar (2021), state that university students with high cognitive flexibility can see and evaluate alternative situations and options, and offer different solutions.

CONCLUSION & RECOMMENDATIONS

It has been detected that early childhood teachers have high levels of emotion regulation and cognitive flexibility; they can control their emotions better when their professional experience increases. It has been shown that the cognitive flexibility of newcomers to the profession is better. In addition, it was found that they used preventive and problem-oriented strategies at a high level and supportive strategies at a moderate level in classroom management.

Nowadays, classroom management focuses on expectations about learning rather than preventing problems before they occur or managing the process when they occur. Classroom management models that encourage active learning and individual participation in cooperation with children by enriching learning environments in the process of achieving success are preferred rather than models that maintain order only by following the rules (Hamre, et al. 2012). This means that nowadays classroom management models are rapidly changing from traditional models to preventive, developmental and holistic models. In other words, classroom management models; that see learners as social beings, take into account their personal and psychological needs, integrate positive teacher-student relationships with supportive environmental conditions, apply methods that facilitate learning, and create a rich learning environment; are preferred (Gehlbach, Brinkworth, & Harris, 2012). For this reason, it is important to include preschool teachers in practical education so that they can use preventive and problem-oriented strategies as well as supportive strategies integrally in classroom management (Karademir & Saatçioğlu, 2021).

It was determined that awareness levels from emotion regulation difficulties and control levels from cognitive flexibility were effective on supportive and problem-oriented classroom management strategies, but not on preventive strategies. According to these findings, it can be stated that supporting the emotion regulation skills of new teachers and cognitive flexibility levels of experienced teachers will have a positively impact on classroom management skills. Thus, the rate of preschool teachers' use of preventive and problem-oriented strategies as well as supportive strategies in classroom management can be increased. Therefore, it is suggested to add content that supports early childhood teachers' cognitive flexibility and emotion regulation skills to education programs that support preschool teachers' classroom management skills. In these trainings, it is recommended that attention should be paid to supporting the emotion regulation skills of early childhood teachers who are new to the profession, and the cognitive flexibility levels of experienced teachers.

Statements of Publication Ethics

The principles of publication ethics were obeyed in the study. Ethical permission of the research was approved by Yozgat Bozok University, Human Research Ethics Committee (19/01/2022-29/17).

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion	(Other)
Author 1	☒	☐	☒	☐	☒	☒	☒
Author 2	☒	☐	☒	☐	☒	☒	☒
Author 3	☐	☒	☒	☒	☒	☒	☒

Conflict of Interest

There are no conflicts of interest in this study.

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Self-Sufficiency Beliefs of Class Teacher Candidates on Museum Education

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Abstract

The aim of the study is to determine the self-sufficiency beliefs of classroom teacher candidates regarding museum education according to the variables of gender, total level, and whether they have taken a course related to the subject of the museum before. The study was conducted with the screening method, one of the quantitative research methods. The study was carried out with teacher candidates who continue their education in the Classroom Teaching Program at a state university located in the Western Black Sea Region. The purposive sampling method was used in the selection of primary school teacher candidates who participated in the study. The implementation process of the study was carried out in the 2020-2021 academic year. The Personal Information Form that was created by the researchers and the "Self-Sufficiency Belief Scale for Museum Education" that is developed by Yeşilbursa & Uslu (2014) was used to gather data. Anova Test, Mann Whitney U Test and Kruskal Wallis Test were used to solve data. As a result of the study, the self-sufficiency beliefs of classroom teacher candidates on museum education were obtained as 'high'; It has been agreed that the gender variable did not show a significant difference in the state of belief regarding museum self-sufficiency, and variables of all level and whether or not to take courses related to museum education beforehand caused a significant difference in the process.

Keywords: Museum, museum education, self-sufficiency belief, class teacher candidates.

Sınıf Öğretmeni Adaylarının Müze Eğitimine Yönelik Özyeterlik İnançları

Öz

Bu çalışmada sınıf öğretmeni adaylarının müze eğitimine ilişkin özyeterlik inançlarının cinsiyet, sınıf seviyesi ve daha önceden müze konusuyla ilgili ders alıp almama değişkenlerine göre belirlenmesi hedeflenmiştir. Çalışma, nicel araştırma yöntemi, tarama yöntemiyle hazırlanmıştır. Çalışma Batı Karadeniz Bölgesi'nde yer alan bir devlet üniversitesinde, Sınıf Öğretmenliği Programı'nda öğrenimlerine devam eden öğretmen adaylarıyla gerçekleştirilmiştir. Çalışmaya katılan sınıf öğretmeni adaylarının seçiminde amaçlı örnekleme yöntemi esas alınmıştır. Çalışmanın uygulama süreci 2020-2021 eğitim öğretim döneminde gerçekleştirilmiştir. Verilerin bir araya getirilmesi için araştırmacılar tarafından oluşturulan Kişisel Bilgi Formu ile Yeşilbursa ve Uslu (2014) tarafından geliştirilen 'Müze Eğitimine Yönelik Özyeterlik İnanç Ölçeği' kullanılmıştır. Verilerin çözümünde Anowa Testi, Mann Whitney U Testi ve Kruskal Wallis Testi kullanılmıştır. Çalışmanın sonucunda, sınıf öğretmeni adaylarının müze eğitimine yönelik özyeterlik inançları 'yüksek' olarak elde edilmiş olup; cinsiyet değişkeninin müze özyeterliğine ilişkin inanç durumunda anlamlı farklılık göstermediği, sınıf seviyesi ve önceden müze eğitimi ile ilgili ders alıp almama değişkenlerinin ise süreçte anlamlı farklılığa neden olduğu anlaşılmıştır.

Anahtar kelimeler: Müze, müze eğitimi, özyeterlik inançları, sınıf öğretmeni adayları.

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INTRODUCTION

Human beings have various interests and needs as social beings from the moment of birth. So, individuals try to meet emerging individual or social needs in time. In this way, they complete their essential and emotional needs. In doing so, they both learn and teach. In this direction, humans are in a development throughout their lives. As developing personally, they take a step into life by putting their emotions at the forefront. At this point, they direct themselves to an area of their interest. In this context, each person's interests may differ. One of them is the area of creating collections with the tendency of researching, examining, collecting and exhibiting old works from past to present because ancient artifacts are the realities of the social life of humanity (Güleç & Alkış, 2003). In this reality that extends from past to present, a human is not only a being who listens and make do with what they listenbut also a person who research, question, criticize and interpret (Janes, 2010; Yücel Kurnaz, 2015). Over time, people have tended to use the ancient artifacts for demonstration purposes. Due to this use, they opened the ancient pieces to their close circle through exhibition. The concept ofthe display has been used for the purpose of hiding and showing off from past to present. These aims have replaced their places with the concept of a 'museum' over time.

A classroom teacher is a person who influences the mental development of people, helps future generations to be researchers and creators in addition to impacting their attitudes and behaviors; a candidate classroom teacher is a student who continues education for these purposes (Aptekin Yolcu, 2018). Classroom teacher candidates, who have an important impact on future generations, need to be knowledgeable about museum education and have a belief in self-efficacy. As for museums, they are places where cultural artifacts are learned (Cengiz, 2006; Lee et al., 2021). Museums are important places for humankind. Because they are the places where information about the past is retrieved. Museum education, on the other hand, is the state in which learning about museums is carried out with a combination of formal and non-formal education (Şahan, 2005). This training should be taken into consideration as it involves teachers and candidate teachers. A teacher is supposed to be able to attract students' attention and raise their awareness about this issue. He/she should be able to arouse excitement and enthusiasm in students. The teachers who possess self-efficacy can support students. Self-efficacy is the awareness of what a person is capable and incapable of doing (Acar, 2007). Candidate teachers' self-efficacy in the subject of museum education can contribute to education.

Museums are places where many artifacts in history are stored, preserved, exhibited and used for information purposes. Many different definitions of “museum” have been made. The definition of a museum by the International Council of Museums (ICOM) is as follows: Institutions that work for the public benefit by collecting artistic, scientific, health and technological works together, which are tasked with preserving cultural artifacts and aiming to prioritize the education, school and taste of these pieces, are called museums (URL-1, 2022).Museums have developed themselves in the society and have taken a step towards becoming an institution that is particularly interested with education and training life of children (Önder, Abacı, & Kamaraj, 2009). According to Özçelik Tezel (2007), museums are important institutions where past experiences are learned with evidence and historical life forms of nations are learned. They are places where artistic and scientific objects, remains and pieces are preserved and stored in order to open and show them to the public (Kocaoluk & Kocaoluk, 1982; MEB, 2015; TDK, 2021).

Museums have been used in different meanings since the day they were founded. In Ancient Greek Mythology, the word ‘Mouseion' in Greek and 'Museum' in Latin in the sense of House of Mousas and then Temple of Sciences have been used, and have been translated into all world languages (Real, 1999; Dilli, 2014; Peker, 2014; Demir, 2015; Sölpük, 2015). The concept of a museum has shown itself in ancient times, originating from the needs of people (Kaya Koçak, 2010). Museums maintain their existence due to situations arising from people's wishes. Therefore, museums have shown their existence together with ancient people. Previously, nobles, wealthy merchants, princes, businesspersons had exhibited their personal belongings and had collected beautiful objects and pictures for show (Camgöz, 1996). In fact, only certain sections of a museum were able to be visited in the first years of existence (Hooper-Greenhill, 1995). In this respect, museums have recently been opened to the public. During the Middle Ages, artifacts have preserved their existence by hiding in holy places and churches and had taken place only in exhibition areas of religious artifacts (Real, 1999; Çetin, 2002; Karakaya, 2015). This order changed with Reformation and Renaissance movements. The discovery of Americans and the antique artifacts which travelers had brought has provided the formation of the museum in real terms (Ören, 1994).

The first museum in the world is the Alexandria Librarywhich was opened in the Egyptian city of Alexandria in the 3rd century BC (Yücel, 1999, 20; cited in Ekelik, 2010; Pekgözlü Karakuş, 2012). However,

creating a museum from the collection was first done in the Ashmolen Museum in England (Yıldızturan, 2007). Other museums in the world: Uffizi Gallery; which is a museum in Italy (Şahin, 2007), the British Museum; the world's first public museum in England, the Smithsonian Institute Museum; which is a foundation museum (Keleş, 2003), the Lauvre Museum; which is the first public museum in France (Kervankiran, 2014), the Metropolitan Museum in New York (Sönmez, 2011), the Hermitage Museum in Russia. Museums have also developed in Turkey. Caves in Anatolia show the existence of museology with rock paintings (Sönmez, 2011). The first step was taken in Turkey with the appearance of Osman Hamdi Bey in museology, which is carried out by foreign people in Turkey (Kervankiran, 2014). The first museum in Turkey was opened in Hagia Eirene Church in Istanbul (Kaplan, 2017). After Osman Hamdi Beyshowed himself in Turkey, he established the Archeology Museum and Sanayi-i Nefise School (Keleş, 2003). Ottoman State enacted the law of Asar-ı Atike Nizamnamesi (Ancient Works Law) in 1869 in order to protect ancient monuments (Turkish Republic Ministry of Culture and Tourism, 2014). Some museums in Turkey are as follows; Ankara Ethnography Museum (Özkoç & Duman, 2008), Rahmi Koç Industry Museum in Istanbul (Çetin, 2002), Natural History Museum (Meydan & Akkuş, 2014), SadberkHanım Museum (Sölpük, 2015). There is not only pottery or artifacts in the museums. Written pieces have also been published. Samuel Van Quichberg's published the book 'Inscriptiones', and C.F. Neicklius published the piece named 'Museographia' (Real, 1999; Şahin, 2007).

Museums have had different purposes and duties since the day they were founded. Museums aim to transfer cultures that humanity has accumulated in the past to future generations (Atınç & Karadeniz, 2011). Museums exhibit pieces by using communication tools in order to keep up with the times (Keleş, 2003). In particular, technological developments have brought changes to the aims of museums and ideas about museums. Technological developments in society also change people's lives and understanding (Şahan, 2005). Museums were initially opened for collection purposes. In the early days when museums emerged, they were seen as a direct educational environment, but this view has changed over time (Tezcan Akmehmet & Ödekan, 2006). However, now museums are also used as educational spaces for people to improve themselves (Kısa & Gazel, 2016). In this case, museums require also scientific information to be shared not only cultural facts (Andre, Durksen & Volmen, 2017) because museums are educational institutions that contribute to the development of taste and creativity feelings in individuals (Şahan, 2005). Museums that help to develop society have purposes related to science, art and social life, but they also have educational and entertainment purposes (Cengiz, 2006; Yeşilbursa & Uslu, 2014; Popielarz & Galliher, 2023). In addition, it can be said that museums also havethe task of collecting, documenting, protecting, exhibiting and training (Demirci, 2009; Ekelik, 2020; Peker, 2014; Yücel Kurnaz, 2015). Museums have developed and differentiated in line with the needs of society (Çerkez, 2011). This differentiation has diversified museums. Museums are divided into types according to their collected pieces, administrative institutions, the region they serve; groups who are interested, places where they exhibit their collections and their themes (Buyurgan & Mercin, 2005).

The use of museums alongside schools for education provides quality learning for students. For this, teachers should also use museums as auxiliary education for schools (Demirci, 2009). The artifacts in museums reflect the ancient culture of existing humanity and the past. In this respect, it helps visitors to see and experience the past, to touch and smell artifacts (Bagherebadian, 2015; Umralieva et al., 2021). In addition, the approach of learning by practicing is adopted in our education system. Museums are one of suitable environments for students to cooperate and socialize in society (Kaya Koçak, 2010). For this reason, museum visits are important for students to learn based on both socialization and cooperative learning of students and teachers. Museum visits enable students to develop their feelings and communication with artifacts and the past. Museum visits need to have several features in order to achieve their purpose and be efficient. These are preparation before the museum visit, responsibility during the museum visit and general evaluation stages after the museum visit (Yücel Kurnaz, 2015). The museum gains its existence with the pieces that it exhibits, becomes a place to exhibit its pieces, and finally establishes a bond between pieces and the society that follows it (Atagök, 1999).

The fact that the Turkish education system is based on the method of learning by practicing and that the students should receive education on museums shows the need for museum education (Şar & Sağkol, 2013). The use of museums for educational purposes is very recent, that is, in the 19th century (Yeşilbursa & Uslu, 2014). Every level of museum education has started earlier in Europe and America than in Turkey (Çakır İlhan, 2016). In this case, the most developed countries see museum education as a valuable resource for both formal and non-formal education (Mercin, 2006). In addition to increasing the awareness level of students in terms of art, knowledge and museum education (Mamur, 2015), the understanding of an individual who is inclined to museum

education also develops because museums provide meaningful information in terms of expressing an individual's thinking skills and emotions (Şahan, 2005).

Museum education can be done both as a visit and in virtual ways. Since virtual museums are not tied to time and place, students at all levels can easily reach them (Sungur & Bülbül, 2019). In the current era, technology has made progress. As a result of this development, museums can be visited without going to their actual locations. Through the Internet, artifacts can be accessed virtually for people who are unable to visit museums (Sönmez, 2011).When museum education is tried to be done in museums, it may cause some problems for the teacher. A few of these problems are crowded classrooms, the indifference of museum officials, intense permission procedures for museum visits, finding a good guide, providing transportation and food, students may damage museum artifacts, etc (Çalışkan, Önal, & Yazıcı, 2016). A teacher should make a good plan for the museum visit because museum education requires a good plan and cooperation of the teacher with the museum (Yeşilbursa & Uslu, 2014). Likewise, different teaching methods and techniques, tools and materials can be used during museum education (Selanik Ay & Kurtdede Fidan, 2014). The aim is to ensure that students are ready for both life and higher education (Tosun, 2015). For this reason, museum education of primary school students should be given importance (Canlı, 2016). Especially,in the first stage, museum achievements are presented with Social Studies lessons. This course is one of the courses that envisages an individual to be intertwined with society throughout his life (Şimşek, 2013). The Social Studies lesson refers to the feelings and thoughts of all the students in 1st, 2nd and 3rd grades (Köken, 2003).It is recommended to combine curricula and museum activities for a quality museum visit (Noel, 2007; Martin et al., 2016).Likewise, it is stated that cooperation with museums should be made in university education and that a program should be prepared and presented to teacher candidates (Seligmann, 2015). The presentation of museum education to teacher candidates by adapting it to course schedules helps teacher candidates gain self-efficacy in museum education. In this regard, pre-service teachers' skills in the field can be improved (Demirtaş, Cömert & Özer, 2011). By means of organizing seminars on this subject for teachers as well, the information they require for instruction at museums is provided (Aktekin, 2008). Before, during and after a museum visit, teachers should have some features in order to inform students. At the beginning of these, self-sufficiency beliefs about museum education are important. Going to a museum might be extremely hard for a teacher due to the fact that keeping an organized atmosphere with the students would not be as easy as in a classroom. However, overcoming this obstacle by making visits to museums indicates their level of knowledge about the topic (Yeşilyurt, 2013). It is utterly important to overcome teachers' deficiencies in regard to museums since it will also affect students. Teachers are of great importance to their students as they are the providers of academic knowledge (Akbaş & Çelikkaleli, 2006). A teacher who has good self-efficacy contributes to competence and personal development as well (Yıldırım & İlhan, 2010). Teacher's beliefs in self-efficacy affect his/her performance in the lesson, the methods used for the lesson and the success of the students (Tschannen-Moran & Hoy, 2001; Akbaş & Çelikkaleli, 2006).

Self-sufficiency beliefs are important for teachers to cope with potential problems and problems in their professional lives to manage their self-confidence (Yeşilyurt, 2013). In this case, the self-confidence of teacher candidates in museum education is important in their future professional lives. In order for museums to be used in lessons, classroom teacher candidates should be informed about the subject by increasing their knowledge and skills about museums (Çalışkan, Önal, & Yazıcı, 2016; Gutwill, 2018). Developing classroom teacher candidates' and teachers' self-sufficiency beliefs advance their positive view of education in museums. Along with teacher's content knowledge, there must also be a belief in self-sufficiency (Saracaloğlu, Yenice, & Özden, 2013) because self-sufficiency belief is an important concept that should be given more value in educational matters (Aşkar & Umay, 2001). Teachers with a developed self-sufficiency belief both enjoy life and are patient and understanding towards their students. Within the scope of the subject, teacher candidates who have a high self-sufficiency belief in museum education can also successfully complete their education. It is hoped that it will help to know thedegree of self-efficacy of candida teprimary school teachers regarding museum education and toguide the problems that mayemerge. Similarly, predicting and ruling out potential issues can be accomplished by assessing whether candidate class teachers' self-efficacy beliefs differ based on gender, gradelevel, and whether or not they have taken a museum education course in the past. It is thought that such a study can contribute to other studies which can be conducted in the future. Self-efficacy beliefs of teachers and candidate teachers are one of the significant focal points (Yeşilyurt, 2013). In this context, the aim of the study is to reveal the self-sufficiency beliefs of classroom teacher candidates on museum education. In line with this purpose, answers to the following questions have been searched:

1.What are the self-sufficiency beliefs of classroom teacher candidates on museum education?

2.Do classroom teacher candidates' self-sufficiency beliefs on museum education differ according to gender, all level and whether they have taken courses related to museum education before?

It is thought that the study within the scope of related questions will be important in terms of revealing the self-sufficiency beliefs of teacher candidates about museums that play a role in the transfer of culture from past to present. Examining the self-sufficiency beliefs of teacher candidates in museum education is a remarkable issue in establishing the past-present-future link with its current structure, and it is aimed that the results of the study will contribute to field literature.

METHOD

Research Model

In this study, was carried quantitative research method to reveal museum self sufficiency of class teacher candidates. In research method process used survey model which is included in the quantitative research method (Sukamolson, 2007), is used in order to determine the self-sufficiency beliefs of classroom teacher candidates on museum education. Survey model includes studying a selected sample from the universe with a large number of data (Kısa & Gazel, 2016).

Study Group

This study is conducted with classroom teacher candidates who study in the 1st, 2nd, 3rd and 4th grade of a state university in the Western Black Sea Region in the 2021-2022 academic years. 100 teacher candidates, 65 females and 35 males, participated in the study. In the selection of samples, the convenience sampling method was taken as basis (Yıldırım & Şimşek, 2006). Due to the pandemic, this method was preferred in order to reach classroom teacher candidates more easily. Since participation in the study was not compulsory, the study group was limited to 100 candidate classroom teachers.

Data Collecting Tools

The data in the study is obtained with the Personal Information Form and "Self-Sufficiency Belief Scale on Museum Education" developed in line with Yeşilbursa & Uslu (2014). The Self-Sufficiency Belief Scale on Museum Education, which is used in the study, is developed in the Likert type. The scale was obtained as a 24-item scale by Yeşilbursa and Uslu (2014) through literature research and expert opinion, and a pilot study was conducted. The internal consistency of the scale was calculated, and it was concluded that it was valid and reliable. Cronbach alpha internal consistency was calculated and it was found to be .94. Items in the scale are prepared to be scored from 1 to 5 points. Permission to apply the scale and necessary permissions from the Ethics Committee are obtained from both the researchers who prepared the scale and the university where the study is conducted.

Data Analysis

Statistical analysis program is applied in the analysis of data. In the study, Anova, Mann Whitney U and Kruskal Wallis tests are used. The significance level of obtained data as a result is taken into account as [p (<)05]. A normality test was performed for the distributions. According to the normality test examined that, it because was controlled that all scores weren't normally distributed at the level of .05. Therefore, in process used the nonparametric tests. According to the studies, a t-test was used to understand whether the data differed according to the specified variables. While evaluating results, standard deviation and arithmetic mean values are used. In the interpretation of data, a classification in the format of '1.00-1.79 quite low, 1.80-2.59 low, 2.60-3.39 medium, 3.40-4.19 high, 4.20-5.00 quite high. 'is taken into consideration and results are evaluated (Yeşilbursa & Uslu, 2014).

Research Ethics

Personal Information Form and Self-Sufficiency Belief Scale on Museum Education are administered online to classroom teacher candidates due to COVID-19 pandemic. Voluntary classroom teacher candidates participated in the study.

FINDINGS

In this section, obtained data as a result of the study are given. The data are given in order according to the sub-objectives of the study.

Findings and Comments on the First Sub-Aim

In this point, findings and comments about the sub-problem on "What are the Self-Sufficiency Beliefs of Classroom Teacher Candidates on Museum Education?" are given. Obtained information for the first problem is defined in Table 1.

Table 1.Total Scores of Self-Sufficiency Beliefs of Classroom Teacher Candidates on Museum Education

	f	Achieved Lowest Total Score (Min)	Achieved Highest Total Score (Max)	$\bar{X}$	Ss	Mode	Median
Total	100	37	120	88,18	16,79	81	90,00

In Table 1, the lowest total score, the highest total score, arithmetic averages and standard deviations of total scores of self-sufficiency beliefs about museum education of classroom teacher candidates are seen. It is seen that 100 teacher candidates participated in the study. As a result, the arithmetic mean is obtained as 88.18. According to this result, classroom teacher candidates' self-sufficiency beliefs in museum education are high. The standard deviation is obtained as 16.79. This result also shows that there is no difference between the data.

Findings and Comments on the Second Sub-Aim

In this title, findings and comments are mentioned about the question of the second sub-problem which is “Do Classroom Teacher Candidates' Self-Sufficiency Beliefs Regarding Museum Education Change According to Gender? Data information is defined in Table 2 and Table 3.

Table 2.T-Test Results on Normality of Self-Sufficiency Beliefs on Museum Education of Classroom Teacher Candidates by Gender Variable

	n	$\bar{X}$	Ss	Sd	t	p
Gender	100	1,35	0,48	99	28,162	0,000

When looking at Table 2, it is seen that the self-sufficiency belief scores of teacher candidates are not normally distributed according to gender variables (t_99=28.162; p<0.05). In this case, since there is no normal distribution, the Mann-Whitney U test is applied to test the difference.

Table 3. Mann Whitney U-Test Results on the Differences in Self-Sufficiency Beliefs Regarding Museum Education of Classroom Teacher Candidates by Gender

	Gender	n	Rank Average	Rank Total	U	p
Total	Female	65	52,62	3420,00		
	Male	35	46,57	1630,00	1000	0,320
	Total	100				

In Table 3, the self-sufficiency beliefs of classroom teacher candidates on museum education didn’t show a significant variation according to gender variable [U= 1000; p>0.05]. In other words, the fact that teacher candidates are male or female does not affect self-sufficiency beliefs about museum education.

Findings and Comments on the Third Sub-Aim

In this point, findings and comments are mentioned about the problem of "Do Classroom Teacher Candidates' Self-Sufficiency Beliefs on Museum Education Change According to the Class Level of Candidates?" The results are described in Tables 4 and 5.

Table 4.T-Test Results on Normality of Total Level on Self-Sufficiency Beliefs of Classroom Teacher Candidates on Museum Education

	n	$\bar{X}$	Ss	Sd	t	p
Total Level	100	2,57	1,112	99	23,103	0,000

When Table 4 is examined, the self-sufficiency beliefs of classroom teacher candidates did not show a normal distribution according to grade level variable (t_99=23.103; p<0.05). In this case, the Kruskal Wallis test is used to test the difference in grade level that is not normally distributed.

Table 5. Kruskal Wallis-Test Results on Differences of Grade Teacher Candidates' Self-Sufficiency Beliefs Regarding Museum Education According to Grade Level

	Grade Level of Teacher Candidates	n	Rank Average	p	Mann Whitney U	U/ p
Grade Total	1. grade	23	36,20	0.013	1st and 4th Grade	152/ 0,003
	2. grade	23	48,09			
	3. grade	28	52,48			
	4. grade	26	63,15			
	Total	100				

According to Table 5, self-sufficiency beliefs of classroom teacher candidates on museum education showed significant variability according to grade level (p<0.05). In this case, studying in the 1st, 2nd, 3rd and 4th grades affects the sense of self-sufficiency in museum education. Mann Whitney U-test is used to see at which grade levels this different output is found and it is concluded that the difference is between 1st and 4th grades (U=152; p<0.01).

Findings and Comments on the Fourth Sub-Aim

In this section, findings and comments are mentioned about the problem of "Do Grade Teacher Candidates' Self-Sufficiency Beliefs on Museum Education Differentiate According to Whether Classroom Teacher Candidates Have Taken Courses Related to Museum Education or not?" Findings related to the problem are described in Table 6.

Table 6. Mann Whitney U-Test Results on Classroom Teacher Candidates' Self-Sufficiency Beliefs on Museum Education According to Variable of Whether Teachers Have Taken a Course Related to Museum Education or Not

	Whether Classroom Teacher Candidates Have Taken Museum Classes Before	p	Rank Mean	Rank Total	U	p
Grade Total	Yes	26	66,90	1739,50	535	0,001
	No	74	44,74	3310,50		
	Total	100				

When Table 6 is examined, it is seen that the self-sufficiency beliefs of classroom teacher candidates on museum education show a significant change according to the variable of whether they have taken a course related to museums before [U= 535; p<0.05]. Taking or not taking courses related to museum education affects the self-sufficiency beliefs of classroom teacher candidates. When the rank mean is examined, it is seen that the difference resulted in favor of teacher candidates who had previously received training in museum education.

DISCUSSION & CONCLUSION

In this section, the results of the study are referred. Discussions and suggestions are also included in the results.

The study was carried out to determine the self-sufficiency beliefs of classroom teacher candidates in museum education. In the study, the self-sufficiency beliefs of classroom teacher candidates on museum education resulted as 'high'. This situation is seen as a positive development in terms of museum self-sufficiency beliefs of classroom teacher candidates because classroom teacher candidates (future classroom teachers) have a positive attitude toward museums that have lighted our history. Bulut & Atilla (2017), in their study on the effect of museum education on visual arts courses in children, concluded that participants exhibited a positive attitude toward the process after museum education. Yaman, Cansüngü Koray & Altunçekiç (2004) studied the self-sufficiency beliefs of science teacher candidates. As a result of the study, it is concluded that the classroom teacher candidates studying in different high school types had similar self-sufficiency. Mamur (2015) studied museum education in visual arts classes and concluded that students' awareness increased. Yeşilbursa & Uslu (2014); Kılınç & Uygun (2015) studied self-sufficiency perceptions and self-sufficiency awareness of primary school teacher candidates in social studies courses and concluded that awareness levels of teacher candidates are high. Tural & Kala (2018) obtained high self-sufficiency beliefs of candidates who study social studies teaching. Again, Demirel

(2020) obtained the information that self-sufficiency of teacher candidates developed positively after given training in his study that is named self-sufficiency for educational practices in museums. When the literature is examined, it is seen that related studies have similar features to this study and in this direction, it is thought to support the results of the study.

In the study on the effect of classroom teacher candidates' self-sufficiency beliefs on museum education on the gender variable, no significant difference was found regarding the second sub-problem. In this context, Yeşilbursa & Uslu (2014) in their study, concluded that self-sufficiency beliefs don't differ according to gender. Peker (2014) it is found that social studies teacher candidates' attitudes toward the use of virtual museums did not change according to gender. Gürbüz (2017) examined the views of classroom teachers about pieces in the museum based on some variables and did not reach any difference regarding the gender variable. Kılınç & Uygun (2015) did not reach a different conclusion regarding gender in their metacognitive awareness study. Kısa & Gazel (2016) analyzed about the use of museums based on the items and found a difference in 2 items related to gender but did not reach a different result in 18 items. Tural & Kala (2018) did not find a significant gender difference in their study. The results of related studies support the results of this research.

The third sub-problem is whether the self-sufficiency of classroom teacher candidates changes significantly according to the total level. As a result of research, a difference is observed in the museum self-sufficiency beliefs of teacher candidates at the 1st and 4th total levels. Yeşilbursa & Uslu (2014) reached a difference between the 3rd and 4th totals in their studies. Peker (2014) didn't find a difference in his study. Tural & Kala (2018), again, did not reach a significant difference at the total level in their studies. Yaman, Cansüngü Koray & Altunçekiç (2004) reached a significant difference in their studies. Körükçü (2019) concluded that the self-sufficiency of history and social studies teachers in museum education does not differ according to total level. It is understood that related studies both improve the results of this study and include various results that contribute to field literature.

In the fourth sub-problem, a significant difference was reached regarding the variable of whether or not to take courses related to museum education. Yeşilbursa & Uslu (2014) reached a significant difference in favor of those who took museum education courses in their study on this subject. Peker (2014) found that the behaviors of teacher candidates who receive museum education and those who do not knit are close to each other. Tural & Kala (2018) did not reach a significant difference in their studies. Gürbey, Efe & Mertoğlu (2020) stated in their work with science teacher candidates that they did not know about the museum before and that they wanted to receive training on the museum from now on. In addition, studies that (Janes, 2010; Martin et al., 2016; Gutwill, 2018; Karadavut, 2021; Lee et al., 2021; Umralieva et al., 2021; Merve Karaman, 2022; Pavlou, 2022; Popielarz & Galliher, 2023; Saglamgöncu, 2023) in the field that are important for this reseach. The results of the relevant studies seem to support the results of this research.

As a result, it can be said that teacher candidates' self-sufficiency beliefs in museum education are at a proficient level. While the effect of gender variable on museum self-sufficiency belief has not been found, it is seen that the variable of total level and whether teacher candidates had taken courses related to museum education beforehand made sense in the process. According to the results, it is seen as beneficial to increase the selective or compulsory courses related to museum education in universities. It can be investigated on reasons why teacher candidates' self-sufficiency beliefs on museum education vary according to all levels; it is suggested that the study can be tried with qualitative or mixed methods by implementing different variables.

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The authors involved in the research contributed equally.

Conflict of Interest

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English Language MOOC to Improve Speaking Skills: A Strategic Partnership Project in the Field of Adult Education-A Proposal

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Abstract

The advent of Massive Online Open Courses (MOOCs) has opened up a whole new world of language learning opportunities. It helps to boost access to language instruction for individuals outside of regular classrooms. Language MOOCs (LMOOCs) are online courses that are generated with the purpose of providing free and accessible content for those who are interested in language learning and who come from various backgrounds. Albeit its potential to improve interaction, most of the LMOOCs have not been designed focusing on individuals' communicative skills in English. Therefore, the current project presented a language MOOC on speaking English for A2/B1 learners in English as a Foreign/Second Language (EFL/ESL) contexts. The content of the speaking lessons was based on a framework for teaching speaking, which reflected the ideas of current SLA research (e.g. the information processing, noticing hypothesis, skill learning theory, transfer appropriate processing) from an interactionist perspective. Within this framework, the lessons were shaped in four stages: identifying the learning outcomes, creating awareness on the target speaking function(s), appropriating the identified function(s) via various activities and tasks, and giving an opportunity for autonomous use of the target function(s). The activities and materials designed were built upon tasks that reflected everyday situations and interactive contexts to guide learners communicate in the target language. Situations similar to real life contexts also helped learners transfer information and expressions they used in these situations into the actual speaking contexts in the outside world. The design and content of the suggested MOOC described here can be helpful for language educators, practitioners, and course designers to integrate technology into classrooms via MOOCs to foster speaking skills in EFL/ESL contexts. Several implications were drawn to shed light on the role of MOOCs for language instruction.

Keywords: MOOC, L-MOOC, language learning, teaching speaking.

Konuşma Becerilerini Geliştirmek İçin İngilizce KAÇD: Yetişkin Eğitimi Alanında Stratejik Bir Ortaklık Projesi-Bir Öneri

Öz

Kitlesel Çevrimiçi Açık Kursların (KAÇD'ler) ortaya çıkışı, dil öğrenme olasılıklarında yepyeni bir dünyanın kapılarını açtı. Normal sınıfların dışındaki bireyler için dil eğitimine ulaşma şansını artırmaya yardımcı olur. Dil KAÇD'leri (D-KAÇD 'ler), dil öğrenmeye ilgi duyan ve çeşitli geçmişlerden gelen kişiler için ücretsiz ve erişilebilir içerik sağlamak amacıyla oluşturulmuş çevrimiçi kurslardır. Etkileşimi geliştirme potansiyeline rağmen, D-KAÇD 'lerin çoğunun bireylerin İngilizce iletişim becerilerine odaklanarak tasarlanmadığı görülmektedir. Bu nedenle, mevcut proje Yabancı/İkinci Dil Olarak İngilizce öğretimi bağlamlarında A2/B1 öğrencileri için İngilizce konuşmaya yönelik bir KAÇD sunmuştur. Konuşma derslerinin içeriği, mevcut Yabancı dil öğretimi araştırmasının fikirlerini (örneğin, bilgi işleme, fark etme hipotezi, beceri öğrenme teorisi, uygun işlemeyi aktarma) etkileşimci bir bakış açısıyla yansıtan bir konuşma öğretimi çerçevesine dayanıyordu. Bu çerçevede dersler, kazanımların belirlenmesi, hedef konuşma işlev(ler)i hakkında farkındalık yaratılması, belirlenen işlev/işlevlerin çeşitli etkinlik ve görevlerle sahiplenilmesi ve dilin özerk kullanımına olanak sağlanması olmak üzere dört aşamada şekillenmiştir. Tasarlanan etkinlikler ve materyaller, öğrencilerin hedef dilde iletişim kurmasına rehberlik etmek için günlük durumları ve etkileşimli bağlamları yansıtan görevler üzerine inşa edilmiştir. Gerçek yaşam bağlamlarına benzer durumlar, öğrencilerin bu durumlarda kullandıkları bilgi ve ifadeleri dış dünyadaki gerçek konuşma bağlamlarına aktarmalarına da yardımcı olmuştur. Burada açıklanan önerilen KAÇD 'nin tasarımı ve içeriği, dil eğitimcilerine, uygulayıcılara ve kurs tasarımcılarına, İngilizceyi yabancı dil olarak öğreticilerin bağlamlarında konuşma becerilerini geliştirmek için teknolojiyi D-KAÇD 'ler aracılığıyla sınıflara entegre etme konusunda yardımcı olabilir. KAÇD'lerin dil öğretimindeki rolüne ışık tutmak için çeşitli çıkarımlar yapılmıştır.

Anahtar Kelimeler: KAÇD, D-KAÇD, dil öğrenimi, konuşma öğretimi.

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MOOCS AND ONLINE LANGUAGE LEARNING

With the current emphasis on technological advancements (i.e. learning management systems, online learning tools and platforms, flipped classrooms, etc.) and their integration into educational environments, how to use such advancements in foreign language (FL) environments have attracted increasing attention. Thus, it becomes inevitable to consider new pedagogical approaches at the dawn of the digital era to foster enriched FL learning and overcome technological challenges (Beetham & Sharpe, 2013). Integration of technology in FL contexts has brought forward many innovations such as computer-assisted language learning, augmented reality, mobile-assisted language learning, and Massive Online Open Courses (MOOCs) into various FL teaching and learning contexts. Among these, MOOCs and their integration into teaching language skills is a new venue for research and a growing interest remarks the importance of this novel FL teaching/learning tool to develop more enhanced FL practices for the teachers, teacher educators, and the learners alike.

In simplest terms, MOOCs aim to make pedagogical content and learning opportunities accessible to various learners regardless of physical and time boundaries. MOOCs are practical tools that provide versatile opportunities for learning on different topics, they are cost-effective, and offer the flexibility to learn in a ubiquitous fashion surpassing the boundaries of classroom environments; and thus, making learning a more long-lasting experience for all (Godwin-Jones, 2014; Martin-Monje & Barcena, 2014; Beirne, Mhichil &Cleircin,2017). When it comes to FL environments, there are many effective internal and external factors in FL learning process, which has a complex structure that includes many interrelated factors (Ellis, 1986). While internal factors such as student readiness, motivation and cognition form the basic structure for acquisition, external factors such as learning environment, material design and curriculum determine the effectiveness of the process. In this regard, it is crucial to design motivating and innovative learning environments which are tailored to the changing needs of FL learners in the digitally enriched world of learning. It is also obvious that a successful FL learning process depends on the effective use of appropriate language learning strategies and FL learners need to use various strategies to cope with the challenges of educational technologies. Since language learning strategies are specific actions, behaviors, steps, or techniques that students often consciously use to improve their progress in comprehension, internalization, and use of L2 (Oxford, 1994), students select and use certain behaviors within appropriate strategies to learn a new language. In recent times, learners need to develop more effective strategies to regulate their learning in the digital realms which offer various opportunities for learning. The choice of strategy is related to a number of variables such as background, experience, motivation, goals and age (Dörnyei, 1990). At this point, a meaningful FL learning process should be designed within the strategies suitable for learner characteristics. Hence, MOOC applications, which can be seen as an extension of online learning approaches for designing foreign language learning environments within the strategies suitable for learner characteristics, have the potential to make a significant contribution to the FL learning process and use of effective learning strategies.

MOOC applications for FL teaching can create an interactive language learning environment that provides unlimited access and a large number of participants. MOOC applications for FL teaching, which can be defined as structured interactive language environments, are capable of promoting autonomous learning within strategies suitable for learner characteristics with the meaningful authentic educational materials they contain. Thus, MOOCs are quite suitable for adult learners who have no formal links to any educational classroom and who are keen on improving their FL skills with accessible and up-to-date content that can be helpful for their FL use in their daily endeavours. The basic principles of the learning process of adult learners are simply and clearly different from the learning process of younger learners. In this regard, the priorities, needs, interests and approaches of instructional designers are extremely important in order to create a meaningful learning environment. At this point, the work of Malcolm Knowles (1978) provides an outline to go further in adult learning in various aspects. According to Knowles, adults are autonomous, goal-oriented, practical and intrinsically motivated learners. In light of this outline, MOOC applications for FL teaching can be defined as an excellent choice for an adult learner who wants to learn a foreign language. As autonomous learners, adults should actively participate in the learning process, in which they take responsibility for their own learning in a self-directed manner. In this respect, efficiently designed MOOC applications for FL teaching offer autonomous learning environments filled with highly authentic educational materials. Moreover, these interactive language environments provide learners with a clear plan with a structured basis for learning objectives, directions, and practical implications. Thus, adult learners can recognize the goals they will set at the initial stage, follow them and evaluate their learning processes. MOOC applications for FL teaching constitute an effective alternative to overcoming the main obstacles such as lack of time and

motivation or the problem of accessing the material that adult learners encounter in their autonomous learning processes.

MOOCs for Language Learning

According to Kasch, Van Rosmalen, and Kalz (2017), Grechushkina (2018), and Paulsen (2002), open online courses are services and tools made available online for educational purposes, such as the provision of learning or teaching materials and facilitating communication between instructors and students. Due to the widespread usage of information and communication technology, online, open, and flexible learning has established itself as the standard in the field of education (Zawacki-Richter, Bozkurt, Alturki, & Aldraiweesh, 2018). In 2008, MOOCs made their debut and quickly became popular. Massive Open Online Courses, or MOOCs, are open and free digital resources for teachers, students, and self-learners to use for research, teaching, and learning (Hew & Cheung, 2014; Zawacki-Richter & Naidu, 2016). Everyone can participate in MOOCs, have access to useful learning resources, interact with other students, and use the Internet to reflect on and share what they have learned with others (Hu, 2013). According to Comer, Clark, and Canelas (2014), open online courses and MOOCs have similar qualities in that they are both online courses accessible to all types of learners. As a result, MOOCs have emerged as the most recent development in online education, attracting more and more language students and courses.

In terms of the application field, researchers have distinguished between two forms of language learning: native language (L1) learning and nonnative language (L2) learning (Hung, Yang, Hwang, Chu, & Wang, 2018). In recent years, some academics have explored online L1 learning. For instance, Sari (2018) studied a group of English instructors who participated in teacher training courses and looked at their perceptions of MOOCs. According to Kwak's (2017) investigation on MOOCs for academic writing, writing may be seen as a form of skill development for enhancing grammatical accuracy and article surface structure. English as a second language has received the most attention from academics who have studied L2 learning in MOOCs (Cimermanová, 2018; Martn-Monje, Castrillo, & Maana-Rodrguez, 2018; Mohamed & Hammond, 2018). For instance, Comer (2013) examined the review procedure for developing MOOCs. The study found that writing MOOCs with both quantitative and qualitative analysis benefited greatly from well-structured and efficient peer assessment. Chacón-Beltrán (2018) taught adult learners how to self-create vocabulary learning strategies through MOOCs; the findings demonstrated that adult learners may successfully study vocabulary anywhere with the use of relevant materials and MOOCs. Additionally, numerous specific languages have drawn interest in L2 learning, including online Tatar (Gimaletdinova & Khalitova, 2016), Portuguese (Zancanaro & Domingues, 2018), and Japanese courses (Fang, 2018).

THE RATIONALE BEHIND SPEAK ENGLISH MOOC- ENGLISH LANGUAGE MOOC TO IMPROVE SPEAKING SKILLS PROJECT

We live in a world that has proven to continuously transform especially with the affects of external factors, such as COVID-19. Such factors have implications on education as they do with most areas of life which, in turn, necessitates the continuous development of existing skills as well as the development new ones. The COVID-19 pandemic we experienced globally has transitioned us to a new era. Even before the pandemic, the significance of language skills, particularly of English as lingua franca, was emphasized in several policy documents. People, in many fields use English as their primary working language. F.e., 98% of German physicists, 83% of chemists and 81% of biologists and psychologists use English as the main language of communication (Graddol, 1997). English has thus become vital for communication in our world today. However, despite the undeniable status of English and importance of foreign language skills, still in very recent reports such as EU's Council Recommendation of 22 May 2019 on a comprehensive approach to the teaching and learning of languages, it is stated that almost half of Europeans say that they are unable to hold a conversation in any foreign language. Therefore, there is an obvious need to improve foreign language skills, particularly English. However, with the emergence of COVID-19, like in any other field, more flexible, non-traditional programs have risen to the forefront and have proved to be significant. MOOCs (Massive Online Open Courses) are one of them. However, subject-wise, of all courses in 2018, %19,9 were offered in the field of technology, %18,5 were offered in business, %10,6 in the field of social sciences and %10 in the field of science (Werl, 2019). On the other hand, Barcena & Martin-Monje (2015) indicate that language MOOCs (L-MOOCs) are in the very early stage of development. Hsu (2021) reports that there are only 143 L-MOOCs available (out of which 94 are for learning English) so there is definitely a requirement for more L-MOOCs in different areas. With this at hand, Speak English MOOC- English Language MOOC to Improve Speaking skills project (*Project no: 2019-1-TR01-KA204-074155*), an Erasmus+ Strategic Partnership Project in

Adult Education, was developed by Bartin University in Turkey in partnership with Universidad Politécnica de Madrid in Spain, BEST Institut für Berufsbezogene Weiterbildung und Personaltraining GmbH from Austria and Anadolu University in Turkey between 2019-2022.

Speaking is by far the most challenging of the four language skills—reading, writing, listening, and speaking. Even though there is currently a seemingly infinite amount of online courses available, there aren't as many Language MOOCs as there are students. Also, the Speak English-MOOC's content is likely to be novel for our target audiences because the existing L-MOOCs are typically not focused on enhancing practical speaking abilities. The Speak English-MOOC material offers the target groups a relevant instructional design to present stronger self-efficacy beliefs in terms of speaking competence to build confidence among English language learners while speaking in English and using the suggested pragmatic phrases. The following exercises are proposed to build the linguistic content (recommended as a 6-week course): Target population needs analysis to inform the content, framework definition, instructional design, pilot testing, and final content change based on piloting findings.

SPEAK ENGLISH MOOC FRAMEWORK AND DESIGN

The suggested MOOC described here was designed following the ideas of Thornbury's (2005) model for teaching speaking. The framework of the MOOC reflects the outcomes of current SLA research (e.g., the information processing, noticing hypothesis, skill learning theory, transfer appropriate processing) from an interactionist perspective. Accordingly, the aims are to;

- take the attention of learners to speech functions by activating their existing schema, leading them into the use of speech functions used in daily life via various audio-visual materials
- help learners notice useful expressions for the identified speech functions by implementing various tasks such as listing, sorting, ordering etc.
- check learners' understanding of speech functions within comprehension-based processing activities prior to practice
- guide learners practice the given speech functions and use them autonomously through various activities based on real life situations
- provide contextual dialogues, conversations or materials in which learners can be exposed to the features of the target speech function(s)

In accordance with these aims, each MOOC unit was designed following the framework given in stages below:

Stage 1-Learning Outcomes

At the beginning of each unit, learning outcomes were clearly stated and listed. While stating the outcomes, specific attention was given to use observable action verbs such as 'identify, ask, answer, use, etc.' This way, learners were able to (self)check whether they achieved these outcomes or not. A sample outcome was: "*At the end of this unit, you will be able to identify common expressions used in expressing preferences/likes/dislikes"*.

Stage 2-Creating Awareness

Learners need to be aware of the features of target speech function(s). That is, they gain awareness on where and how the selected speech function is used and in what kind of situations the target function occurs. For this purpose, dialogues, conversations or other kinds of audio-visual materials (e.g., cartoons, videos, advertisements, reading passages) were used as models to expose learners to samples of the target speech function(s). This introductory stage included the following components for an effective awareness raising:

Attention: The aim was to take attention to the target speech function via audio/visual materials.

- Lead-in questions, brainstorming or chart filling activities based on eliciting general world knowledge related to speech function were used here. In this way, learners' existing schemas were activated to boost their curiosity about how to express speech events in daily life.
- Learners listened to/watched or read sample dialogues/conversations or other materials exemplifying the use of speech functions. Simple questions or activities were used to draw their attention to the gist of these materials before they noticed formulaic expressions related to the speech events.

Noticing: Learners were guided to notice the useful expressions in the sample texts and the knowledge gaps in expressing and using speech functions.

· An activity for comparing and contrasting/identifying/counting/classifying etc. was used here to help learners notice the identified speech functions. Sample dialogue scripts were used here to work on the expressions related to the target function.

· Questions were asked to elicit what other expressions learners know/remember (self-noticing)

· At the end of noticing, a comprehensive table or chart was provided to show learners various expressions used for the target speech functions. Hence, learners had a chance to refer to this table/chart throughout the unit via a link on the MOOC platform.

Understanding: The aim was to check learners' understanding of the features of the target speech function(s).

· Dialogues/conversations/ materials rich with the samples of formulaic expressions related to the target speech function were used to check understanding via comprehension-based types of activities.

· Jumbled dialogues, matching, sorting, fill in the blanks, choosing the right option etc. were used to check whether the learners recognized a general principle of pattern regarding the target function.

Stage 3-Appropriation

In this stage, learners were guided to use/practice the useful formulaic expressions and language features related to the target function(s). Various practice activities (involving listening, reading, writing, and speaking) appropriate for a MOOC platform were used here. Since it was not possible to design interactive activities due to the nature of the MOOC, activities at this stage aimed at developing progressive control over the use of speech function(s).

Sample activities used to appropriate the use of target speech function(s) included:

· *Drilling:* It focused on imitating and repeating words, phrases and even the whole utterance where possible. It was advantageous as it helped with gaining control over language. Drilling was used to fine tune for articulation.

· *Dialogues:* Recorded dialogues were provided to learners. They were able to perform the roles in the dialogues by recording their own productions and comparing them to the given dialogues. Learners also checked whether their pronunciation was closer to the sample or not. Incomplete dialogues, choosing the right option within the dialogues, or matching type of activities were also used.

· *One-sided choice cue-cards:* Dialogues given in cue cards which included information gap between the interlocutors were given here. Learners were able to choose among the options regarding formulaic expressions appropriate for the context. One side of the cue card was given, and the other side of the cue card involved options so that the users could make choices.

· *Manipulation Drills:* Parts of a sentence in the dialogues was given and learners were expected to form sentences using good intonation. In this way, they compared their productions with the given samples.

· *Substitution:* Within dialogues, target phrases were underlined, and users were asked to replace these phrases with another one with similar function.

· *Casting Conversations:* Learners were expected to form parts of conversations based on the given context. They had the opportunity to talk about their choices with other users on the discussion board embedded on the MOOC platform. Talking about their choices helped them better understand the register.

· *Language Games:* Language games where appropriate for the target speech function(s) designed. For instance, users were able to drag and drop certain phrases or expressions within the game, accomplish certain tasks and proceed in the game accordingly.

· *Downloadable Materials:* Downloadable study materials and activities were provided to help learners study on the target function on their own.

Stage 4-Autonomy

In this last stage of each unit, learners were expected to experience autonomous use of the target speech functions in a more free and communicative way. On the MOOC platform, they were able to record their productions and share them with each other on the discussion board. Alternatively, they could compare their productions with the given samples.

Sample activities used in the autonomy stage included:

· *Functional/Visual Cue Cards:* Role playing activities with appropriate purposes and contexts that were presented in the form of cue cards. These cue cards involved guided cues to help learners produce target speech functions. One side of the cue card was given in a recorded fashion and the other part was performed by the learners. They recorded their own productions and shared them on the discussion board.

· *Narrations:* Learners were given chances to narrate events/stories or talk about their own experiences. They listened to sample narrations and compared their own talk.

· *Links to Online Sources:* Links to various sources were provided where possible.

IMPLICATIONS

A vast variety of conceptual and pedagogical approaches are utilized in a wide variety of techniques when language acquisition is considered today. They all coexist in current practices and are frequently combined by people switching between various approaches, from traditional drill-and-practice grammar-based learning to notional functional syllabus, from more cognitive stances to sociocultural perspectives, focused on communicative skills and real-world interactions in context. Since they allow for very wide communities of practice—one of the essential elements of a successful language learning experience—MOOCs currently offer exciting possibilities for language instruction. Unfortunately, the majority of L-MOOCs do not expressly highlight the communicative abilities of students. If you're interested in LMOOCs as a language learner, teacher, or designer, you are welcome to check out the following tips:

1. Increase participation and interaction

Think about the ways that students can participate in MOOCs. If students can interact with one another, they will be more motivated to use language. Instead of only memorizing course materials, interaction should be the main focus of learning.

2. Help to facilitate self-organized learning, but do not manage it

When possible, provide options for students to self-organize through social media or in-person gatherings, but avoid managing these organizations. In reality, it is highly likely that students will form these groups without any help from the instructor.

3. Establish a presence for the teacher

Students need to be aware that a real instructor is taking part in the LMOOC. Create a Facebook page or Twitter feed to support the class, make regular updates, and take the time to respond to student conversations in the MOOC.

4. Make video engaging

Consider using video as a source of real language materials rather than just as a lecture delivery medium. Use video to provide pupils the chance to learn about culture in addition to the language.

5. Specify success.

Consider what course completion will entail as you create a Language MOOC. Students should be encouraged to consider their own objectives and how they will use the course to attain them.

6. Align the assessment's objectives with its format.

Analyze what kind of assessment best satisfies the course's objectives as you consider its objectives. Assessment methods should evaluate writing in a meaningful way, such as through peer and self-assessment rather than through multiple-choice questions, if the course's focus is on writing, for instance.

In brief:

-The content should be based on learners' needs.

-It is important to engage the learners with communicative and meaningful real-life activities and tasks.

-It is important to facilitate learners to be autonomous in their own learning process.

-The materials should be engaging, goal-oriented and stimulating.

-Learners should know the outcomes of the process and they should be able to assess their own learning.

Author Contributions

All of the authors contributed equally in the article.

Conflict of Interest

The authors declare no conflict of interest in the research.

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Evaluation of the Changes and Achievements Perceived in Graduate Tourism Education on the Basis of Transformative Learning Theory

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Abstract

It is seen that postgraduate education gains importance to have new information, skills and experiments in a constantly changing and transforming world. Postgraduate education in a field that shows a need for high-quality labor, such as the tourism industry, is expected to comply with this structure and create a transforming effect on the learners. This study aims to evaluate the personal changes, skills and learning outcomes that the students studying in postgraduate programs of tourism can perceive as a result of the educational process on the basis of Transformative Learning Theory, and has been built according to the qualitative research model. As the data collection technique, the interview technique was employed to the study group which consists of 34 people who were designated through a purposeful sampling method. From the data obtained, totally eleven main codes and six groups of themes derived. The findings showed that postgraduate tourism education generally provides the expected academic and vocational gains; however, they are not at a level that is effective in causing a transformation in individuals. On the other hand, it was detected that some transformations occurred in a small part of the study group in compliance with the transformative learning theory. Critical thinking, self-expression and showing empathy are remarkable among the new knowledge and skills defined as an achievement. Interrogative manner, acting self-confident, and being kind to different thoughts and cultures became prominent as the new personality traits. Such findings indicate the necessity of new researches on the relation between perceived achievements and graduate tourism education. It will be beneficial for the researchers in the future to focus on the methods to improve the quality of education in postgraduate tourism education and it can be suggested to implement such researches in mixed patterns.

Keywords: Tourism education, graduate education, transformative learning, transformation

Lisansüstü Turizm Eğitiminde Algılanan Değişimlerin ve Kazanımların Dönüştürücü Öğrenme Kuramı Ekseninde Değerlendirilmesi

Öz

Sürekli değişmekte ve dönüşmekte olan bir dünyada yeni bilgi, beceri ve deneyimler kazanmak için lisansüstü eğitimin önem kazandığı görülmektedir. Turizm sektörü gibi yüksek nitelikli işgücü ihtiyacı sergileyen alanlardaki lisansüstü eğitimin de bu yapıya uygun nitelikte olması ve öğrenenler üzerinde dönüştürücü etki yaratması beklenir. Turizm alanında lisansüstü öğrenim görmekte olan öğrencilerin, eğitim süreçleriyle edinildiğini algıladıkları beceriler ile tanımlayabildikleri öğrenme kazanımlarının Dönüştürücü Öğrenme Kuramı temelinde değerlendirilmesini amaçlayan bu çalışma, nitel araştırma modeline göre kurgulanmıştır. Veri toplama tekniği olarak yüz yüze görüşme tekniği kullanılmış olup, amaçlı örneklem yöntemiyle seçilmiş 34 kişilik çalışma grubuna uygulanmıştır. Verilerden on bir ana kod ve altı tema grubu oluşturulmuştur. Bulgular, lisansüstü turizm eğitiminin beklenen akademik ve mesleki kazanımları sağladığını, fakat, Dönüştürücü Öğrenme anlamında bir dönüşüm doğuracak düzeyde etkili olmadığını göstermiştir. Bununla birlikte, çalışma grubunun küçük bir bölümünde, Dönüştürücü Öğrenme Kuramı'yla uyumlu bazı dönüşümler saptanmıştır. Kazanım olarak tanımlanan yeni bilgi ve beceriler arasında eleştirel düşünebilme, kendini ifade edebilme ve empati yapabilme dikkat çekicidir. Yeni kişilik özellikleri arasında sorgulayıcılık, özgüvenli davranma, farklı düşüncelere ve kültürlere karşı hoşgörü öne çıkmıştır. Bu bulgular, algılanan kazanımlar ile lisansüstü turizm eğitimi ilişkisini inceleyen yeni araştırmaların gerekliliğini göstermektedir. Gelecekteki araştırmaların, lisansüstü turizm eğitiminde eğitimin niteliğini artırma yöntemlerine odaklanması ve bu tür çalışmaların karma desenli tasarlanması önerilebilir.

Anahtar Sözcükler: Turizm eğitimi, lisansüstü eğitim, dönüştürücü öğrenme, dönüşüm.

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INTRODUCTION

The need for continuous learning; renewing outdated knowledge and skills; coping with ordinary crises; creating differences in order to gain new advantages in the competitive environment; approaching our problems and our lives from very different perspectives than before; transforming according to the conditions of life and gaining different identities. All of these skills are actions that can emerge in response to the conditions and problems imposed by today's world. Especially in countries with unstable socio-economic conditions and economic structures, and in economic structures such as the tourism sector that are based on delicate balances and are very sensitive to external factors (Samırkaş & Bahar, 2013), it is necessary to be able to identify individual development needs that play a key role for organizational success. In a world of the 4th Industrial Revolution, new knowledge, technologies and skills brought by the social, political and economic structures affected and completely changed by the digital transformation, complex problems are emerging in many countries (de Falco, 2019). This can also change the structure and components of individual needs and individual development.

The tourism sector has the largest income and export level in the world economy after the chemical industry and the energy sector. Since the effective use of human capital can provide a significant advantage in a competitive environment, it can be said that there is a high need for quality communication and interaction between employees, customers and organizations in tourism activities (Kuzu, 2020). Therefore, this need will trigger the need for qualified personnel. The unique structure of the tourism sector with its positive and negative aspects makes businesses in this sector heavily dependent on human resources in order to survive and compete (Sezerel & Tonus, 2017). This structure makes it imperative to aim for achievements beyond undergraduate tourism education. As emphasized by the World Tourism Organization in recent years, qualified manpower is the basic component of this sector. It is important for higher education institutions to respond to this need by renewing curricula with new departments and programs (Cited in Ribeiro et al., 2020). At this point, it is important that the learning outcomes in tourism education are in line with the educational objectives determined in line with the needs and problems of the sector. Naturally, the biggest task in this process falls to the undergraduate and graduate programs of universities.

In many countries around the world, studies on different learning and education models emphasize the importance of lifelong learning philosophy and adult learning and define the new roles of universities. In addition to what numerous studies and evaluations have presented, especially regarding the functionality of Transformative Learning Theory in today's conditions (Duffy et al., 2020; Jacobs, 2019; Johnson and Olanof, 2020; Upenieks, 2019), the new functions of universities, which have assumed many functions in today's societies, regarding the 4th generation university profile, also emphasize the phenomenon of graduate education. Considering all these, it is expected that the learning outcomes of individuals receiving graduate education in the field of tourism will be effective and efficient enough to lead to a transformation in the lives of individuals and meet the expectations of the sector.

The need for individuals who play an active role in the processes of acquiring and imparting knowledge and skills, such as professionals working in the tourism sector, educators and university students, to comprehend the world correctly and make the right decisions is in line with the critical role of Transformative Learning Theory. Today's world is possible with individuals who are able to update their knowledge and skills quickly and effectively and adapt quickly to the conditions, and this needs to be defined within the framework of formal education. In addition, there is insufficient research in the relevant literature, both on graduate education practices in tourism and on Transformative Learning Theory. Hence, the main purpose of our study is to evaluate the skills, changes and gains that graduate students in the field of tourism think that they have acquired through their educational processes on the basis of Transformative Learning Theory. As mentioned below, such transformations involved in perceived achievements, changes and gains which can be perceived by individuals cover both daily-social and professional-academical lives' all fields.

In this context, answers to the following research questions, which were determined on the axis of the basic components of the Transformative Learning Theory regarding personal and professional life as a whole and related, are sought:

- What are the students' opinions about the graduate education they have received?
- How has the graduate education received by the students created a conflict with the old knowledge, skills and views learned and acquired in their previous lives?
- What kind of new knowledge and skills do the students think their education has provided them with?

- How do students think that the education they have received has led to a transformation in their personality traits and individual lives?

- What are the students' evaluations of their old habits or views that were broken after the conflicts and dilemmas caused by the education they received?

Graduate Education in Tourism

Graduate education, which refers to the highest level of the formal education process, includes education programs that aim to train scientists, researchers and qualified human resources, which provide the title of scientific expertise or doctor of science after the completion of undergraduate education (Karaman & Bakırcı, 2010). When we consider at the change in the functions of universities, which are the main source of graduate education, we come across the 4th generation university phenomenon. The 4th generation university differs from previous generation universities in its mission, role, method and product components. The main difference is defined in the function of contributing to the regional economy with the goal of ensuring proactive economic development. Therefore, graduate education processes in 4th generation universities should succeed in playing a leading role in the development of the local economy, in addition to the mission of education, research and knowledge processing in previous generations (Kuzu, 2020). In achieving this, not only undergraduate educational activities but also graduate education should have a special place, because it would be wrong to aim to improve the quality of university products and scientific researches without improving the quality and competencies of researchers as learner and practitioner.

Upon considering the definition of the process to its functions, graduate education has functions such as disseminating science and art, identifying social problems and producing appropriate solutions, and training high-level labor force. Apart from classical functions, it can be argued that graduate education has become a necessity due to factors such as the increase in the number of undergraduate graduates, developments in economic activities and technological transformations (Karaman & Bakırcı, 2010). Therefore, the same findings can be made in terms of the tourism sector and tourism education. The fact that the World Tourism Organization draws attention to qualified and educated human resources in the tourism sector reminds the role of universities for a qualified workforce. Developments in telecommunication technologies and global crises have made it necessary for professionals in the tourism sector to acquire new skills and develop new strategies in communication and social media (Ribeiro et al., 2020). As a matter of fact, especially in developing countries such as Türkiye, the basic need for the tourism sector to be permanent and to increase its revenues is the development of tourism education at all levels, and the need for graduate education is also important in this context (Okumuş & Yağcı, 2005; Unur & Köşker, 2015).

Graduate education in tourism is a must for students who want to improve themselves following their undergraduate education and learn about the sector in an academic dimension. In Tarcan İçigen et al.'s (2018) study on the graduate education of managers in the tourism sector, it was found that the participants' perceptions of the education they received were positive and they were generally satisfied. At the same time, it was stated that the education received contributed to both their personal and professional development. Considering the provisions of the relevant legislation and classical function definitions (Karaman & Bakırcı, 2010), the main learning objectives of graduate programs in the field of tourism can be considered to gain the ability to conduct scientific studies on the needs and problems in the field of tourism, to correctly identify the problems of the sector and to offer solutions, to think critically and to exhibit creativity when needed.

In line with these goals, it is clear that individuals who participate in graduate education processes in the field of tourism will experience some change processes that will take place at the level of knowledge, skills and attitudes. Naturally, such processes are expected to lead to new principles, skills and views in the lives of learners. Some recent studies have revealed the chronic problems of tourism education in Turkish universities. Tourism education is plagued by favoritism in the selection of courses and academic staff, inexperienced academics, low-qualified students, and various bureaucratic obstacles (Kırlar Can et al., 2021), and with the solution of these problems, it will be possible to transition to a more qualified graduate education model.

Transformative Learning

It can be argued that Mezirow's philosophy of transformative learning can define all our actions related to decision-making and learning in post-childhood processes. Transformative learning, which adult educators such as Mezirow and Merriam attach great importance to because of the critical function it plays in individual development, encompasses transformations and achievements that can be accomplished in the upper stages of adult development. According to some, it is not possible to achieve this before early forties, whereas according to

others, such a transformation is possible through a combination of formal education and life processes during youth (Jacobs, 2019; Malkki, 2010). In Mezirow's (1997) definition, transformative learning is a learning that leads to a change in the meaning/reference framework that constitutes the individual's life and makes the individual radically question his/her previous life. This completely changed framework encompasses the values, beliefs and attitudes in the individual's life, which refers to the individual with its cognitive and emotional components.

Based on the classical definition of transformative learning, our transformative learning experience can be triggered by encountering a new situation that conflicts with our knowledge and thoughts that form the basis of our current worldview. Having to reconcile this new information, which will enable us to create a new perspective in our future actions, with our old perspective will ignite the fuse that puts us into a transformational phase (Jacobs, 2019; Johnson & Olanoff, 2020). The roots of this learning process, which Mezirow defines as a form of "meaning making", can be traced back to the work of Freire and Habermas. In this process, the individual evolves towards a broader and more inclusive worldview by reinterpreting and redefining his/her old experiences and knowledge with new expectations and perspectives (As cited in Izmirli, Odabaşı & Yurdakul, 2012; Jacobs, 2019; Mezirow, 1997). Therefore, the transformative learning model has a special place in Constructivism, Humanism and Critical Social Theory due to its multi-dimensional and multi-source structure (Jacobs, 2019). As a matter of fact, the fact that it can be applied in a wide range of fields such as business administration, teacher training, medical education, organizational management, community development, sustainability education and environmental awareness-raising trainings in recent years shows that it can play an effective role in solving many different social problems (Jacobs, 2019; Weinberg et al. 2020). For example, Katz's (2019) transformative learning model proposal for the adaptation of Open Education Resources to undergraduate education is a transformation that will enable students to get rid of costly textbooks.

The basic stages of the transformative learning process define the products of this process and the change experienced. The process starts with a confusing dilemma that triggers the criticism and questioning of the emotions and basic assumptions that constitute identity. In the following stages, after the discovery of new roles and relationships, new action plans including new competencies and different perspectives are formed, beliefs, values and attitudes related to a new worldview are born in the individual (Akçay, 2012; Jacobs, 2019; Katz, 2019). Two key concepts in this transformation process are "critical reflection" and "perspective transformation". Mezirow (1997), who argues that this process will result in the individual gaining independent thinking skills, defines the main learning outcomes on instrumental, communicative and emancipatory axes (As cited in Aboytes & Barth, 2020).

Critical reflection is a component of critical thinking skills. By questioning one's own ideas, feelings and actions, it enables the individual to comprehend contradictions and differences from other people's beliefs, values and attitudes (Blalock & Akeh, 2018). Perspective transformation, on the other hand, is the acquisition of new perspectives instead of the old ones after the confusing dilemma (Akçay, 2012; Çimen and Yılmaz, 2014; Malkki, 2010). A study examining the internship experiences of Chinese and Spanish trainee teachers who experienced the critical stages of this traumatic process showed that the transformative learning process played a role in the formation of trainee teachers' professional identity (Zhu, Iglesia & Wang, 2020). At the end of such a process, radical changes in an individual's moral, political and professional profile are inevitable, as their perspectives, habits, beliefs, values and behaviors as a whole undergo change. This is because not only a change at the intellectual level but also a transformation in actions and relationships must occur (Aboytes and Barth, 2020; Mezirow, 1997). Based on the fact that learning is lifelong, such a process of change can be ensured to occur repeatedly at different stages of life and at different age periods (in periods related to formal and non-formal education), or such processes can be triggered and directed through different educational models (distance education, on-the-job training, non-formal education, etc.) that are becoming widespread today. For example, in Çimen and Yılmaz's (2014) experimental study involving pre-service teachers at two state universities in Ankara, environmental education based on transformational learning theory was applied to develop environmental awareness, and significant transformations were found in the views, feelings and attitudes of the experimental group towards the environment. Boonphadunga and Seubsang's (2021) research on pre-service teachers also showed that transformative learning practices can make a great contribution to improving pre-service teachers' classroom management and teaching competencies.

At this point, the role of the educator comes into play. According to Mezirow, the role of educators in this direction is expected to take place in three stages: enabling learners to focus on questioning their feelings, beliefs and behaviors, evaluating the results of questioning and critical reflections, and testing their validity by presenting alternative perspectives (As cited in Akçay, 2012; Boonphadunga & Seubsang, 2021). Akçay, 2012;

Boonphadunga & Seubsang, 2021; İzmirli, Odabaşı & Yurdakul, 2012). As a result, it is possible to summarize the basic concepts of Transformative Learning Theory with the statements illustrated in Figure 1, which indicate the individual's large-scale cognitive transformation.

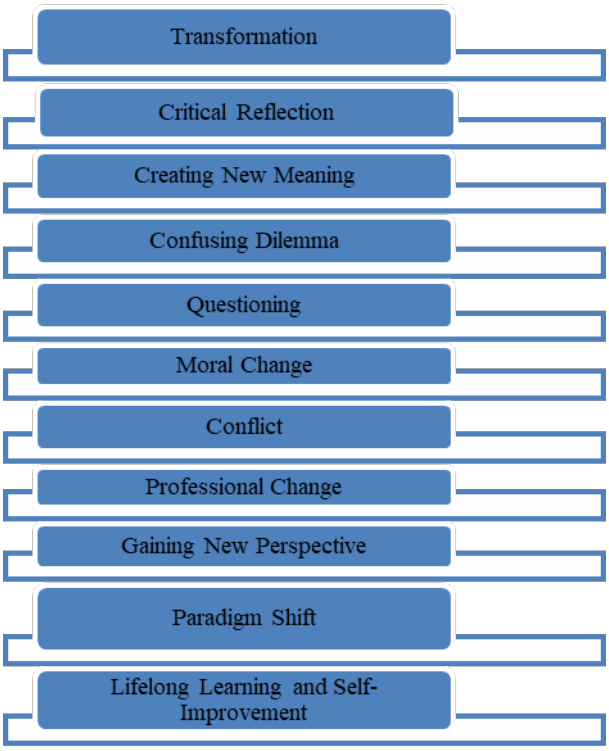

Figure 1. *Literary codes that can be derived from transformative learning theory*

Graduate Education in Tourism and Transformative Learning

What needs to be emphasized at this point is not the nature and types of new needs, skills and knowledge specific to the period and conditions we live in. The main issue is that all individuals, regardless of their field and profession, may have to undergo transformations in today's conditions as in the Transformative Learning Theory, and graduate education processes are capable of triggering such transformations.

The need for educators' roles of guidance, facilitation and evaluation is clear. This points to a bidirectional need that young people at different stages of the formal education process may also face: To transform by transforming. Moreover, Mezirow's roles of questioning, critical reflection, and alternative perspectives are appropriate for graduate programs in tourism education to meet the need for innovative individuals. In today's world, where identity and character formation can extend into early 40s, graduate studies can be expected to take on multifaceted functions and play the role of the main stage for transformative learning processes. Indeed, the value of individuals with the ability to transform themselves is different in the management of workload and stress that arise in the tourism sector, which is based on multifactorial balances at national and international levels.

Nonetheless, the effectiveness of transformative learning, which may not yield the same results for every individual and every system, depends on individuals having equal opportunities in terms of access to information, freedoms and communication opportunities, and their personality traits being suitable for critical reflection (Akçay, 2012; İzmirli, Odabaşı & Yurdakul, 2012; Malkki, 2010). Therefore, it is wrong to see this theory as a magic wand for all personal development programs and formal education processes. In recent years, research has been conducted examining some teaching methods and topics that can trigger transformative learning. For example, traumatic experiences arising from the unique nature of foreign language teaching and the encounter of foreign language learners with different cultural values related to the language learned can lead to transformations in learners. As a matter of fact, research on the fact that language teaching can lead to such transformations with its effects on both cognitive and affective levels has become widespread (Arı & Kurnaz, 2018). In addition, there are studies that argue that instead of a tourism education based on a classical pedagogical understanding, a tourism education that is in line with the transformative spirit of travel, liberating the individual, emotion-oriented and encouraging critical reflection is possible (Kırlar Can et al. 2021; Walker & Manyambai 2020). In conclusion, there is a need for further studies on the possible transformative effects of tourism education and education methods..

METHOD

Research Design

In this study, a qualitative research design was employed. All qualitative research is concerned with how meanings are constructed, and the primary purpose of this "basic qualitative research" type study is to identify and interpret meanings based on the research questions. In this model, the findings collected by applying the interview technique based on purposeful sampling are thematized and described through inductive data analysis (Merriam, 2018). Therefore, the process that started with the application of the interview form developed in accordance with the purpose of the research to the selected participants was finalized by classifying and describing the findings through codes and themes. In terms of structural features, this research is within the scope of the general survey model. Research in the general survey model identifies and describes a situation that existed in the past or present (Karasar, 2019).

Participants

In qualitative research, sample size does not have the same function as in quantitative research. The aim is not to generalize to the universe, but to get more in-depth information from a small sample. For this reason, some researchers argue that the sample size in qualitative research should be determined according to the data collection method used. For example, in the in-depth interview method, a study group of 30 people is considered as sufficient (Başkale, 2016). The study group of this research, which collected data through in-depth face-to-face interviews, consisted of 34 people.

In qualitative studies, it is important to determine the suitability of the study group size for data collection processes and the adequacy of participation. If the researchers realize that collecting more data does not contribute to the analysis, the application can be terminated. Thus, it is accepted that the optimal study group size has been reached (Merriam, 2018). In this study, it was observed that the average size of the study group in the relevant literature was around 15 people, but it was thought that this might not be sufficient for the structure of this study. The study started with a goal of 25 participants; when it was seen that the similarities in replies increased too much after the 30th participant, data collection was ended after 34 participants.

In order to increase the validity of the purposive-intentional sample, students in the last semesters of both master's and doctoral education processes (in terms of experience accumulation) were selected. Through snowball sampling, which is one of the types of purposive sampling, those who were willing to contribute and who could express themselves among the candidates who met the criteria were selected (Merriam, 2018). Purposive-intentional sampling is based on those whom the researcher believes will find answers to the research questions and is not randomly selected but consists of participants determined according to certain criteria (Altunışık et al., 2010; Merriam, 2018).

The study group consisted of 12 master's and 22 Ph.D. students who were conducting graduate studies in the field of tourism. These students are conducting their graduate studies in eight different state universities in Türkiye. The study group was selected among successful graduate students at the university where the researchers work and participants who could be reached through their volunteer friends. Table 1 presents the profile of the study group.

Table 1. Participant Information

Gender	(f)	%	Age	(f)	%	Graduate Phase	(f)	%	Department	(f)	%
Female	21	61,7	20-24	1	3	Ph.D.	22		Tourism Management	16	
Male	13	38,3	25-29	11	32,3	Master's	12		Gastronomy	10	
Total	34	100	30-34	17	50	Total	34	100	Tourist guiding	8	
			35-39	4	11,7				Total	34	100
			40-44	1	3						
		Total		34	100						

As seen in the Table 1, the majority of the study group which is predominantly female, is between the ages of 25-34 (82.3%). Besides, the majority of them are doctoral students and continue their graduate studies in the departments of "Tourism Management", "Gastronomy" and "Tourist Guiding".

Data Collection Tool and Data Collection Process

The data of this study were collected through interview method. Interview technique is the collection of research data through oral communication (Karasar, 2019). "Face-to-face interview" was preferred as a data collection method among the interview types; a semi-structured interview form consisting of 14 questions was applied as a data collection tool. Face-to-face interviews were conducted through forms printed on paper. This format has more advantages than telephone or computerized applications (Tymms, 2017) and is more suitable for the purpose of this research.

In addition to basic demographic information, the interview form included 8 open-ended questions to identify the basic facts about transformative learning and literary codes in Figure 1. Open-ended questions are often preferred in qualitative research based on the interview technique because they enable in-depth information gathering (Tymms, 2017). In this study, in-depth interviews were conducted using semi-structured interview forms. The semi-structured interview technique can be applied more flexibly and can provide access to a wider range of data. The aim of this method is not to reach definitive answers, but to enable the participant to describe his/her perceived world in his/her own words (Merriam, 2018).

In accordance with the purposive sampling approach, in the process of identifying suitable candidates, those who were deemed to have adequate communication skills were selected from among the researchers' own graduate students, and then prospective participants were identified from their circle of friends. Firstly, the comprehensibility of the questions was tested by preadministration as a pilot implementation via applying the interview questions to two people of the study group. After some changes were made to the sentence structures in questions 8 and 13, in order to get clarity, the main interviews started then.

Within the scope of internal validity or trustworthiness criterion, for participant confirmation, the data collected by face-to-face interview technique were written and organized on papers and then read to the participants at the end of the interview to confirm their responses. Upon the request of a total of two participants, some corrections were made to the recorded responses. Participant 10 corrected the sentence fragments in her answers to questions 9 and 14. Participant 28 further expanded and elaborated on her answers to questions 11 and 13. The other participants approved what was written without requesting any corrections or changes. Most of the interviews were conducted in the researcher's room in the university building, while some were conducted in graduate school classrooms and other convenient locations on the university campus. The interviews lasted 40-45 minutes on average, and the entire implementation was completed in 17 days. After each 3-4 completed interviews, the status of the data and the course of the research were evaluated by looking at the course and structure of the obtained responses.

Data Analysis

In the analysis of qualitative studies, descriptive analysis or content analysis is generally applied. Content analysis refers to creating themes in accordance with the relationships between the codes derived from the findings with an inductive approach. Three types of coding can be applied in this model: Coding based on concepts in the literature, coding based on research data, and general framed coding reflecting the combination of these (Yıldırım & Şimşek, 2000). In this study, "general framed coding" was applied on the axis of content analysis. For this purpose, while creating the themes, both the literary codes in Figure 1 were utilized and the codes based on the findings were evaluated. Thus, the functionality of the analysis was increased by ensuring that both the basic concepts in the literature and the results based on direct data were used together. The details of the analysis process are described in the Validity and Reliability section.

Validity and Reliability

In qualitative research, the criterion of "trustworthiness" is recommended instead of the concepts of validity and reliability in quantitative research. Within the scope of credibility, "purposive sampling", "participant confirmation" and "researcher triangulation/diversification" were used in this study. Participant confirmation refers to the verification of the data and report by contacting the participants at the end of each interview; researcher triangulation refers to the involvement of more than one researcher in the collection, analysis and interpretation of data (Başkale, 2016; Merriam, 2018). In this context, a suitable study group was determined on the basis of purposive sampling in accordance with the basic qualitative research model; the data collected were verified by the participants. In addition, in order to create researcher triangulation, another academic working at Mersin University Faculty of Tourism and conducting graduate courses supported the interview and analysis processes. In these processes, both researchers participated in the data collection and analysis processes consecutively.

In a good qualitative research, a sincere explanation of how the obtained results are reached is an indicator of reliability or consistency. In this method, called the audit technique, it is necessary to describe the analysis process and how the findings were reached, as if recording in a ship's logbook (Merriam, 2018). The analysis process of this study can be summarized as follows:

1- The author of the study and an experienced researcher from the Faculty of Tourism, who supported data collection and analysis, independently carried out the process of creating themes and codes. 34 forms were shared and codes were defined; two rounds of analysis were completed by exchanging the finished forms. While the first researcher identified a total of 15 main codes, the second researcher created 12 codes. It was seen that the difference was due to the detailed recording of the problems related to graduate education, and in order not to deviate from the research purpose, a consensus was reached on the code "inadequacy of graduate education". Afterwards, it was understood that the other codes were close to each other at 90% level and the main code list in Table 2 was created.

2- The creation of themes required a longer effort and the researchers worked in parallel in this process. For example, since it took a long time to define the codes forming the themes of "new habits", "new personality traits", "new knowledge and experiences", the derived codes were shared instantly. After the codes forming the other themes were completed, they were merged and the similar ones were eliminated. At this stage, a complete harmony was achieved in all 6 main themes. The level of agreement in the codes of the themes "broken prejudices" and "graduate education" remained at 70%, and the codes were corrected after discussions and rereading of 16 forms.

3- In the final stage, the interview forms were returned and the initial notes were compared with the codes created. In this context, it was seen from the responses in forms 3,11,19,22 and 31 that the codes "gaining self-confidence" and "being patient" should be added to the theme of "new personality traits".

Research Ethics

All the ethical procedures were implemented in this study. Such principles and related procedures may be defined in two aspects: Participants and researchers. In this research process, all the participants were informed about the research's aim and scope initially, then their all responses were confirmed through confirmation statements after the interviews. There is only one author of this study and there is no need to practice any ethical procedure.

FINDINGS

First of all, when we consider at the codes obtained from the collected findings, we can say that a structure parallel to the literary codes presented in Figure 1 has emerged. Table 2 shows the themes and sub-components generated based on the findings. Before moving on to the findings related to the research questions, it can be said that the participants have a perception of transformation close to the theoretical components of the Transformative Learning Theory. As a matter of fact, the themes developed based on these codes will be more helpful in defining such a transformation. Table 2 shows the themes organized in a way to provide a detailed description and classified in 6 subgroups.

Table 2. Main Themes and Subcomponents

Themes	
New Knowledge Areas	New Habits and Hobbies
- Tourism sector	- Book Reading
- Writing articles and papers	- Monitoring current developments in the tourism sector
- Accommodation services	- Researching recipes for different foods
- Tour management	- Conducting research on topics of interest
- Economy	
- Hunting tourism	
- Business management	
New Skills and Experiences	Old Prejudices and Habits Which Are Broken
-To be able to conduct scientific research	- Old study methods and long study period
-To be able to publish scientific publications	- Prejudgmentalism
- Ability to think fast	- Believing everything you hear without question
- Tour organization	- Aversion to different foods and culinary cultures
	- Dislike of different cultures and people
	- Hostility towards foreign tourists

- Ability to empathize	- Not accepting tourism as a science
-Establishing social relations	- Intolerance of criticism
- Communication	
- Making a presentation	
- Hygienic work	
- Critical thinking	
- Self-expression	
- Lecturing	
New Personality Traits	Graduate Education
-Gaining different perspective	- Outdated course material
- Learning to question	- Inadequate research and scientific work techniques
- Critical thinking	- Course content and methods indistinguishable from undergraduate education
- Gaining self-esteem	- Insensitivity to students' demands
- Tolerance	- Sufficient and comprehensive course topics
- Patience	-Ability to think more scientifically than in undergraduate education
	- Gaining the ability to think and work scientifically
	-More functional and developmental knowledge acquisition compared to undergraduate education
	- Inadequacy of academics

In the light of the themes shown in the Table 2, the findings according to the research questions are presented below:

1- What are the students' opinions about the graduate education they have received?

Although the findings show that the majority of the students have positive opinions about the graduate education process, the content and axis of the negative opinions heavily question the effectiveness of graduate education.

Table 3. Opinions on Graduate Education

Positive Opinions
Course topics are adequate and comprehensive
Scientific thinking skills have been gained
The habit of scientific study was born
More functional and developmental information compared to undergraduate education
Negative Opinions
Course material is outdated
The scientific research methods taught are inadequate
Course content and teaching methods are no different from undergraduate education
Faculty members are insensitive to students' demands
Faculty members are academically inadequate

A total of 11 students expressed both positive and negative opinions, 4 students expressed entirely negative evaluations, and the remaining 19 students expressed entirely positive opinions. Table 3 shows these findings. When we consider the distribution according to demographic and academic profile, it is seen that primarily female students expressed more negative opinions than male students. While the majority of male students defined graduate education as adequate and developmental, the majority of female students emphasized the deficiencies related to course content and scientific research techniques.

As an example of positive evaluations, participant-33's response is as follows:

P33: "The courses and topics I took during the training were very good. In particular, it was very useful to learn about Industry 4.0, which is one of the most important issues in business management today, and the advantages, disadvantages and people affected by it."

However, the most emphasized negative situation is the inadequacy of the way scientific research methods courses are taught and their content. Approximately 40% of master's students and half of doctoral students stated that their graduate education process was inadequate. In addition, those who stated that they received graduate education for personal development stated that they gained new knowledge and skills, but two of them emphasized inadequacy in terms of content and methodology.

The responses of P17 and P25 reflect their views on the content and curriculum of the educational processes.

P17: "Economics, politics, destination management, sustainability and scientific research methods courses should definitely be taught and explained properly in graduate education. Because a student or a tourism professional should be able to make economic forecasts while listening to the news or following the agenda of the country and analyze what is meant by the information provided. When choosing courses, students should be asked why they are doing graduate education in the first place, and students should be guided to choose the right courses. Courses should be determined according to the needs of the society, not according to the lecturer. [...]"

P25: "What did the courses I took contribute to me? I filtered which subjects I lacked, which courses I could not get efficiency from. The courses I took during the graduate education process were necessary. They made positive and productive contributions in terms of how to conduct research and how to collect data. But there were also places where they were insufficient. Research methods and techniques were mostly theoretical and superficial."

The following response example emphasizes the views that question the adequacy of academic staff:

P20: "I did my bachelor's degree at another university and my master's and doctorate at another university. I had the opportunity to evaluate both universities. I do not think that the lecturers of the university where I did my MA and PhD are very competent in graduate education. In the PhD, except for one lecturer, the lectures were no different from graduate education in the form of lectures. At this point, the job falls to the candidate.[...]"

As can be seen from the above responses, the level of students' expectations is not compatible with what the graduate education process can offer, and students are seemed to be at a level to express clear demands about this situation.

2- How has the graduate education received by the students created a conflict with the old knowledge, skills and views learned and acquired in their previous lives?

Table 4 shows the findings on graduate students' experience of conflict and dilemma.

Table 4. Conflict in Old-New Knowledge and Skills

Experience of Conflict	(f)	%
It has created conflict in knowledge, beliefs and opinions	8	24
It has not created a conflict	26	76
Total	*34*	*100*

According to the findings in the Table 4, 8 of participants stated an experience of conflict, but the rest. Both female and male students (4 each) stated that they experienced conflict between the knowledge and views from their previous experiences and the knowledge and views gained during their graduate education. In the master's-Ph.D. distribution of the responses, it was observed that the majority of the participants who stated that they experienced conflict were participants in the doctoral process. 3 master's students and 5 Ph.D. students responded positively to this question.

P1, one of the male participants who stated that he had experienced conflicts, emphasized that he had conflicts especially regarding his religious beliefs, indicating that the basic references related to his worldview were questioned:

P1: "The courses I took and the theses I wrote in my graduate education did not cause any conflict with the values and ideas I had in my previous life, except for one important issue. However, the process that I think led to a conflict regarding my religious belief took place in the Philosophy of Science course I took during my doctoral program. The way the course was taught allowed me to freely present ideas and freely question the topics[...] The sources we read on the history of religions and the perspective on science in the same period both affected me as a person coming from a conservative society and made me question my religious belief at some point."[...]

And participant P15's response points to the conflict between practice and theory:

P15: "The personal observations and experiences I have gained in my social life have often clashed with the scientific backgrounds I have learned in my graduate studies. The best example of this was when I had to unconditionally accept the scientific background of the topic I was studying in my first research study."[...].

The vast majority of participants (76%) stated that they had not experienced a conflict that could be a trigger for a possible transformation. The examples of P6 and P11 presented below reflect this.

P6: "When you already have graduate education, you understand that the education you receive in undergraduate education is simpler and more understandable. It is understood that graduate education is more

academic.[...] In general, I did not have any conflict of opinion. I just did not have enough knowledge about academics and academic education."

P11: "The courses taken in graduate education (master's and doctorate) do not differ from the courses taken in undergraduate education. Therefore, it did not lead to a conflict regarding the values I hold. The thesis did not cause a conflict in the same way."

3- What kind of new knowledge and skills do students think they have gained with the education they have received?

Considering that graduate education should have different and effective outcomes, the participants were asked about their new knowledge, skills and experience. All but one of the participants in the master's program responded positively to this question, while three of the participants in the doctoral program stated that they did not gain anything. Therefore, the majority of the participants (30 people) said that they gained something from their graduate education. Table 5 shows the areas of new knowledge, new skills and experiences reported to have been gained by these respondents.

Table 5. New Achievements

New Knowledge Areas	*New Skills and Experiences*
- Tourism sector	- To be able to conduct scientific research
- Writing articles and papers	- Scientific publication
- Accommodation services	- Fast thinking
- Tour management	- Tour organization
- Economy	- Ability to empathize
- Hunting tourism	- Establishing social relationships
- Business management	- Effective communication
	- Making a presentation
	- Hygienic operation
	- Critical thinking
	- Self-expression
	- Lecturing

As seen in the Table 5, the new areas of knowledge mentioned by the participants include academic subjects related to the tourism sector, and thus, it is seen that some knowledge gains are realized on top of the knowledge provided by undergraduate education.

A more comprehensive list of outcomes has been identified pertaining to "skills and experiences". It can be posited that these emerge not only within professional and academic realms but also extend to perspectives on life and interactions with others. Conversely, four of the participants have indicated that postgraduate education has not contributed any value to them.

The responses of P18 and P27 point to intellectual gains such as being able to think critically and develop empathy towards differences:

P18: "One's perspective changes inevitably. As we read, we start to look at events and situations from a different and wider perspective. As I read articles and encounter different opinions of different authors, I realized that I started to be less certain. Different reasons and results can be obtained by looking at the same event from different angles."

P27: "Getting to know new cultures, which is one of the main purposes of tourism, was one of the factors that changed my perspective on life. On a large scale, I learned that I should examine the cultures of people in other countries before questioning their behavior. I started to approach people in my country, which hosts many cultures, more moderately."

Among the participants who emphasized academic knowledge and skills, the responses of P20 and P26 stood out:

P20: "I definitely gained something. I learned how to make analyses; I learned how to do academic work. In my master's degree, I preferred to write my thesis in the field of marketing because I considered myself incomplete in the field of marketing. But I learned that this was a wrong strategy over time. Later, thanks to the necessary readings and research, I determined that my field of interest was human resources and organizational behavior."

P26: "By participating in activities on tourism, I had the opportunity to gain new knowledge both personally and by communicating with experts in the field. By participating in congresses, symposiums and

conferences, it helped me to contribute to the literature by preparing studies related to the field and presenting my thoughts. It gave me the habit of reading books, magazines, articles and news carefully."

4- What kind of transformation do students think the education they have received has led to in their personality traits and individual lives?

This question was used to determine the perception of a dimension that plays a key role in terms of Transformative Learning Theory. 11 of the doctoral student participants and 8 of the master's student participants stated that they had experiences that meant a change in their personality traits and transformation in their lives. The majority of these were female participants (14 female, 5 male). The responses regarding permanent change and transformation were categorized as habit, hobby and personality trait. Table 6 shows the new habits and personality traits mentioned by those who have experienced such a situation.

Table 6. Transformation Status of Graduate Education

New Habits and Hobbies	*New Personality Traits*
- Book Reading	- Gaining different perspectives
- Monitoring current developments in the tourism sector	- Learning to question
- Researching recipes for different foods	- Critical thinking
- Conducting research on topics of interest	- Gaining self-confidence
	- Tolerance
	- Patience

In the Table 6, 4 themes have been conducted as new habits&hobbies, and 6 themes have been determined as new personality traits. In this context, participant P27's response is one of the responses that indicates a wide-impact personality transformation and shows that the individual is able to move to a stage of self-criticism that accompanies the ability to act from different perspectives. P14's response, on the other hand, describes a change that leads to the disappearance of a prejudice that is entrenched at both academic and social levels:

P27: "First of all, graduate education showed me that there are things I need to question in every aspect of my life. The education I received started to remind itself in every step I took. I started to measure the accuracy of my actions and speech.[...] I was not afraid to change and I did not avoid explaining the things I thought were wrong to those around me by giving a logical explanation. Graduate education did not only help me learn scientific knowledge; it caused me to criticize my own life with that knowledge."

P14: "In my master's degree, I prepared a thesis on the evaluation of accommodation facilities in terms of their suitability for people with disabilities. Therefore, some of the studies I read during the thesis preparation process affected my approach to people with disabilities in my social life. For example, people with disabilities do not like it when we fall into the misconception that they need help in everything, and this is an annoying situation they often encounter. I now try to remember this when I meet someone with a disability."

Participants P3 and P6 are among the best examples reflecting the transformations that can arise from gains at the professional and personal levels. In these examples, it is seen that critical thinking, questioning and learning by researching attitudes can be gained:

P3: "Living a life of research and learning may be the most important development I have gained on this path. I try to see the real and scientific side by not being fixed-minded, not believing everything I hear or investigating what is going on behind what I hear and see. This makes a difference for me."

P6: "Of course, it has a lot to gain in terms of education and sector development. When you do not improve yourself, the fact that you have a graduate education will become meaningless for your environment. Before graduate education, I was not in an effort to do much research in the field, but this has improved me and I am constantly trying to learn new information."

5- What are the students' evaluations of the old habits or views broken after the conflicts between old and new knowledge and ideas caused by the education they received?

This research question also includes findings that can be considered as signs of important transformations in terms of Transformative Learning Theory. The identification of old habits and attitudes that have been broken may indicate a change in a person's character or attitudes. 6 master's and 11 doctoral students (17 participants in total) reported such an experience. Four of these were men and the rest were women. Table 7 presents the findings of those who responded positively to this question.

Table 7. Broken Prejudices and Habits

- Old study methods and long study period
- Prejudgmentalism
- Believing everything you hear without question
- Intolerance of criticism
- Aversion to different foods and culinary cultures
- Dislike of different cultures and people
- Hostility towards foreign tourists
- Not accepting tourism as a science

As seen in the Table 7, there are 8 themes defined as broken attitudes and/or habits. Some examples of responses presented below show that graduate education in tourism has contributed to reducing or eliminating reservations and prejudices against diversity in some individuals. For example, P10 and P34 describe transformations in structures that are closed and prejudiced towards different cultures and ways of life:

P10: "I was not very open to trying new flavors and having new experiences before. The gastronomy tourism I am working on is based on the need to be the opposite, to be open to new flavors and experiences. This has helped me to be open to innovation, not only in food and drink, but in many areas, to not show excessive resistance and to get rid of my prejudices."

P34: "[...] The information I learned broadened my horizons and made me look at life from different perspectives. My prejudices against foreign tourists were broken. While I used to think that many tourist models were hostile to Turks and our country, this prejudice has disappeared."

An example of a response pointing to the emergence of questioning, acceptance of criticism and the ability to think critically together came from P17:

P17: "Before, I was very upset when I was criticized. Now, I can be happy when I am criticized. I say, "How nice that they have made it better." Also, before, when I read and learned something, I would say, "OK, this is true," and memorize the information. Now I think more critically; I question more; I ask the questions, "According to what and according to whom?"

DISCUSSION AND CONCLUSION

When we consider the characteristics and functions of graduate studies, we see functions such as disseminating science and art, defining social problems and producing appropriate solutions, and supporting the training of high-level workforce. Graduate education has become a necessity due to factors such as the increase in the number of undergraduate graduates, economic crises and technological transformations (Karaman & Bakırcı, 2010), and the role of graduate education in the new generation university concept has become more critical, and the tourism sector has become one of the fields with the highest need in this regard. In this context, Mezirow's approach, which encourages learners to question, critically reflect and alternative perspectives, is in line with the structure of the workforce profile needed in many branches of tourism education. For example, innovative and creative individuals needed in fields such as hotel management, travel and guiding can be trained through graduate education programs that can achieve transformative change.

In today's environment where learner-centered lifelong learning is becoming more widespread, graduate studies can serve as the main stage for transformative learning processes. The findings of this study showed that the study group, which participated in the graduate education process in the field of tourism, was able to achieve gains close to some of the learning objectives envisaged for the tourism sector in general. In particular, the achievements of being able to make academic publications, give lectures, communicate effectively, think critically, empathize and tolerate differences are noteworthy.

The research findings show that there is not enough indication of the existence of perspective transformation, which is a key component in the transformative learning process. In other words, there are no signs of a transformation equivalent to Mezirow's definition of meaning/reference frame. In terms of external factors, this may be due to the fact that a purposeful and planned transformative education model is not implemented in graduate education practices, and in terms of internal factors, it may be due to the individual characteristics of the learners. It may be due to the fact that the educator-teacher roles in the graduate education process are focused on the acquisition of certain academic knowledge and skills instead of directing to questioning and criticizing. On the other hand, although no real transformation can be mentioned, most of the participants described learning experiences that left important traces and signaled cognitive and emotional changes, albeit limited. Among those who reported gaining new character traits (new habits, ways of thinking and attitudes) and new skills, gaining self-

confidence, gaining a critical perspective and gaining academic skills stood out. It was also found that some participants were able to engage in critical reflection.

Participants' reasons for pursuing graduate studies were predominantly focused on academic goals. In addition, a significant group (21%) stated that they pursued graduate education for personal development purposes, and all of them stated that they gained new knowledge and skills during their graduate education. Therefore, it can be said that this study group was able to fulfill the function of the graduate education process to gain certain knowledge and skills. In Aydemir and Çam's (2015) qualitative study, the reasons for gaining an academic career, competence and prestige were also emphasized as goals.

Regarding the quality of graduate education, it was observed that female students expressed more negative opinions than male students. The majority of male students defined graduate education as adequate and developmental, while female students emphasized the deficiencies in course content and scientific research techniques. The most emphasized negative situation among both male and female students is the inadequacy of the content and the way scientific research methods courses are taught. Approximately 40% of master's students and half of doctoral students stated that their graduate education process was inadequate. This situation may not be related to the expectations from graduate education, but may indicate the deficiencies that the participants were able to identify with their knowledge and awareness of the content and methodology. As a matter of fact, the points raised by the participants who expressed negative opinions also showed that they had a high level of expectation from graduate education and that they had the cognitive competence to evaluate this educational process. In addition, all of the participants who stated that they received graduate education for personal development stated that they gained new knowledge and skills; two of them described the education as inadequate in terms of content and methodology. Considering at some quantitative studies from abroad, Ruhanen and McLennan (2012) found that in their study on graduate students in tourism, students demanded an education that provides active learning with an emphasis on practice and hoped to gain work experience during their education. Kazmina et al. (2020) emphasized the need to train innovative individuals in tourism education. In Leshchenko et al.'s (2021) empirical study on graduate students, it was emphasized that the ability to conduct scientific research focused on digital transformation and information society should be gained. Such parallel findings may indicate that the quality of graduate education is not aligned with the transformations in learners' expectations or societal needs.

The responses to the conflict experience question, which emphasizes a key dimension in terms of Transformative Learning Theory, showed that the graduate education experience of the study group had a low power to create a conflict in the direction of transformative learning. As a matter of fact, although it was understood that conflicts that could lead to a perspective transformation with critical reflection were not experienced much, a few participants experienced situations that led to serious conflicts with some values and views in their previous lives. There were 5 participants who showed sufficient evidence that the dilemmas and conflicts they experienced led to a real transformation. This group, which constitutes the majority of the 8 participants who stated that they had experienced a conflict between their old lives and their achievements in the graduate education process, emphasized the axes of "renewing the philosophy of life", "courage to question everything" and "tolerance towards differences" that could trigger perspective transformation. The transformation stage is the end point of the Transformative Learning Theory, which is reached by completing the other stages. In the success of the process that starts with a confusing dilemma or conflict, the fact that the instructor and learners are oriented towards the goal of change in cooperation and readiness plays an important role (Akçay, 2012). However, in graduate learning experiences, it may not be common for instructors and educational programs to include such goals. In addition, the majority of those who stated that they experienced a conflict and dilemma were in doctoral education. This may be due to the potential of doctoral education to lead to different, freer and more critical thinking and acting skills compared to master's education. In Nyamunda and Westhuizen's (2018) study on triggering potential entrepreneurship of university students, it was observed that dilemma and conflict experiences yielded more effective results for female students.

In recent years, some studies based on the transformative teaching approach have shown that both the increase in knowledge and skills and the needed individual transformations can be achieved through the cooperation of the instructor and the learners. For example, the characteristic structure of foreign language education can enable learners to be transformed by being influenced by the cultural differences reflected in a foreign language. Moreover, there have been studies showing that transformations begin when foreign language instructors apply new techniques that foster learners' participation and creativity (Arı and Kurnaz, 2018). This feature of foreign language learning can be compared to the interactions created by the multicultural content of the tourism field. As a matter of fact, one of the important findings of this study, "tolerance towards differences" behavior, is a point reached after the participants encountered the food, lifestyle and views of people from different

cultures. Similarly, a study examining the internship experiences of Chinese and Spanish trainee teachers showed that the transformative learning process played a role in the formation of trainee teachers' professional identity (Zhu, Iglesia & Wang, 2020).

The majority of the participants stated that they gained important knowledge and skills during their graduate education. The new areas of knowledge mentioned included topics related to the tourism sector, thus indicating that in addition to the narrow scope of knowledge provided by undergraduate education, knowledge from related fields was also gained. A richer list of gains was identified in the area of skills and experiences, which can be said to have emerged not only at the professional and academic level, but also in a wider range of areas, including life outlook and communication with other people. For example, the ability to think quickly, empathize, establish social relationships, gain a critical perspective, and express oneself are considered to be basic skills that are not only necessary in academic life but also critical for daily life, and can be said to reflect the characteristics of the workforce needed in the tourism sector. In Tarcan İçigen et al.'s (2018) study on tourism sector managers' perceptions of graduate education, it was observed that graduate education contributes to both personal and professional development. Similarly, the transformative education model developed by Tsimane and Downing (2020) in nursing education facilitated the training of nurses who can think critically and make rational decisions.

In our opinion, one of the most important findings of this study is that the majority of the participants (25 participants) stated that they gained positive new character traits and work habits with graduate education. All of the male participants expressed this view. This may be due to the fact that female participants were less inclined or willing to acquire new character traits and habits. The identification of old habits and attitudes that have been broken may indicate a change in character or attitudes. Moreover, half of the participants emphasized that graduate education in tourism eliminated prejudices and preconceptions towards different phenomena, ideas, cultures and tastes. As a matter of fact, this finding is reminiscent of the philosophy of tourism education proposed by Walker & Manyamba (2020), which is emotion-oriented and liberating for learners, stemming from the unique nature of tourism.

The responses to the question on the old habits and worldviews broken indicate the existence of stereotypes against the different and foreign. This is because, among the old habits and attitudes that the participants said they had broken, "prejudice" and "intolerance towards different people and cultures" stood out. Changing such stereotyped attitudes is not easy; it requires the individual to face dilemmas and come to terms with himself/herself and explore new perspectives in the context of transformative theory (Jacobs, 2019), so it may carry clues about the existence of transformative learning. The majority of those who stated this were female students. This may mean that women in the study group are more willing or inclined to abandon old thoughts, habits or attitudes rather than acquiring new personality traits.

In Çimen and Yılmaz's (2014) study on prospective biology teachers, when the effect of transformative learning theory on the experimental group was examined, it was seen that there was a significant difference in knowledge, attitude and behavior changes. In Güler's (2021) qualitative study on the transformative effects of visual art education through music, transformations were observed in undergraduate and graduate students in the direction of developing abstract thinking and creativity, moving away from rote memorization, and provoking metaphorical thinking. Based on these findings, it can be argued that some changes and gains have emerged in this study group, which received graduate education in the field of tourism, regarding some of the issues required by today's conditions and the tourism sector. The experiences of "experiencing dilemmas and conflicts", "acquiring new character traits" and "breaking some old prejudices and habits" and the skill of "critical reflection", which were found in a small part of the participants, showed that a transformation process may have been triggered and certain stages may have been completed, even though it is not yet mature and complete.

Recommendations

Future researchers may be advised to examine the reasons for the prevention or interruption of learning-based individual transformations in terms of various factors through quantitative studies to be conducted in parallel with such qualitative studies. In addition, it has been found that there are very few studies on both graduate tourism education and transformative learning theory in the relevant literature in Turkiye. Therefore, new researches should be encouraged to meet the need for knowledge accumulation in these areas.

Limitations

This research is limited to the perceptions and opinions of 34 participants from Mersin University. Additionally, as a qualitative research design, it is not recommended to derive and disscuss inductive results from that study’s findings.

Statements of Publication Ethics

In this article, the writing and ethical rules of the journal, the publication principles of the journal, and the rules of scientific research and publication ethics have been fully complied with. All responsibility for any ethical violations that may arise from this study belongs to the author. The ethical approval document required for research permission was obtained from the Ethical Committee of Social Sciences and Humanities of Mersin University, with the date and number 25.10.2021-173.

Conflict of Interest

There is no conflict of interest in this research. The research was carried out without any commercial or financial support from any legal person, institution or organization.

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Assessing Reading Proficiency in Turkish as a Foreign Language: A Validation, Skill and Standardisation Study

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Abstract

Language assessment has long become an independent academic discipline, producing and contributing to a large body of literature. However, key considerations in testing and assessment in the context of Teaching Turkish as a Foreign Language (TTFL) has been often neglected so far, leading to exams that lack evidence for validation. The present study aims to address this shortcoming by offering a standardized validation approach for assessing reading skills in Turkish proficiency exams, using several theoretically robust validity frameworks and cognitive models. The study particularly focussed on the development and validation of B2-C1 reading proficiency descriptors using a mixed-methods approach with the participation of 8 field experts. The findings from the study can provide guidance to item writers in the design and development of standardized test specifications and test items compatible with the levels intended to be assessed.

Keywords: teaching Turkish, language assessment, reading skills, a priori validity

Yabancı Dil Olarak Türkçe Okuma Becerisinin Ölçülmesi: Geçerlik, Kazanım ve Standartlaştırma Çalışması

Öz

Dil öğretiminde ölçme ve değerlendirme uzunca bir süredir literatür oluşturan ve onun gelişimine katkıda bulunan bağımsız bir akademik disiplin hâline gelmiştir. Ancak Yabancı Dil Olarak Türkçe Öğretimi (YDTÖ) bağlamında ölçme ve değerlendirme disiplinindeki pek çok konu ihmal edilmiştir ve bu durum Türkçe öğrenen bireylerin yeterliliklerini ölçmek için kullanılan sınavların geçerlik kanıtlarının bulunmamasına ya da yetersiz olmasına yol açmaktadır. Bu çalışma, kuramsal olarak güçlü geçerlik ve bilişsel modeller kullanarak Türkçe yeterlik sınavlarındaki okuma becerisinin değerlendirilebilmesi için standart bir ölçme yaklaşımı oluşturarak bu eksiklikleri gidermeyi amaçlamaktadır. Çalışma çerçevesinde okuma becerilerini değerlendirmek için kazanımlar geliştirilmiştir. Karma araştırma modeli kullanılan bu çalışmada B2-C1 düzeylerinde okuduğunu anlama becerilerine yönelik kazanımların 8 alan uzmanının katılımıyla geliştirilmesi ve geçerliliğinin sağlanması üzerinde durulmuştur. Çalışmada elde edilen sonuçlar hem sınav özelliklerinin belirlenmesi ve geliştirilmesi hem de madde yazarlarına ölçülmek istenen dil düzeylerine uyumlu sınav maddeleri oluşturma konusunda rehberlik sağlayacaktır.

Anahtar Sözcükler: yabancı dil olarak Türkçe öğretimi, yabancı dilde ölçme, okuma becerileri, ön geçerlik.

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INTRODUCTION

Reading skill, which is one of the receptive skills, has both direct and indirect effects on the productive skills of language users. Although there are various studies in the literature on reading skills in teaching Turkish (Altunkaya, 2016; Ülper, 2021 Ülper & et all, 2017), there is no standard model on how to assess these skills. In Turkey, Turkish language teaching centers affiliated to universities that carry out the processes of teaching Turkish as a foreign language apply their own course and proficiency exams. The sections where reading skills are measured in these exams vary from institution to institution. Institutions do not share the content they have designed to measure the reading skills, the method they use in the development of the items, and the studies showing the reliability and validity of the measurement such as item analysis. As a matter of fact, in various studies conducted in the field, there are many studies underlining that standardization is the biggest problem in Turkish as foreign language exams (Gedik, 2017; Boylu, 2019, 2021; Duru, 2014; Durmuş, 2013) and that the content and items in the exams are not suitable for the levels and basic principles of assessment (Işıkoğlu, 2015; Boylu, 2019; Kolcuoğlu, 2022).

The assessment process in a foreign language should be planned theoretically and in a needs-oriented manner. Turkish Language Teaching Centers in Turkey provide education based on the *Common European Framework of Reference for Languages* (CEFR) and provide language certificates according to the levels in the framework. Therefore, the assessment and evaluation process should be organized based on the descriptors in the CEFR. In order to develop a test based on the descriptors, each item must be associated with the descriptor at that level. Each item should be prepared to measure the performance indicator of the descriptors in the CEFR. No data on this association has been shared for the exams prepared by Turkish Language Teaching Centers.

Studies that examine the practices designed on the basis of CEFR and explore the validity of the assessment process through psychometric analyses can be accepted as more reliable and valid. The literature offers several well-established validity frameworks, and one such example is Weir's validity model, which is frequently used in language testing. Khalifa and Weir's (2009) model for measuring reading comprehension skills, is one of the well-known models for measuring reading skills in a foreign language. This study, proposes and performs a model of an a priori validity analysis based on Weir's (2005) validity model.

Following Weir's (2005) sociocognitive validity approach, the primary focus was on evaluating cognitive competencies to assess reading skills. Khalifa and Weir's (2009) reading model was utilized to establish the scope of theory-based validity and context validity.

One of the important steps in the development cycle for assessing reading is the determination of the construct definition, or what Weir (2005) calls theory-based validity. It is recommended in the literature to use theoretical frameworks that provide evidence-based and reliable data and are based on communicative competence (Fulcher, Practical Language Testing). Thus, the study was based on the competencies in the CEFR and the *ALTE Can Do Project* (ALTECDP). Indeed, validity studies were conducted with large groups of participants in order to provide evidence-based and reliable data for the development of descriptors using both frameworks. ALTECDP, which is a language proficiency and level descriptor, developed in alignment with the CEFR by the Association of Language Testers in Europe (ALTE), is a popular framework. As far as the authors are aware, ALTECDP has not be frequently used as a framework in the literature on teaching Turkish as a foreign language and exam practices. In some areas, ALTECDP competencies are complementary to the CEFR and may have more specific performance indicators. Thus, it could serve as a useful tool for the exploration of context validity in language assessment. This study presents the

translation of ALTECDP B2 and C1 level reading competencies[1] to test developers in the field of teaching Turkish as a foreign language by using them to develop context validity in the assessment process.

Validity Approaches in Language Assessment

Weir proposes two primary types of validity in language tests: a priori and a posteriori validity. A priori validity comprises Theory-based validity and context validity, while a posteriori validity encompasses scoring validity, criterion-related validity, and consequential validity. Given that this study's scope does not encompass the analysis of exam results, the focus will be solely on the a priori validity model. The details are provided on the methodologies of a priori validity studies for assessing reading skills in teaching Turkish as a foreign language in the following sections.

Weir (2005, p. 15) asserts that the validity of an exam is not established and interpreted solely based on arguments developed by the test developer, but rather by the evidence they gather to support those arguments. This evidence should be gathered during the test design process, where theory-based validity plays a crucial role. When creating an exam for specific skill(s), it is imperative to first determine "what and whom to assess." This entails defining the purpose and target population of the exam. This study focuses on the a priori validity process for Turkish language proficiency exams, as issues identified in the literature often highlight concerns about standardization (Fulcher, 2010) in proficiency exams. Given that candidates taking Turkish proficiency exams are typically international students, it can be inferred that the exam's target audience comprises language users who will pursue higher education.

In designing an exam to assess reading skills for this target group, it is essential to question the purpose. For instance, there would be a distinction in content between an exam designed to evaluate the academic reading proficiency of postgraduate candidates and one aimed at assessing general reading-comprehension proficiency. In the former case, various texts on a similar subject might be used as input, and candidates could be tasked with composing a text. However, in this scenario, it is not just a single skill, but multiple skills (reading and writing) that are being assessed. Incorporating different language skills into the assessment process will impact the context validity of the assessment.

Furthermore, considering the target group participating in proficiency exams and the expected reading competencies, it will be imperative to assess both general reading comprehension skills and reading skills exclusively.

Theory-based validity prompts new questions at this juncture: How can reading skills be effectively assessed? What are the processes through which a language user comprehends a text, and how can we observe these processes? These inquiries can only be addressed by identifying the cognitive processes involved in reading comprehension. Context validity, in turn, can only be achieved by identifying and linking these cognitive processes with the anticipated competencies.

Reading in a Foreign Language and Cognitive Processes Involved in Reading

Reading comprehension is a complex and multifaceted process that involves the synchronization of various integrated processes (Keenan et al., 2008; Perfetti and Adlof, 2012). This high level of complexity poses numerous challenges for the design of the assessment. Designers are usually tasked with making crucial decisions regarding the purpose and administration of the assessment. They must also determine which aspects of the underlying latent traits they wish to evaluate, including the types of texts, tasks, and items used to measure the targeted skill. These decisions often necessitate trade-offs with less critical or less feasible test spesifications due to practical and technical constraints, such as time limitations, administration methods, scoring techniques, and the cost of test development. Consequently, the content of an assessment activity comprises a sample group that represents a vast array of texts, items, and skills required to perform a range of real-world tasks (Mislevy and Haertel, 2006; Mislevy and Sabatini,

[1] Appendix 2 and Appendix 4

2012). The choices made in this process and the subsequent design of the scale play a pivotal role in determining what the test scores signify and what inferences can be drawn from them (Kane, 2006).

Assessing reading skills in a foreign language entails ascertaining the levels of comprehension and identifying the items to be prepared for each level in the measurement process. Within the framework of the socio-cognitive model, we can also delineate the cognitive competencies that language users may exhibit at each level, thus enabling the development of items appropriate for the desired language proficiency level.

Extensive research has been conducted, and continues to be carried out, on reading comprehension within the realms of cognitive psychology, linguistics, and language teaching (Kintsch and Van Dijk, 1978; Kintsch, 2005; Kintsch and Welsch, 2013; Day and Park, 2005; Khalifa and Weir, 2009; among others). Although various approaches expound upon these processes differently, it has been widely acknowledged by many researchers that both top-down and bottom-up models operate concurrently (Khalifa and Weir, 2009, pp. 41-42). Cognitive processes can be broadly categorized into surface comprehension (recognizing letters, words, syntax, and language structures), deep comprehension (recognizing propositions in the text and their interconnections), and the level of comprehension where the reader amalgamates their own knowledge with the information in the text to draw inferences.

In their model of reading comprehension, Khalifa and Weir (2009,p. 43) draw attention to the distinction between reading comprehension in a foreign language and establish a comprehension model based on Field's (2004) model (Psycholinguistics: the Key Concepts):

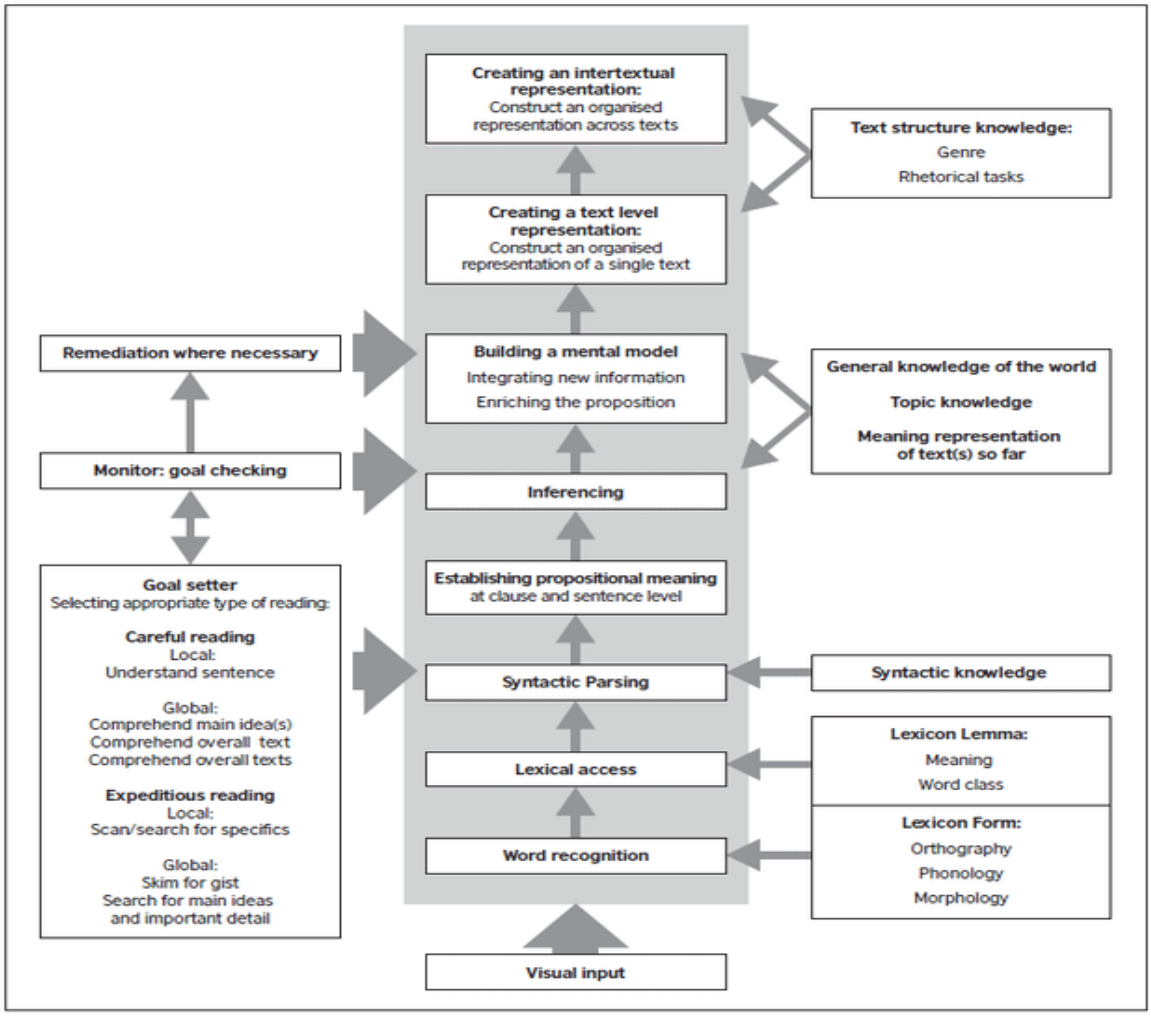

Figure 1. *Khalifa and Weir (2009, p. 43) Reading Model Schema*

The model consists of simultaneous processes that are interconnected. The reader determines the appropriate reading type (careful global reading, careful local reading, expeditious global reading, expeditious local reading) by determining the purpose of reading the text with the "*goal setter*". In the assessment of reading skills in a foreign language, the type of reading will change depending on the candidate, according to the content of the items and the *goal setter* gains importance. The instructions in the item (e.g., What is the main idea of the text?) allow the test-taker to decide which of the reading types "expeditious reading (skimming, scanning, search reading) or careful reading (global or local)" to apply. Simultaneously, a "*monitoring*" process in the reader's mind checks the appropriateness of the goal set during the reading process and allows the goal to be renewed or changed if necessary.

Reading strategies and monitoring are metacognitive skills and are not cognitive competencies that we can directly observe in the assessment of reading skills. However, competencies such as "being able to determine reading purpose" and "being able to use expeditious reading strategies" can be used to determine the duration, number of items and item types of the test. As a matter of fact, Weir (18) states that measuring only careful reading and not speed reading cannot measure a holistic reading proficiency and he emphasizes that exams assessing reading skills should cover all reading strategies.

In language tests, test takers will determine which reading strategy to use based on the instructions. In language tests, the instructions should be written clearly and simply and the framework expected from the test taker should be drawn in a way that leaves no room for ambiguity. The instructions should be presented to test taker before the reading texts and test taker should read the text according to the instructions.

Within the scope of the model, another and the most important stage that will guide the test designers and item writers in the assessment of reading skills is the interpretation process that starts with the visual input within the scope of cognitive competence. In the *inference* and *building a mental model* stages of the interpretation process, the reader's "*general knowledge of the world* ", "*topic knowledge*" and "*meaning representation of text(s) so far*" are involved in the process. At the text level and intertextual representation creating stage, "*text structure knowledge*" including "*genre and rhetorical task*" comes into play. At this stage, *topic knowledge* and *general knowledge of the world* are related to the content of the text. Readers who cannot access topic knowledge and general knowledge of the world in the mental model cannot go beyond the "*inference*" stage in the comprehension process. In order to conduct a fair and equal assessment process, the inputs used in language tests should be directed toward the common mental schemas of all candidates.

Word recognition, *lexical access* and *syntactic parsing* are the basic stages in the model and are suitable for the items prepared for basic (A1 and A2) levels and for grammar or vocabulary skills in the assessment of reading comprehension skills. However, this explanation does not mean that these stages are not used at higher levels. Especially in foreign language reading processes, these cognitive processes are used much more actively. Since we think that direct assessment of these cognitive processes is not necessary for language users at higher levels, these cognitive stages were excluded from the study. In order to plan an assessment process at higher levels, items should be prepared for *establishing propositional meaning* and the cognitive competencies above.

Establishing propositional meaning is the literal interpretation of the propositions and phrases in the text, independent of the reader's associations and his/her own interpretations; it is the mental record of the basic meaning of the phrase (Khalifa and Weir 50). Items related to the cognitive process of the basic meaning and literal interpretation of sentences can be measured by asking for the meaning and restatement of phrases, idioms, and metaphors in the text. In addition, items about information explicitly given in the text (dates, places, etc.) are also related to this cognitive process.

Since a text cannot contain all the information needed to be meaningful, readers need to add their own information. The reader accesses the meaning of the text through a creative cognitive process by inferring information that is not explicitly included in the text (Khalifa and Weir 50-51). Inference also takes place at the lexical level. Readers can reach the meanings of unfamiliar words based on the context. Therefore, items related to lexical knowledge are also related to the *inference* process.

Another *inference* process is related to the analysis of implicit referents. Analyzing what is marked by pronouns or other referential elements based on the text is also an inference process. Asking the person, place, or object to which the pronouns in the text refer by underlining them (such as "What is marked by 'this, that, here, etc. ?") are the items

within the scope of this cognitive process. In addition, multiple-choice items such as with a "Which of the following interpretation can / cannot be reached based on the text?" instructions can also be applied for cognitive competencies at the inference level. The most important point to be considered in inference questions is that the inference to be expected from test takers does not require content knowledge or background knowledge. Inference should only be made by using the information in the text. Therefore, in order to reach the inference in question, there should be enough information in the text to support a clear inference. (Green, 2014, p. 112)

In the stage of *building a mental model* that follows *inference*, the information is added together to reach the general meaning of the text. The information in each sentence is added and harmonized by using the inference process if necessary. This process requires the reader to recognize the main idea of the text, to associate new ideas with previous ones, and to distinguish between macro and micro propositions. (Field, 2004, p. 241 as cited in Khalifa and Weir, 2009, pp.51-52)

Khalifa and Weir (2009) state that a process of "*selection*" is also involved in this process, which determines which information is relevant or important. At this point, similar to the process in Kintsch and Dijk's (1978) reading model, micro-structures are perceived and transformed into meaningful propositions and stored in working memory to establish coherence between them. As the process continues, the macro-structure is created. The reader's prior knowledge is also used in the reading process to create a suitable schema for the macro-structure and to determine the coherence between the micro-structures. A hierarchical structure emerges when perceiving new information. Through a process of selection, readers place important and basic information at the top of the hierarchy and detailed information at the bottom.

This hierarchical structure in the measurement of reading skills can be associated with item difficulty. Asking for detailed information that seems less important than the information in the text will increase item difficulty as it will require more processing in the reader's mind. Since the reader stores detailed information lower in the hierarchical structure, he/she has to do more mental processing to highlight, process and interpret this information. Therefore, item difficulties should be diversified by asking questions related to micro-structure as well as macro-structure questions about the text.

Creating a text level representation is concerned with making sense of the text as a whole. The structure of the text appears to the reader as a collection of micro-propositions under the macro-propositions, sorted and ordered according to their importance. (Field "Psycholinguistics" 225 as cited in Khalifa and Weir 52) According to Khalifa and Weir (52), at the end of the reading process, a discourse-level structure is created for the whole text. A good reader can distinguish which information is central to the text, how different parts of the text fit together, which part of the text is important to the author. Understanding the relationship of ideas at the higher level of discourse structure (related to the whole text), understanding which propositions are central to the purpose of the text and which ideas are of secondary importance are essential requirements for making sense of reading. In addition, at this level, the reader can comprehend the discourse structure of the text as a whole. Accordingly, reader can make determinations about discourse type and text type and recognize genres.

At the level of "*creating a text level representation* ", items such as the finding main idea of the text or supporting ideas, determining what is important according to the author, determining the purpose of the text, inferring the main message in the text, finding propositions that are appropriate to the author's attitude, finding the links between paragraphs, ordering paragraphs and matching paragraphs with proposition can be created.

Creating an Intertextual representation, which is the last stage of the comprehension model, is about reading different texts related to a specific topic and creating a "discourse synthesis". Synthesizing from different texts is cognitively different from reaching a representation from a single text and requires a higher level of cognitive processing. Khalifa and Weir (2009, p. 53) cite Stromso and Braten's (2002, p. 211) definition of "composing a new text by selecting, organizing and connecting content from more than one source texts" for this cognitive level.

The level of *creating an Intertextual representation* can generally be observed by transferring knowledge from reading to writing skills. It is very difficult to assess this cognitive level in a single-session exam. This stage of the model can be used in a process-based assessment, especially for academic reading and writing skills. Since the objectives and items in this study were prepared for proficiency exams in which reading skills are assessed in a single session, this cognitive competency was considered out of scope in this study.

METHOD

The study employed an exploratory mixed-methods research approach (Creswell & Clark, 2017), due to the nature of the research and the sequential interplay between qualitative and quantitative methods. The initial qualitative phase, employing content analysis, was essential for developing a comprehensive theoretical framework and identifying subskills. This approach allowed for a deep, nuanced understanding of the theories and frameworks, which is a strength of qualitative methods. By extensively reviewing literature and frameworks, the study was able to ground its exploration in a solid theoretical base. This phase was not only foundational in shaping the research but also crucial for ensuring theory-based validity, a key aspect in studies dealing with conceptual frameworks and theoretical constructs. The subsequent quantitative phase, involving the use of Fleiss's kappa statistics to analyze expert evaluations, provided a robust method for validating the descriptors identified in the qualitative phase. This quantitative analysis allowed for the empirical testing of the qualitative insights, adding a layer of rigor and objectivity to the study. The use of Fleiss's kappa offered a reliable measure of agreement among experts, thereby strengthening the validity of the findings. Overall, the exploratory mixed methods design enabled a holistic approach: beginning with a broad, theory-driven exploration and then moving towards a more focused, empirical validation. This design effectively harnessed the strengths of both qualitative and quantitative methods, ensuring a comprehensive and credible exploration of the study's objectives.

Research Design

Recent studies in language assessment have placed significant emphasis on conducting validity studies right from the moment the decision to administer the exam is made. Within this context, considerations include identifying the target test-takers, defining the scope and sections of the exam, and specifying the content's nature. Weir's (2005) validity model also advocates for determining cognitive competencies related to skills using the sociocognitive validity approach. In alignment with this approach, the initial stage of this study involved a thorough review of CEFR descriptors and ALTECDP competencies. This review was conducted taking into consideration the cognitive stages outlined in Khalifa and Weir's (2009) reading model. Subsequently, the skills required for the assessment process for each descriptor/competency were delineated.

Relating Cognitive Processes to CEFR Descriptors and ALTECDP "Can Do Statements"

In order to develop a test that aims to assess reading comprehension, it is necessary to identify the target group and the purpose, followed by the performance indicators expected from the test-takers. Weir (2005, p. 88) underlines the importance of defining the skills expected for reading comprehension by stating that "If we can identify the skills and strategies that appear to make an important contribution to the reading process, it should be possible to test these and use the composite results for reporting on reading proficiency."

Although the descriptors in the CEFR provide some guidance, they generally include the phrase "can understand" a text, its content, attitudes, textual features, etc. "Comprehension" is a cognitively complex process and is too broad a definition to determine whether a language user "understands" a text. At this point, it is necessary to define "can understand", which has a very broad meaning, more clearly and in detail and to determine the appropriate sub-skills for the assessment process.

In this study, based on the above-mentioned findings, the sub-skill lists for the assessment were prepared based on the literature, Khalifa and Weir's reading comprehension model, CEFR descriptors and ALTECDP "can do" statements. Since the sub-skills were prepared for proficiency exams, the skills were developed in accordance with the item types (true/false, multiple-choice, yes/no, short-answer questions, etc.) that are generally used in these exams to assess a single skill.

As CEFR and ALTECDP set different descriptors and competences, the different sub-skill lists for both frameworks are shown in different tables for levels B2 and C1. Depending on the content of the descriptors, the same sub-skill may match different descriptors and therefore a sub-skill appears more than once in the same table.

The sub-skills were developed by taking Khalifa and Weir's (2009) cognitive model into consideration and each sub-skill corresponded to a cognitive stage. Table 1 shows the association of the sub-skills with cognitive processes.

Table 1. Association of Cognitive Processes with Sub-skill Types

Cognitive Competence Stage	Examples of sub-skills grouped according to competency types
Goal Setting	Identifying reading purpose and strategy Utilizing reading techniques such as skimming, scanning, etc. to access information in the text
Establishing propositional meaning	Understanding the information and propositions in the surface structure of the text Locating information in the text Understanding the expressions in texts produced in colloquial language Identify instructions, requests, tasks in the text
Inference	Accessing implicit knowledge by inference Determining the meaning of words based on context Determining the wishes, expectations, etc. in the text based on the context
Building a mental model	Determining the main idea and supporting ideas of the text Finding information and propositions in the deep structure of the text Associating information and propositions with each other, sorting and classifying them according to their importance Identifying comparisons, opposing views, cause-effect and justification relationships, etc. in the text Understanding culture-specific references
Creating a text level representation	Determining the subject of the text Determining text type and discourse type Determining the purpose of the text and attitude in the text Determining the main idea of the text Determining the temporal sequence of events in the text Analyzing the relationships between the events in the text by justifying them Determining the coherence of the text Making inferences about the text by using the information and propositions in the text To be able to understand textual elements other than written discourse and interpret them together with the propositions in the text

The general skills associated with the cognitive processes based on the competency types in Table 1 were divided and organized in such a way that each of them contained a single cognitive load, and the list of sub-skills in Appendix 1,2,3 and 4 was prepared.[2]

[2] Since the aim of the study is to take a step towards standardizing assessment in Turkish as a foreign language, the lists at the Appendix 1 were prepared in Turkish, taking into account that not all of the lecturers and/or item writers working in this field may read in English. In addition, ALTECDP competencies were translated from English to Turkish by the researchers in the study so that everyone who has a role in the field can benefit from them.

Data Collection

The theory-based validity study was conducted on the developed subskills with 8 academic experts who are experienced in Turkish language teaching and teaching Turkish as a foreign language. The experts consisted of 6 faculty members (5 professors and 1 associate professor) from Turkish language education and linguistics departments of various universities, and lecturers who have been teaching Turkish as a foreign language for at least 10 years in the Turkish language teaching center of two different universities and who have completed or are currently completing their doctorate in this field. We also sought evaluations from a professor of educational sciences specializing in the field of educational measurement and evaluation.

Prior to the validity study, the experts were briefed on the reading model utilized in the study. They were informed of the association between CEFR descriptors and ALTECDP competencies with the model, and clarified that the subskill lists were exclusively created for assessment purposes.

The validity study involved the experts assessing the sub-skills designated for each descriptor and competency, categorizing them as either "Appropriate" or "Not Appropriate". Additionally, experts were asked to provide justifications and suggestions for any sub-skill marked as "Not Appropriate". The results of the validity study were scrutinized, and the outcomes were adjusted in line with the feedback provided by the experts.

Data Analysis and Results

Tables 1 and 2 present the number of sub-skills established for the CEFR descriptors within the study's scope, along with the changes made based on expert evaluations.

Table 2. Number of Sub-skills at Level C1 Before and After the Validity Study

C1 Level		
CEFR Reception Activities	Number of sub-skills before validity study	Number of sub-skills after validity study
Overall Reading Comprehension	11	11
Reading correspondence	10	9
Reading for orientation	8	7
Reading for information and argument	8	8
Reading instructions	2	2
Reading as a leisure activity	13	13
CEFR Reception Strategies	Number of sub-skills before validity study	Number of sub-skills after validity study
Identifying cues and inferring	5	6
ALTECDP Reading ‘can do’ statements	Number of sub-skills before validity study	Number of sub-skills after validity study
Social and Tourist	8	9
Work	16	16
Study	5	4

Table 3. Number of Sub-skills at Level B2 Before and After the Validity Study

B2 Level		
CEFR Reception Activities	Number of sub-skills before validity study	Number of sub-skills after validity study
Overall Reading Comprehension	10	9
Reading correspondence	6	6
Reading for orientation	10	9
Reading for information and argument	14	14
Reading instructions	3	3
Reading as a leisure activity	11	10

CEFR Reception Strategies	Number of sub-skills before validity study	Number of sub-skills after validity study
Identifing cues and inferring	1	1

ALTECDP Reading 'can do' statements	Number of sub-skills before validity study	Number of sub-skills after validity study
Social and Tourist	22	26
Work	11	10
Study	5	5

After determining the expert evaluation scores, the sub-skills underwent a revision process. For each level and framework, experts were tasked with evaluating the appropriateness of these objectives by selecting one of the options: "appropriate," "not appropriate," or "needs revision."

The assessments provided by the eight experts were analyzed for reliability using Fleiss's kappa method, as there were more than two evaluators (Kılıç, 2015). Fleiss's kappa statistic is a measure that assesses the reliability coefficient of agreement among evaluators, taking into consideration the agreement scores assigned by the evaluators. The results of Fleiss's kappa statistic indicated a high level of agreement among the assessors for all descriptors, with a mean value of 0.90. Notably, no descriptor had a kappa value below 0.70.

The results of the analysis demonstrated that the developed sub-skills exhibited high validity values. Despite the already high validity values for each sub-skill, recommendations for alterations were carefully considered, and adjustments were made in accordance with the experts' guidance. Table 3 provides an example of some of the implemented changes.

Table 4. Examples of Changes of Sub-skills After the Validity Study

Activities and levels	Before	After
CEFR C1 Reading for orientation CEFR B2 Reading for orientation ALTECDP C1 - ALTECDP B2 Social and Tourist	Can use expedious reading strategies.	*Taken Out from the lists*
CEFR C1/B2 Overall Reading Comprehension, Reading for information and argument, Reading as a leisure activity ALTECDP C1 Social and Tourist, Work, Study ALTECDP B2 -	Can determine the main idea and supporting ideas in the text.	*Splited in two:* Can determine the main idea of the text. Can determine the supporting ideas in the text.
CEFR C1 Overall Reading Comprehension, Reading for information and argument, Reading as a leisure activity CEFR B2 Reading correspondence ALTECDP C1 Social and Tourist, Work ALTECDP B2 Social and Tourist, Work	Can determine the function and the purpose of the text.	*Simplified:* Can determine the purpose of the text.
CEFR C1 Overall Reading Comprehension, Reading correspondence, Reading as a leisure activity CEFR B2 Overall Reading Comprehension, Reading for information and argument, Reading as a leisure activity ALTECDP C1/B2 -	Can determine the type of discourse.	*Expanded:* Can determine the type of discourse (explanatory, informative, narrative, descriptive, etc.).

Research Ethics

This study was prepared in parallel with the studies carried out within the scope of the Development of 4 Skill-Based Turkish Examination Project conducted by ÖSYM. The authors of the study are also the coordinators and researchers of the project. Supporting academic studies and contributing to the literature is one of the aims of the project. In this context, data were collected and analyzed for the study in the project activities. The researchers involved in the project received permission from the institution to conduct the study. Since the participants were assigned within the scope of the project and only expert opinion study was conducted, ethics committee permission was not needed.

FINDINGS

This study aimed to develop a detailed set of sub-skills for the CEFR B2 and C1 Reception (reading comprehension) and for each of the ALTECDP Reading Skills at B2 and C1 levels. The development process described in the study was firmly grounded in a specifically chosen cognitive model, ensuring that the methods were deeply rooted in a priori validity principles (Weir, 2005). A posteriori validation of the development process was conducted using an expert judgment analysis.

The theoretical validity analyses conducted within our research pointed to a notable gap in the literature focusing on assessment and evaluation in teaching Turkish as a foreign language (Kırkgöz, 2008). This gap highlights the innovative nature of our sub-skills lists, which not only address this scarcity but also represent a pivotal completion of the initial phase in the validity study for assessment designing process.

Many international examinations leverage the strategy of localizing and adapting CEFR and ALTECDP outcomes to enhance their relevance and effectiveness in assessment and evaluation processes (North, 2007). This practice, endorsed and recommended by the CEFR (Council of Europe, 2018), was affirmed by the expert opinions we gathered during our research.

Our validity study, although conducted with a limited number of experts, confidently demonstrated that the sub-skills developed are valid. This validation is a significant endorsement for their use in subsequent stages of test development.

Looking ahead, research focusing on item development using the sub-skills crafted within the framework of this study is poised to be a subject of independent investigation (Alderson, Clapham, & Wall, 1995). Such research is anticipated to yield further data, reinforcing the validity of these sub-skills. In light of this, we extend an invitation to educational institutions and researchers involved in exam preparation and implementation. We encourage them to apply the results and sub-skills from our study in their work and to contribute to the field by conducting new validity studies and sharing their findings.

By embracing this collaborative approach, we believe that there will be substantial theoretical and practical advancements in the assessment and evaluation methodologies in teaching Turkish as a foreign language. The active use and validation of these sub-skills in various educational contexts will not only confirm their efficacy but will also enrich the academic discourse (Bachman & Palmer, 1996).

DISCUSSION AND CONCLUSION

To ensure standardization in the assessment of Turkish as a foreign language, it is imperative to establish common theoretical frameworks for assessing each skill and sub-skill. These frameworks will serve as guiding principles for institutions in determining the sections, characteristics, and item development for their exams. While these theoretical frameworks will offer a standardized assessment for language proficiency levels, they should also allow institutions the flexibility to employ their preferred methods and techniques. The standardization process should not only aim for accurate assessment but should also accommodate diverse practices by the language assessment professionals.

For a precise and standardized assessment of reading skills, it is essential to first identify the cognitive skills involved in the reading-comprehension process and establish methods for observing these skills. In this context, the reading model and the frameworks describing language levels (CEFR, ALTECDP) should be chosen and integrated to define the skills expected from test takers. In this study, Khalifa and Weir's (2009, p. 43) reading-comprehension model is recommended for assessing reading skills in Turkish as a foreign language. Implementing the reading model and the skill lists outlined in the study by Turkish Language Teaching Centers would represent a crucial step towards standardization. It is also advised that these centers conduct validity studies and share their findings, adhering to the principle of transparency in assessment. This practice will significantly contribute to long-term standardization efforts.

Implications

When designing and developing their exams, Turkish Language Teaching Centers should definitively outline the characteristics of the assessment. Organizing meetings and workshops with specific groups within the institution can aid in this process. Ensuring theory-based validity is of utmost importance when defining these characteristics. Therefore, it is imperative that language testers and item writers possess a solid understanding of language assessment theories. Institutions can facilitate the professional development of language teachers and item writers in language assessment through in-service training programs.

The utilization of sub-skill lists developed within the scope of this study will also enable the alignment of items created for the reading section of Turkish proficiency exams with the CEFR descriptors and ALTECDP competencies. Matching each item in the test with the descriptors allows for the test to be calibrated in accordance with the underlying framework. This item-descriptor mapping ensures an authentic assessment of the proficiency levels stipulated in the CEFR. Test developers should employ this mapping method to confirm that the test accurately assesses the designated level. The sub-skill lists, synchronized with descriptors/can do statements in the study, will prove invaluable to test developers in this regard. Implementing these recommendations by Turkish language teaching centers during the preparation of their proficiency exams will establish an equivalent, fair, and transparent assessment process in line with international standards.

Limitations

Since the study included the test specifications of the exam developed within the scope of the project, the experts involved in the study were limited. For this reason, the number of experts whose opinions were taken in the validity study was limited to 8.

Statements of Publication Ethics

This study complied with research ethics and data protection rules within the scope of the institution. Since the experts involved in the study also served as consultants in the project, their information was kept confidential to protect their personal data.

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1	☒	☒	☒	☐	☒	☒
Author 2	☒	☐	☒	☐	☒	☒
Author 3	☒	☒	☐	☒	☒	☒

Conflict of Interest

This study does not have any conflict of interest.

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APPENDIX

Appendix 1.

Table 5. CEFR B2 Level Reception Activities and Reception Strategies Reading Comprehension Descriptors and Sub-skills List

Alımlama Etkinlikleri		
Genel okuduğunu anlama	Okuma tarzını ve hızını farklı metin ve amaçlara uyarlayarak ve uygun başvuru kaynaklarını titizlikle seçip kullanarak büyük ölçüde bağımsız bir şekilde okuyabilir. Geniş bir aktif okuma sözcük birikimine sahiptir fakat düşük kullanım sıklığına sahip deyimlerde biraz zorluk yaşayabilir.	a) Okuma amacını belirleyebilir. b) Metin türünü fark edebilir. c) Metnin konusunu belirleyebilir. d) Metnin ana fikrini bulabilir. e) Metindeki yardımcı fikirleri bulabilir. f) Metindeki kurucu (makro) önermeleri bulabilir. g) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. h) Metindeki bilgileri ilişkilendirip bütünleştirebilir. i) Sözcüklerin, kalıp ifadelerin, deyimlerin anlamını bağlamdan hareketle belirleyebilir.
Yazışmaları okuma	İlgi alanları hakkındaki yazışmaları okuyabilir ve temel anlamını anında kavrayabilir.	a) Metnin yazım amacını belirleyebilir. b) Metnin konusunu belirleyebilir. c) Metnin ana fikrini belirleyebilir.
	Bazı yerlerinde gündelik anlatım kullanılsa bile kişisel e-posta ve ilanlarda söyleneni anlayabilir.	a) Günlük dilde ve/veya teklifsiz dilde üretilmiş metinleri, bu metinlerdeki kalıp ifadeleri anlayabilir.
	Özel yazışmalardaki argo, deyimsel ifade ve şakaları anlayabilir.	a) Hedef dildeki yerleşik kültüre özgü göndergeleri fark edebilir ve anlayabilir. b) Metnin yazarının tutumunu fark edebilir.
Fikir sahibi olmak için okuma	Hem kendi alanındaki hem de ilgili alanlardaki birçok birbiriyle paralel kaynakları (makaleler, raporlar, web siteleri, kitaplar vb.) tarayabilir ve bu kaynaklardaki belirli bölümlerin üzerinde çalıştığı görevle ilgili uygunluğunu ve yararlılığını tanımlayabilir.	a) Okuma amacını belirleyebilir. b) Metnin yüzey yapısındaki bir bilgiye ulaşmak için göz atma, tarama, gözden geçirme gibi okuma tekniklerini kullanabilir. c) Metnin yüzey yapısındaki önermeleri, tümceleri, bilgileri anlayabilir. d) Metnin yüzey yapısındaki bilgileri bulabilir ve bu bilgilerin birbiri ile ilişkilerini belirleyebilir.
	İlgili ayrıntıları bularak uzun ve karmaşık metinleri hızla tarayabilir.	a) Metnin yüzey yapısındaki bir bilgiye ulaşmak için göz atma, tarama, gözden geçirme gibi okuma tekniklerini kullanabilir. b) İstenilen bilgiyi metinde bularak yerini belirleyebilir.
	Çok çeşitli mesleki konularla ilgili haberlerin, makalelerin ve raporların içerik ve uygunluğunu, bu metinleri daha detaylı okumanın faydalı olup olmadığına karar vererek belirleyebilir.	a) Okuma amacını belirleyebilir. b) Metnin yüzey yapısındaki önermeleri ve bilgileri anlayabilir. c) Metnin yüzey yapısındaki bilgilerin birbiri ile ilişkilerini belirleyebilir.
Bilgi ve sav için okuma	Alanındaki son derece uzman kaynaklardan bilgi, fikir ve görüş alabilir.	a) Metindeki bilgileri bulabilir. b) Metinden yola çıkarak amacına uygun bilgileri belirleyip önem derecesine göre sınıflandırabilir. c) Metnin içeriği ile konu alanlarını ilişkilendirebilir.
	Söylemsel metindeki farklı yapıları (karşıt savlar, sorun-çözüm sunumu ve sebep-sonuç ilişkisi) tanıyabilir.	a) Metindeki karşılaştırmaları, karşıt görüşleri, neden-sonuç ve gerekçelendirme ilişkilerini vb. belirleyebilir.
	Terminoloji hakkındaki tahminlerini doğrulamak için zaman zaman sözlük kullanabilmesi koşuluyla alanı dışındaki bir uzmanlık alanına ait makaleleri anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin ana fikrini belirleyebilir. c) Metindeki yardımcı fikirleri belirleyebilir. d) Metindeki önermeleri bulabilir. e) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. f) Metindeki bilgileri ilişkilendirip bütünleştirebilir.
	Belirli duruş ve tutumun sergilendiği çağdaş sorunlarla ilgili makaleleri ve raporları anlayabilir.	a) Metnin yazarının tutumunu belirleyebilir. b) Metnin yüzey yapısındaki ve derin yapısındaki bilgileri ve önermeleri bulabilir.

	Bir metnin ne zaman olgusal bilgi verdiğini ve ne zaman okuyucuyu bir şeye ikna etmeye çalıştığını fark edebilir.	a) Söylem türünü (açıklayıcı, bilgilendirici, anlatısal, betimleyici vb.) belirleyebilir. b) Metnin yazarının tutumunu belirleyebilir
Yönergeleri okuma	Zor bölümleri tekrar okuyabilmesi koşuluyla koşullar ve uyarılar hakkındaki ayrıntılar da dâhil olmak üzere alanındaki uzun karmaşık yönergeleri anlayabilir.	a) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir. b) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir. c) Metindeki önermelerin öneri, uyarı ya da talimat içerip içermediğini ayırt edebilir.
Serbest zaman etkinliği olarak okuma	Büyük ölçüde bağımsız olarak, okuma tarzı ve hızını farklı metinlere (ör. dergiler, daha karmaşık olmayan romanlar, tarih kitapları, biyografiler, gezi günlükleri, rehberler, şarkı sözleri, şiirler) uyarlayarak ve uygun başvuru kaynaklarını titizlikle kullanarak kendi zevki için okuyabilir.	a) Okuma amacını belirleyebilir. b) Okuma stratejilerini belirleyebilir. c) Metin türünü belirleyebilir. d) Metnin konusunu belirleyebilir. e) Metnin ana fikrini belirleyebilir. f) Metindeki yardımcı fikirleri belirleyebilir. g) Metindeki önermeleri bulabilir. h) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir.
	Yeterli zamanı olması ve sözlük kullanabilmesi koşuluyla güçlü bir olay örgüsü olan ve karmaşık olmayan, ağdalı dil kullanmayan romanları okuyabilir.	a) Anlatısal metinlerde olayların zamansal sıralamasını belirleyebilir. b) Metindeki olayları, bu olayların birbirleri ile ilişkilerini gerekçelendirerek çözümleyebilir.
Alımlama Stratejileri		
İpuçlarını belirleme ve çıkarım yapma	Ana noktalara dikkat etme ve bağlamsal ipuçlarını kullanarak kavramayı kontrol etmek de dâhil olmak üzere kavramayı gerçekleştirmek için çeşitli stratejiler kullanabilir.	a) Metnin tutarlılığını da fark ederek metindeki bilgileri ve önermeleri kullanıp metne ilişkin çıkarımlar yapabilir.

Appendix 2.

Table 6. ALTECDP Level B2 Reading Comprehension Competencies and sub-skills List

Konu Alanı	Etkinlikler ve Bağlam/Çevre	Yeterlilikler	Kazanımlar
Sosyal ve Turistik	Etkinlik: Alışveriş Bağlam/Çevre: Mağazalar, tezgahlar, pazarlar, alışveriş merkezleri	Örneğin elektrikli tıraş makinesi gibi cihazların kullanım talimatlarını anlayabilir.	a) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir. b) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir.
Sosyal ve Turistik	Etkinlik: Finans ve posta hizmetlerini kullanma Bağlam/Çevre: Bankalar, postaneler, döviz büroları	Bir bankadan alınan çoğu rutin banka literatürünü ve yazılı iletişimi anlayabilir.	a) Metindeki kurucu (makro) önermeleri bulabilir. b) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. c) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir. d) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir. e) Metnin yazım amacını belirleyebilir. f) Metindeki bilgileri ilişkilendirip bütünleştirebilir. g) Metinden hareketle metne bağlı sonuçlara çıkarım yoluyla ulaşabilir. h) Metinden hareketle ulaştığı sonuçları değerlendirip yorumlayabilir.
Sosyal ve Turistik	Etkinlik: Bir ülkeye ulaşım, o ülkede gezme, yol tarifi verme/alma, araba kiralama Bağlam/Çevre: Havalimanı, liman, tren istasyonları/otogarlar, caddeler, garajlar vb., seyahat firmaları, kiralama firmaları	Bir araç kiralama sözleşmesinin ana noktalarını anlayabilir.	a) Metindeki kurucu (makro) önermeleri bulabilir. b) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. c) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir. d) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir. e) Metnin yazım amacını belirleyebilir. f) Metindeki bilgileri ilişkilendirip bütünleştirebilir. g) Metinden hareketle metne bağlı sonuçlara çıkarım yoluyla ulaşabilir.
Sosyal ve Turistik	Etkinlik: Acil durumlarla başa çıkma (kaza, hastalık, suç, araba arızası vb.) Bağlam/Çevre: Halka açık yerler, özel yerler, hastane, polis karakolu	Polis ifadesini okuyabilir, anlayabilir ve onaylayabilir.	a) Metindeki kurucu (makro) önermeleri bulabilir. b) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. c) Anlatısal metinlerde olayların zamansal sıralamasını belirleyebilir.
Sosyal ve Turistik	Etkinlik: Gazete, dergi vb. okumak Bağlam/Çevre: Ev, araba, kamusal alanlar vb.	Basitçe ifade edilen görüşleri anlayabilir. Bilgi için medyayı hızlıca ve iyi anlayarak okuyabilir.	a) Metnin yüzey yapısındaki bir bilgiye ulaşmak için göz atma, tarama, gözden geçirme gibi okuma tekniklerini kullanabilir. b) Metnin yüzey yapısındaki bilgilerin birbiri ile ilişkilerini belirleyebilir.
Sosyal ve Turistik	Etkinlik: Mektup, kartpostal vb. okuma ve yazma Bağlam/Çevre: Ev, evden uzakta	Konuşma dilinin kullanıldığı durumlarda bile kişisel bir mektupta söylenenleri anlayabilir.	a) Günlük dilde ve/veya teklifsiz dilde üretilmiş metinleri, bu metinlerdeki kalıp ifadeleri anlayabilir. b) Metnin yazım amacını belirleyebilir. c) Metnin konusunu belirleyebilir. d) Metnin ana fikrini belirleyebilir.
İş	Etkinlik: Faksları, mektupları, notları, e-postaları vb. anlamak ve yazmak. Bağlam/Çevre: İş yeri (ofis, fabrika vb.)	(Meslekî) Rutin mektuplarla başa çıkabilir. Rutin olmayan mektupların genel anlamını anlayabilir ve içeriğin çoğunu anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin ana fikrini belirleyebilir. c) Metnin yazım amacını belirleyebilir.
İş	Etkinlik: Raporları anlama ve yazma Bağlam/Çevre: İş yeri (ofis, fabrika vb.)	Konu tamamen tahmin edilebilir olmasa bile bir raporun genel anlamını anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin ana fikrini belirleyebilir. c) Metnin yüzey yapısındaki bilgileri bulabilir.
İş	Etkinlik: Ürün literatürü, mesleki ve ticari dergiler, reklamlar vb. kaynaklardan ilgili bilgilerin edinilmesi Bağlam/Çevre: İş yeri (ofis, fabrika vb.), ev	Kendi çalışma alanındaki çoğu gerçek ürün literatürünü anlayabilir.	a) Metnin yüzey yapısındaki bilgileri bulabilir.
İş	Etkinlik: Bildirimleri anlama (örn. Güvenlik), talimatları	Alanı dışında kalan ama kendi çalışma alanına yakın bir işle ilgili	a) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir.

	anlama ve yazma (örn. kurulum veya bakım kılavuzlar) Bağlam/Çevre: İş yeri (ofis, fabrika, vb.)	metinlerdeki talimatların niyetini anlayabilir.	b) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir. c) Metindeki önermelerin öneri, uyarı ya da talimat içerip içermediğini ayırt edebilir.
Eğitim	Etkinlik: Bilgi edinmek Bağlam/Çevre: Çalışma ortamları, kütüphane	Karşılaşabileceği çoğu görseli anlayabilir, ancak bazen metinsel açıklamalarda zorluk yaşayabilir.	a) Yazılı söylem dışındaki metinsel ögeleri (grafik, tablo, çizelge, veri değerlendirmesi vb.) çözümleyebilir.
Eğitim	Etkinlik: Bilgiye erişim (örn. bir bilgisayar veritabanından, kütüphaneden, sözlükten vb.) Bağlam/Çevre: Kütüphane, kaynak merkezi vb.	İki dilli bir sözlük kullanabilir ve somut kelimelerin ana dildeki karşılığını bulabilir. Özetlerdeki ana fikirleri takip edebilir.	b) Metnin yüzey yapısındaki bilgileri bulabilir. c) Metnin ana fikrini belirleyebilir.
Eğitim	Etkinlik: Örneğin, teslim edilmesi gereken işler için son tarihler konusunda üniversite personeli ile düzenlemeler yapmak Bağlam/Çevre: Amfi, sınıf, çalışma odası vb.	Öğretmenlerin veya öğretim görevlilerinin yazması muhtemel, öğretim için pratik düzenlemelerle ilgili tüm bilgileri okuyabilir.	a) Metnin yüzey yapısındaki bilgileri bulabilir. b) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir.

Appendix 3.

Table 7. CEFR C1 Level Reception Activities and Reception Strategies Reading Comprehension Descriptors and Sub-skills List

Alımlama Etkinlikleri		
Genel okuduğunu anlama	Zor bölümleri tekrar okuyabilmesi koşuluyla kendi uzmanlık alanıyla ilgili veya uzmanlık alanı dışında uzun ve karmaşık metinleri ayrıntılı bir şekilde anlayabilir.	a) Metnin ana fikrini belirleyebilir. b) Metindeki yardımcı fikirleri belirleyebilir. c) Metindeki kurucu (makro) önermeleri bulabilir. d) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. e) Metindeki bilgileri ilişkilendirip bütünleştirebilir. f) Sözcüklerin, kalıp ifadelerin, deyimlerin anlamını bağlamdan hareketle belirleyebilir.
	Tekrar okuma fırsatı olması ve kaynak araçlara erişebilmesi koşuluyla edebî yazılar, gazete veya dergi makaleleri ve uzmanlık alanına ait akademik ve mesleki yayımları da kapsayan çok çeşitli metinleri anlayabilir.	a) Metin türünü ve tür özelliklerini belirleyebilir. b) Söylem türünü (açıklayıcı, bilgilendirici, anlatısal, betimleyici vb.) belirleyebilir. c) Metnin konusunu belirleyebilir. d) Metnin yazım amacını belirleyebilir. e) Metindeki karşılaştırmaları, karşıt görüşleri, neden-sonuç ve gerekçelendirme ilişkilerini vb. belirleyebilir.
Yazışmaları okuma	Ara sıra sözlük kullanarak herhangi bir yazışmayı anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin yazım amacını belirleyebilir.
	Tekrar okuma fırsatı olması ve kaynak araçlara erişebilmesi koşuluyla e-posta, tartışma forumları, vloglar/ bloglar vb.de ifade edilen örtük ve açık tutumları, duyguları ve fikirleri anlayabilir.	a) Metin türünü ve tür özelliklerini belirleyebilir. b) Söylem türünü (açıklayıcı, bilgilendirici, anlatısal, betimleyici vb.) belirleyebilir. c) Metnin konusunu belirleyebilir. d) Metnin yazım amacını belirleyebilir. e) Metnin yazarının tutumunu belirleyebilir. f) Metindeki örtük bilgilere çıkarım yoluyla ulaşabilir.
	Özel yazışmalardaki argo, deyimsel ifade ve şakaları anlayabilir.	a) Hedef dildeki yerleşik kültüre özgü göndergeleri belirleyebilir.
Fikir sahibi olmak için okuma	*Tanımlayıcı yok; bk. B2* B2: Hem kendi alanındaki hem de ilgili alanlardaki birçok birbiriyle paralel kaynakları (makaleler, raporlar, web siteleri, kitaplar vb.) tarayabilir ve bu kaynaklardaki belirli bölümlerin üzerinde çalıştığı görevle ilgili uygunluğunu ve yararlılığını tanımlayabilir.	a) Okuma amacını belirleyebilir. b) Metnin yüzey yapısındaki bir bilgiye ulaşmak için göz atma, tarama, gözden geçirme gibi okuma tekniklerini kullanabilir. c) Metnin yüzey yapısındaki önermeleri ve bilgileri anlayabilir. d) Metnin yüzey yapısındaki bilgilerin birbiri ile ilişkilerini belirleyebilir.
	İlgili ayrıntıları bularak uzun ve karmaşık metinleri hızla tarayabilir.	a) Metnin yüzey yapısındaki bir bilgiye ulaşmak için göz atma, tarama, gözden geçirme gibi okuma tekniklerini kullanabilir. b) İstenilen bilgiyi metinde bularak yerini belirleyebilir.
	Çok çeşitli mesleki konularla ilgili haberlerin, makalelerin ve raporların içerik ve uygunluğunu, bu metinleri daha detaylı okumanın faydalı olup olmadığına karar vererek belirleyebilir.	a) Okuma amacını belirleyebilir.
Bilgi ve sav için okuma	Sosyal, mesleki veya akademik hayatta karşılaşılması muhtemel çok çeşitli uzun, karmaşık metinleri, tutumları ve hem ima edilen hem de açıkça belirtilen fikirleri içeren daha ince ayrıntı noktalarını belirleyerek detaylı olarak anlayabilir.	a) Metnin ana fikrini belirleyebilir. b) Metindeki yardımcı fikirleri belirleyebilir. c) Metindeki kurucu (makro) önermeleri bulabilir. d) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. e) Metindeki bilgileri ilişkilendirip bütünleştirebilir. f) Metindeki karşılaştırmaları, karşıt görüşleri, neden-sonuç ve gerekçelendirme ilişkilerini vb. belirleyebilir. g) Yazılı söylem dışındaki metinsel ögeleri (grafik, tablo, çizelge, veri değerlendirmesi) çözümleyerek önermeler ile birlikte yorumlayabilir. h) Metindeki örtük bilgilere çıkarım yoluyla ulaşabilir. i) Metnin yazarının tutumunu belirleyebilir.

Yönergeleri okuma	Zor bölümleri tekrar okuyabilmesi koşuluyla, yeni bir makine veya prosedürle ilgili uzun ve karmaşık yönergeleri, bu yönergelerin kendi uzmanlık alanlarıyla ilgili olup olmadığını detaylı bir şekilde anlayabilir.	a) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir. b) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir.
Serbest zaman etkinliği olarak okuma	Belli bölümleri yeniden okuyabilmesi ve dilerse kaynak araçlara ulaşabilmesi koşuluyla çeşitli edebî metinleri okuyabilir ve fark edip takdir edebilir.	a) Metin türünü ve tür özelliklerini belirleyebilir. b) Söylem türünü (açıklayıcı, bilgilendirici, anlatısal, betimleyici vb.) belirleyebilir. c) Metnin konusunu belirleyebilir.
	Dilin standart biçiminde veya aşina olduğu bir ağzında üretilmiş çağdaş edebî ve kurgu olmayan metinleri, biraz zorluk yaşayarak ve örtük anlam ve fikirleri fark edip takdir ederek okuyabilir.	a) Metin türünü ve tür özelliklerini belirleyebilir. b) Söylem türünü (açıklayıcı, bilgilendirici, anlatısal, betimleyici vb.) belirleyebilir. c) Metnin konusunu belirleyebilir. d) Metnin ana fikrini belirleyebilir. e) Metindeki yardımcı fikirleri belirleyebilir. f) Metindeki kurucu (makro) önermeleri bulabilir. g) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. h) Metindeki bilgileri önem derecesine göre sıralayabilir. i) Metindeki bilgileri ilişkilendirip bütünleştirebilir. j) Sözcüklerin, kalıp ifadelerin, deyimlerin anlamını bağlamdan hareketle belirleyebilir.
Alımlama Stratejileri		
İpuçlarını belirleme ve çıkarım yapma	Tutum, ruh hâli ve amaçlar konusunda çıkarım yapmak ve daha sonra ne geleceğini tahmin etmek için bağlamsal, dil bilgisel ve sözcüksel ipuçlarını kullanma konusunda beceri sahibidir.	a) Metnin yazarının tutumunu belirleyebilir. b) Metindeki tutarlılık ve bağdaşıklık ögelerini saptayabilir. c) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. d) Tutarlılık, bağdaşıklık ve önermeler arası ilişkilerden hareketle metindeki eksik bilgileri tamamlayabilir. e) Tutarlılık, bağdaşıklık ve önermeler arası ilişkilerden hareketle metnin devamını tahmin edebilir. f) Metindeki örtük bilgilere çıkarım yoluyla ulaşabilir.

Appendix 4.

Table 8. ALTECDP C1 Level Reading Comprehension Competencies and Sub-skills List

Konu Alanı	Etkinlikler ve Bağlam/Çevre	Yeterlilikler	Kazanımlar
Sosyal ve Turistik	Etkinlik: Geçici konaklama için kiralama eylemleri Bağlam/Çevre: Emlakçılar, ev sahipleri ile görüşmeler	Konaklama reklamları ile ilgilenebilir ve kullanılan kısaltma ve terimlerin çoğunu anlayabilir.	a) Sözcüklerin, kalıp ifadelerin, deyimlerin anlamını bağlamdan hareketle belirleyebilir. b) Metnin yüzey yapısındaki bir bilgiye ulaşmak için göz atma, tarama, gözden geçirme gibi okuma tekniklerini kullanabilir.
Sosyal ve Turistik	Etkinlik: Gazete, dergi vb. okumak Bağlam/Çevre: Ev, araba, kamusal alanlar vb.	Ölçünlü dilde ve resmi bir dille yazılan gazetelerde ifade edilen karmaşık görüşleri/argümanları anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin ana fikrini belirleyebilir. c) Metindeki yardımcı fikirleri belirleyebilir. d) Metindeki kurucu (makro) önermeleri bulabilir. e) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. f) Metindeki bilgileri ilişkilendirip bütünleştirebilir. g) Metindeki karşıt görüşleri saptayıp kendi dünya bilgisi ile yorumlayabilir.
İş	Etkinlik: Faksları, mektupları, notları, e-postaları vb. anlamak ve yazmak. Bağlam/Çevre: İş yeri (ofis, fabrika vb.)	Ölçünlü olmayan bir dilde ifade edilen yazışmaları anlayabilir.	a) Günlük dilde ve/veya teklifsiz dilde üretilmiş metinleri, bu metinlerdeki kalıp ifadeleri anlayabilir. b) Sözcüklerin, kalıp ifadelerin, deyimlerin anlamını bağlamdan hareketle belirleyebilir.
İş	Etkinlik: Raporları anlama ve yazma Bağlam/Çevre: İşyeri (ofis, fabrika vb.)	Karşılaşabileceği çoğu raporu oldukça kısa bir süre içinde anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin yazım amacını belirleyebilir. c) Metnin ana fikrini belirleyebilir. d) Metindeki yardımcı fikirleri belirleyebilir. e) Metindeki kurucu (makro) önermeleri bulabilir. f) Metindeki önermelerin birbiri ile ilişkisini çözümleyebilir. g) Metindeki bilgileri ilişkilendirip bütünleştirebilir. h) Metindeki karşılaştırmaları, karşıt görüşleri, neden-sonuç ve gerekçelendirme ilişkilerini vb. belirleyebilir. i) Yazılı söylem dışındaki metinsel ögeleri (grafik, tablo, çizelge, veri değerlendirmesi, istatistiksel veriler) çözümleyerek metindeki önermeler ile birlikte yorumlayabilir.
İş	Etkinlik: Ürün literatürü, mesleki ve ticari dergiler, reklamlar vb. kaynaklardan ilgili bilgilerin edinilmesi Bağlam/Çevre: İşyeri (ofis, fabrika vb.), Ev	Ciddi bir yanlış anlama olmaksızın karmaşık makalelerin en azından genel anlamını anlayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin ana fikrini belirleyebilir. c) Metindeki yardımcı fikirleri belirleyebilir.
İş	Etkinlik: Bildirimleri anlama (örn. Güvenlik), talimatları anlama ve yazma (örn. kurulum veya bakım kılavuzları) Bağlam/Çevre: İşyeri (ofis, fabrika vb.)	Ayrıntılı uyarılar, tavsiyeler, koşullar vb. veren talimatları anlayabilir.	a) Metindeki bilgilerin yanı sıra yönergeleri saptayabilir. b) Bağlamdan hareketle metindeki beklentileri, istekleri ve görevleri saptayabilir. c) Metindeki önermelerin öneri, uyarı ya da talimat içerip içermediğini ayırt edebilir.
Eğitim	Etkinlik: Bilgi edinmek Bağlam/Çevre: Çalışma ortamları, kütüphane	Kendi uzmanlık alanındaki çoğu ders kitabı, makale vb. ile başa çıkabilir. İlgili bilgiler için metinleri tarayabilir ve metnin ana konusunu kavrayabilir.	a) Metnin konusunu belirleyebilir. b) Metnin ana fikrini belirleyebilir. c) Metindeki yardımcı fikirleri belirleyebilir.
Eğitim	Etkinlik: Bilgiye erişim (örn. bir bilgisayar veritabanından, kütüphaneden, sözlükten vb.) Bağlam/Çevre: Kütüphane, kaynak merkezi vb.	Kendi çalışma alanındaki çoğu ders kitabı ve makalenin uygunluğunu değerlendirebilir. Kendi çalışma alanındaki veya ilgili çalışma alanlarındaki makaleleri, ders kitaplarını vb. orta hızda tarayarak uygunluklarına / yararlılıklarına ilişkin güvenilir yargılar oluşturabilir.	a) Metindeki bilgileri kendi dünya bilgisi ile birleştirip yorumlayarak önermelere ulaşabilir. b) Metnin içeriği ile konu alanlarını ilişkilendirebilir.

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Evaluating the Psychometric Characteristics of Generated Visual Reading Comprehension Items

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Abstract

Reading comprehension, a crucial skill in today's information-rich environment, extends beyond text to include visual elements. Manual creation of visual reading comprehension items poses challenges, necessitating an innovative approach. This situation has led to the exploration of Automatic Item Generation (AIG) as a solution. This study aims to demonstrate the use of AIG for the creation of visual reading comprehension items. By developing cognitive and item models through expert input and utilizing computer algorithms for item generation, the study seeks to provide a time-efficient and reliable alternative for item writers. The field test involved 1,380 8th-grade students to evaluate the psychometric properties of the generated visual reading comprehension items. The AIG process starts with expert insights to develop cognitive and item models. Computer algorithms are then employed for AIG. The study utilizes a diverse sample of 8th-grade students for field testing, assessing the psychometric properties of the generated items. Field test results indicate the potential of AIG in efficiently producing a substantial item pool for visual reading comprehension. The generated items exhibit consistent difficulty levels (0.58 to 0.66), ensuring an appropriate challenge for students. High item discrimination (0.48 to 0.69) effectively distinguishes between students with varying visual reading comprehension skills. Item-total correlations (0.40 to 0.57) further validate the quality and validity of the generated items. The automated process yields efficient results in terms of item difficulty and discrimination, emphasizing the potential of AIG for high-quality assessment of visual reading comprehension items.

Keywords: Visual reading comprehension, automatic item generation, high-stake tests, parallel test.

Otomatik Üretilen Görsel Okuduğunu Anlama Maddelerinin Psikometrik Özelliklerinin Değerlendirilmesi

Öz

Günümüz bilgi dünyasında diğer becerilere ve disiplinlere de temel oluşturan okuduğunu anlama, metnin ötesine geçerek görsel unsurları da kapsamaktadır bu nedenle de ölçülmesi önemli görülmektedir. Görsel okuma maddelerinin oluşturulma süreci ise geleneksel yaklaşımla manuel bir şekilde yürütülmekte, görseller üzerinde müdahaleler kısıtlı olmakta ya da he bir tablo, grafik, diyagram madde yazarları tarafından manuel oluşturulmaktadır. Bu da zaman alıcı, yoğun çaba gerektiren bir sürece işaret etmektedir. Bu durumla başa çıkmak için bilgisayar teknolojisindeki yenilikleri kullanan bir yöntem olan Otomatik Madde Üretimi (OMÜ) yöntemi geliştirilmiştir. Bu çalışma, görsel okuduğunu anlama maddelerinin oluşturulması için OMÜ'nün nasıl kullanılacağını göstermeyi amaçlamaktadır. Model tabanlı OMÜ'ye göre gerçekleştirilen işlemlerde öncelikle uzmanlar bilişsel ve madde modelleri geliştirmiş, ardından madde üretimi için bilgisayar algoritmaları kullanılmıştır. Eş değer maddelerin üretiminin amaçlandığı bu çalışma madde yazarları için zaman açısından verimli ve güvenilir bir alternatif sağlamayı amaçlamaktadır. Üretilen görsel okuduğunu anlama maddelerinin psikometrik özelliklerini değerlendirmek için 8. sınıfta öğrenim gören 1.380 öğrenci ile ön uygulama çalışması gerçekleştirilmiştir. Araştırma sonucunda madde güçlük seviyelerinin (0,58 ila 0,66) benzer özellikler gösterdiği belirlenmiştir. Yüksek madde ayırt ediciliği (0,48 ila 0,69), farklı görsel okuduğunu anlama becerilerine sahip öğrenciler arasında etkili bir ayrım yapmaktadır. Madde-toplam korelasyonları (0,40 ila 0,57), oluşturulan maddelerin kalitesini ve geçerliliğini ek bir kanıt sunmaktadır. Bu çalışmada gerçekleştirilen otomatikleştirilmiş süreç, madde güçlüğü ve ayırt edicilik açısından verimli sonuçlar vermekte ve OMÜ'nün görsel okuduğunu anlama maddelerinin yüksek kalitede değerlendirilmesine yönelik potansiyelini vurgulamaktadır.

Anahtar kelimeler: Görsel okuduğunu anlama, otomatik madde üretimi, yüksek riskli testler, eş değer test

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INTRODUCTION

Reading comprehension items directly measures an individuals' ability to understand and interpret texts. These items require individuals to grasp the main idea, make inferences, draw conclusions (Fielding & Pearson, 1994; Woolley & Woolley, 2011), and engage in critical evaluation of the text, including identifying supporting evidence, analyzing the purpose and point of view, and making connections to other texts and real-life situations (Aloqaili, 2012; Brevik, 2019; Hosseini et al., 2012). Students are presented with reading comprehension items to provide data on students' curricular achievements and various aspects of their development. The results obtained from the process help to identify individual differences and learning difficulties among students and allow educators to provide targeted support and intervention. These interventions may encompass areas such as vocabulary development, inferencing skills, and understanding text structure (Chandran & Shah, 2019; Cornoldi & Oakhill, 2013; Klingner et al., 2015; Westwood, 2016). Moreover, reading comprehension is a fundamental skill for all disciplines, beyond academia, and is also crucial for professional contexts and the development of daily life skills, where individuals encounter complex multimodal texts on social media and other platforms (Barnes, 2015; Boonen et al., 2016; Kinniburgh & Shaw, 2009; Oliver, 2009; Österholm, 2006; OECD, 2021).

The development of comprehension skills involves a combination of language and cognitive abilities, ranging from literal understanding of explicit information to inferential and evaluative comprehension, which requires inference and critical analysis, respectively (Basaraba et al., 2013). Although these skills are listed hierarchically, they are interconnected. For example, lower-level language skills such as vocabulary and grammar are important for developing higher-level comprehension skills (Silva and Cain, 2015), and oral language skills and higher-level cognitive skills form the basis for improving listening and learning, reading comprehension, and managing complex texts (Lervåg et al., 2017; Eason et al., 2012). Research also distinguishes between literal and inferential comprehension; states that skilled comprehenders are successful in inferential tasks (Duncan et al., 2015) and recognizes digital stories as tools to improve comprehension at different levels (Al-Hameed and Al-Shuair, 2019). In this regard, the elements developed for reading comprehension need to change according to the feature they aim to measure. In the context of PIRLS, fourth-grade readers are evaluated based on their ability to focus on and retrieve explicitly stated information, make straightforward inferences, interpret and integrate ideas and information, and evaluate and critique content and textual elements. This framework posits four distinct levels of comprehension assessment. Similarly, the PISA framework elaborates on the comprehension process by delineating it into several cognitive processes: locating information, accessing and retrieving information within a text, searching and selecting relevant text, reading fluently, understanding (which encompasses representing literal meaning and integrating and generating inferences), and evaluating and reflecting (which includes assessing the quality and credibility of the text, reflecting on content and form, and detecting and handling conflicts). These categorizations exemplify the nuanced approaches to measuring reading comprehension, underscoring the multifaceted nature of understanding textual material in educational assessments. This research aimed to generate visual reading comprehension items required by inferential cognitive processes.

In today's information-rich society, reading comprehension items extend beyond written text and involve visual texts, which are combinations of textual information and visuals (Li et al., 2019; Woolley & Woolley, 2011). Visual texts, which are increasingly prevalent in our daily lives, also play a crucial role in reading comprehension assessments such as SAT, TOEFL, PISA, and PIRLS. These assessments specifically measure students' ability to make inferences, conclude, and critically analyze the relationship between textual and visual information, thereby assessing higher-level skills (Cahalan et al., 2002; Cohen & Upton, 2006; Unsworth, 2014; Mullis et al., 2017; OECD, 2019). Additionally, well-constructed visual texts with captivating visual stimuli enhance students' motivation for exams (Glenberg & Langston, 1992; Hoyt, 1992). However, creating visual texts and writing visual reading comprehension items can be challenging and time-consuming compared to other item types (Author, 2023).

Visual texts demand effective integration of visual elements with accompanying text, including selecting appropriate visuals that align with the content and purpose of the item. Balancing textual and visual components coherently and meaningfully can be more complex than writing text-only items (Daly & Unsworth, 2011; Sabatini et al., 2014). The images used in visual texts must accurately represent the information presented in the text be clear, appealing, and effectively convey the intended message. Additionally, factors such as layout, design, and readability of visuals should align with the objectives of the item and support comprehension for the target audience (Hoyt, 1992). Furthermore, the integration of visual and auditory elements has become a compelling feature of computer-based tests, making them highly appealing and widely used in modern educational settings.

As a result, computer-based testing is shown to be an effective method for assessing students' visual reading comprehension skills.

Computer-based tests offer flexible testing options and rapid score calculation, benefiting educators and students alike (Chen et al., 2019; Gierl et al., 2021). This flexibility is particularly advantageous in classroom practice, where traditional paper-and-pencil exams can be time-consuming to score due to large class sizes and other responsibilities (Chen et al., 2019). It provides swift feedback, allowing teachers to identify individual learning needs promptly and facilitate targeted support (Weber et al., 2003). Moreover, the use of multimedia elements, such as photos and videos, in electronic tests enhances assessment opportunities and supports diverse item types (Gierl et al., 2021; Kosh et al., 2019). However, digital assessments or computer-based tests also face challenges, particularly in the context of distance education (Arrend, 2007). Security concerns and the need to create a substantial item pool are noteworthy issues. To prevent the disclosure of items before exams, synchronous test administrations have been adopted, but this approach sacrifices the flexibility that computer-based tests can offer (ÖSYM, 2020). Furthermore, the practice effect, where repeated test performance influences scores, can compromise the validity and reliability of measurement (Hausknecht et al., 2007). To ensure diverse items for in-class follow-up tests and personalized assessments, a substantial item pool with established psychometric properties is essential (Hausknecht et al., 2007). For that, creating an item pool with scalable difficulty is crucial, and it applies not only to the textual components but also to visuals in visual reading comprehension items. Ensuring that visuals are adaptable to difficulty levels adds flexibility to computer-based tests, allowing students to take the test at different times and locations, such as over three days. However, it's worth knowing that this process is challenging and resource intensive. To address this challenge, the field of AIG has emerged, combining computer technology with cognitive and psychometric theories (Arendasy & Sommer, 2012; Embretson & Yang, 2006; Gierl & Haladyna, 2012b).

Automatic item generation

Automatic item generation (AIG) is the process of automatically generating tests, exams, or items for educational and assessment purposes. It leverages cognitive and psychometric theories along with computer technology to produce high-quality items efficiently (Embretson & Yang, 2006; Gierl et al., 2019; Gierl & Lai, 2018; Gierl et al., 2012; Irvine & Kyllonen, 2013). AIG aims to continuously generate and diversify new items to assess student's various abilities and learning styles. It ensures items meet assessment criteria such as objectivity, reliability, and validity (Gierl & Haladyna, 2012a). AIG enables the creation of item pools for individual-specific tests, facilitates adaptation to updated curricula and learning objectives, and saves time and costs compared to traditional item writing processes (Gierl et al., 2019; Kosh et al., 2019).

AIG involves two main methods: artificial intelligence and templated-based approaches. The present study employs the templated-based AIG, which consists of three stages: developing the cognitive model, creating the item model, and automatically generating items using computer technology. This framework was similarly applied in the generation process of visual reading items. Given that visual texts are comprised of images analogous to how traditional texts are composed of words, the methodology was adapted to define visual elements within these texts with the same rigour and systematic process used for word-based texts. Specifically, the visual elements were identified and characterized following a structured approach, ensuring that the generated items aligned with the cognitive and item models initially developed. This adaptation underscores the flexibility and applicability of the template-based AIG method in addressing both textual and visual information, thereby facilitating the generation of comprehensive assessment items that accurately evaluate reading comprehension across different modalities. In the first stage, subject matter experts define the content required to generate new items, forming the cognitive model that encompasses the knowledge, skills, and abilities necessary to solve problems. In the second stage, item models are created as templates for the assessment tasks, specifying the parts of the items that should be modified to generate new items. In the final stage, the content from the first step is inserted into the template described in the second step using computer-based algorithms. The final stage involves combining the content from the cognitive model with specific parts of the item model according to predefined rules and restrictions established by subject experts. This process enables quick and AIG. Following these stages, AIG can be applied in various disciplines such as medicine, dentistry, mathematics, and literature (Adji et al., 2018; Embretson & Kingston, 2018; Falcão et al., 2022; Gierl & Lai, 2012; Lai, Gierl, Byrne, et al., 2016; Author, 2023).

AIG has demonstrated successful results in verbal fields, including reading comprehension items, by generating a wide range of items with various types, formats, and difficulty levels (Holling et al., 2009; Setiawan et al., 2022; Shin & Gierl, 2022). These items can effectively integrate textual information with images, graphics, or other visual elements. AIG allows customization of reading comprehension assessments based on individual

student characteristics and performance (Shin & Gierl, 2022). It dynamically adjusts the level of difficulty or item type presented to each student, providing a personalized and engaging assessment experience. AIG can also provide feedback and personalized learning support based on students' responses, promoting self-learning, and helping students identify their strengths and weaknesses in reading comprehension items (Author, 2023). However, using automatic item creation for visual reading comprehension items presents two main challenges (Shin & Gierl, 2022). First, visual item responsiveness requires a simultaneous understanding of both visual content and natural language elements within an image. Additionally, effectively modelling the interactions between visual and textual elements in the generation of visual reading comprehension items can be challenging (Li et al., 2019). In this research, a model has been designed to overcome these challenges, and data-based evidence has been obtained.

The Present Study

Visual reading comprehension extends beyond traditional written text and involves the interpretation of visual elements in combination with textual information. As a result, visual texts are increasingly prevalent in various assessments, such as SAT, TOEFL, PISA, and PIRLS, aiming to evaluate higher-order cognitive skills. However, the creation of effective visual reading comprehension items poses significant challenges, and the process can be time-consuming compared to text-only items. To address the need for creating items with scalable difficulty, this study aims to use visual reading comprehension assessment through AIG (AIG). Leveraging cognitive and psychometric theories, AIG combines computer technology to efficiently generate high-quality and scalable items. By developing a cognitive model and item model for verbal and visual text, it was generated a vast array of visual reading comprehension items using Python codes. The items underwent testing through field trials, assessing their difficulty and discrimination levels. The findings demonstrated the potential of AIG as a reliable and innovative approach to creating diverse, engaging, and valid visual reading comprehension items. As technological advancements continue to shape the educational landscape, it is considered that AIG emerges as a powerful tool to elevate the quality and efficiency of visual reading comprehension assessments, ultimately benefitting learners across diverse educational settings.

In shortly, this study aims to automatically generate visual reading comprehension items and examine their psychometric properties. The research intends to provide item writers with an alternative method to address their difficulties when writing visual reading comprehension items (Setiawan et al., 2022; Shin, 2021). The study encompasses (i) the development of an AIG model, (ii) the generation of items with similar item difficulties, (iii) the creation of a large item pool, and (iv) the examination of the psychometric properties of the items.

METHOD

Research Design

This study was designed as descriptive survey research to automatically generate visual reading comprehension test items and to examine their psychometric properties.

Participants

The research was conducted in the 2023-2024 academic year, with 1,380 students attending the 8th grade at a private educational institution in Türkiye. The age range of the students was between 13 and 14 years, and their native language is Turkish. The field test of 5 items randomly selected from the generated items was carried out in the screening test applied to these 8th-grade students by a private institution.Within the scope of the LGS screening test, five booklets have been prepared for participants. A visually based reading comprehension question, developed specifically for this research, has been incorporated into the 19th question of each booklet. The administration of the test has been conducted in a computer-based format. Students are afforded the opportunity to complete the test between Monday and Wednesday, thereby providing flexibility in terms of both location and time.

Data Collection

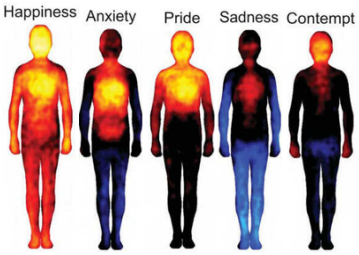
In the current study, visual reading comprehension items in the high school entrance exam (known as LGS), which is a high-risk test in Türkiye, were determined as parent items to generate items. This item's objective of the 8th-grade Turkish curriculum is "Establishes a relationship between visual elements and what they read the text". The items aimed for students to "conclude by evaluating visual and written text together." To achieve this goal, first, the five criteria to be included in an item are defined: (i) evaluating visual and verbal text together, (ii) organizing the options to be verbal or visual text, (iii) being scientifically accurate, (iv) engaging and intriguing,

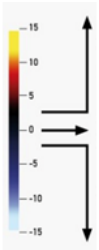
(v) establishing a relationship with daily life. Since this study aimed to generate items of similar difficulty, the semantic or proposal variable, which directly affects the item's difficulty, was added to the sixth criterion, (vi) establishing content on the same topic and main idea for both verbal and visual text. After determining the criteria for the features of the items to be produced, the generated process started. The visual reading comprehension items in this study were constructed using AIG following a three-stage process. In the first stage, a cognitive model was developed. As seen in Figure 1, the item body consists of verbal text, visual text, and a diagram. Also, idioms were used in the options as a verbal text for establishing a relationship with daily life. In this process, which was determined according to expert opinion, the cognitive model was created by listing the information sources, features, and elements for each part of the stem and the options. These variables were placed in the item model development by the experts in the second stage. In the third stage, the information in the cognitive model was placed into the item model and the items were automatically generated with computer algorithms using Python codes.

In this study, generation was performed by taking a parent item written by the researcher as a reference. As seen in Table 1, the parent item contains verbal text and two different visual texts. Since the second visual text is not generated, it is called a diagram.

Table 1. Parent item

Embarking on a captivating journey, the compelling "Bodily Maps of Emotions" study rallied more than 700 individuals from Finland, Sweden, and Taiwan, aged between 18 to 45, into a fascinating exploration. This research voyage set out to plumb the depths of emotionally charged materials and their profound ramifications on the human psyche. Participants were treated to an array of captivating stimuli, a medley encompassing words, videos, facial expressions, and stories, prompting them to introspect and identify the distinct regions of their bodies that experienced heightened arousal or, conversely, exhibited indifference. Leveraging cutting-edge computer technology (detectors), the researchers adroitly recorded the participants' bodily reactions, skilfully interwoven with their candid self-reported responses. Amidst diverse cultural backgrounds, the study yielded an enthralling revelation, unveiling strikingly similar body sensory maps among the participants. A part of the body sensation map is shown below and a comment on the interpretation of colours has been added:





From black to warm colors→ 0-15 indicated by	It expresses an increased sensation in the body. For example, after encountering material that expresses an emotion, a person's pulse rate increases and the reaction increases in certain parts of the body.
Black→ denoted by 0.	It refers to the body's normal course of sensation. For example, there is no change in a person's pulse rate when they encounter any material that expresses emotion. The body response remains the same.
Black to cool colors from → 0 indicated by -15	It expresses a decrease in sensation in the body. For example, after encountering any emotionally expressive material, the pulse rate drops and the reaction in certain parts of the body decreases.

Which of the sentences below aligns with the findings of the "Bodily Maps of Emotions"?

A) He always said that when he felt excessively contemptuous of someone, it gave him a stomachache.

B) After receiving the accident news, my feet were eager to run away from there due to the sadness.

C) Happiness is like butterflies dancing in my stomach, bringing joy to every corner of my being. *

D) When I saw my son on the television screen, I was filled with pride from head to foot toe.

In this study, as it is seen in the patent item the item generation process encompassed both verbal and visual texts within the stem, with each being generated accordingly. Additionally, a diagram incorporating both visual and verbal elements (constituting a second visual text) was created. Unlike the verbal and primary visual texts, this diagram was not generated but manually crafted. The variables from both text types were translated into a cognitive model, which informed the development of the item model. Subsequently, algorithms for generating items were devised. Furthermore, the research extended to the generation of answer choices, incorporating idiomatic expressions relevant to the context presented in the stem. The use of contextually appropriate idioms represented advanced reading comprehension skills. Following the identification of necessary features for generating plausible distractors, the generation process was executed using Python. This approach underscores the integration of computational methods with cognitive and linguistic theories to facilitate the automated generation of complex assessment items, thereby advancing the generating for evaluating comprehensive reading comprehension skills.

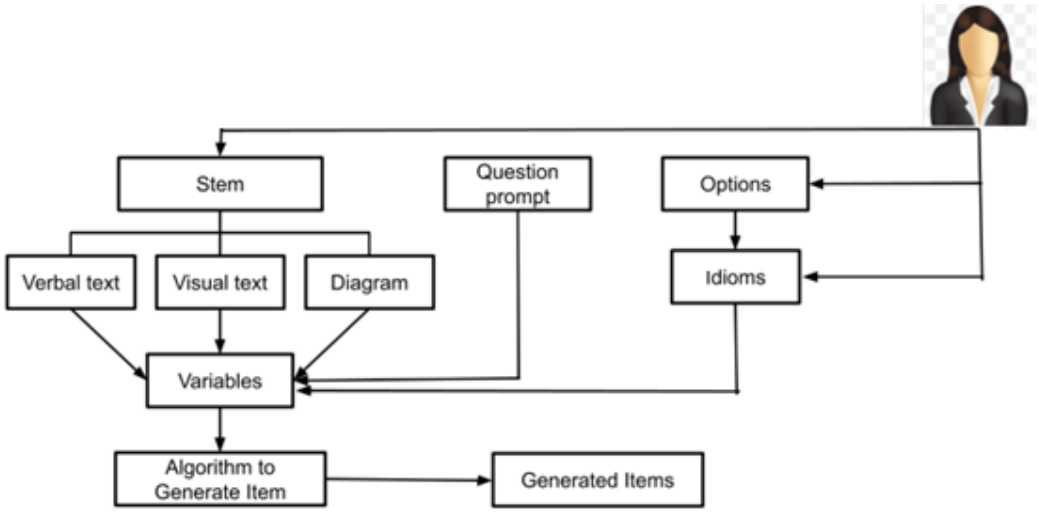


Figure 1. AIG Process

Development cognitive model

In this study, a text with a combination of text and visuals was designed to measure the acquisition of "Establishes a relationship between visual elements and what they read". In this way, the main purpose of the generated items is to interpret and integrate ideas and information. For the automatically generated items to be of similar difficulty, the item's topic and main idea features, which can be called semantic or purposive, were kept constant. As it is seen in the parent item, the focal point of this research is the exploration of bodily maps of emotions, as featured in the parent item stem. Bodily maps of emotions delineate the specific topographical distribution of bodily sensations that correspond to various emotional states. These representations have been empirically validated across diverse cultures, offering a universally consistent framework that underpins discrete emotional experiences (Nummenmaa et al., 2013; Goldstein et al., 2020). Studies, including those conducted by Hietanen et al. (2016), have elucidated those basic emotions—namely anger, fear, disgust, happiness, sadness, and surprise—are each linked to unique patterns of bodily sensations. This specificity in the bodily changes associated with distinct emotions suggests that these topographical representations are critical in differentiating between emotional states, thereby serving as an essential component of emotional experience (Goldstein et al., 2020). In essence, the study of bodily maps of emotions was selected for the item because there is a relationship between somatic sensations and emotional processes, presenting an interesting subject for students.

Following the determination of the subject matter, the stages of developing the cognitive model have defined the cognitive processes applicable for visual reading comprehension items: focusing on and retrieving explicitly stated information, making straightforward inferences, interpreting and integrating ideas and information, and evaluating and critiquing content and textural elements. The objective of this study was to develop parallel forms by generating isomorphic items, thereby maintaining consistency in the topic and cognitive load. The subject matter focused on the bodily maps of emotions, with cognitive processing occurring at the level of interpreting and integrating ideas and information. Upon deciding the scenario for the cognitive model, the next phase involved identifying features and elements. For the verbal text's introduction (feature), information related to the purpose of the research and its participants (elements) was specified, in the development (feature) phase, the method and form (elements) were outlined, and for the conclusion (feature), details regarding the outcomes of the research (element) were defined. To achieve items of equivalent difficulty, elements were constrained. In the second phase of developing the cognitive model, the same processes applied to the visual text. As observed in the parent item, based on the research outcomes, five body shapes were identified. These shapes were categorized into increased sensation (feature) represented by warm colors (elements), decreased sensation (feature) indicated by cool colors (elements), and mixed sensation (feature) depicted using both warm and cool colors (elements). During the visual constraints process, emotions (elements) were identified in alignment with the bodily maps presented in the research, reflecting real-world knowledge encountered in everyday life. Since no visual was produced to explain the color tones within the scope of the research, this was expressed through a diagram. Options were also generated in the research; these options articulated the body-emotion relationship through idioms, with body parts determined as elements for the features. Following the development of the cognitive model, the study progressed to the phase of developing the item model. The developed cognitive model is shown in Figure 2.

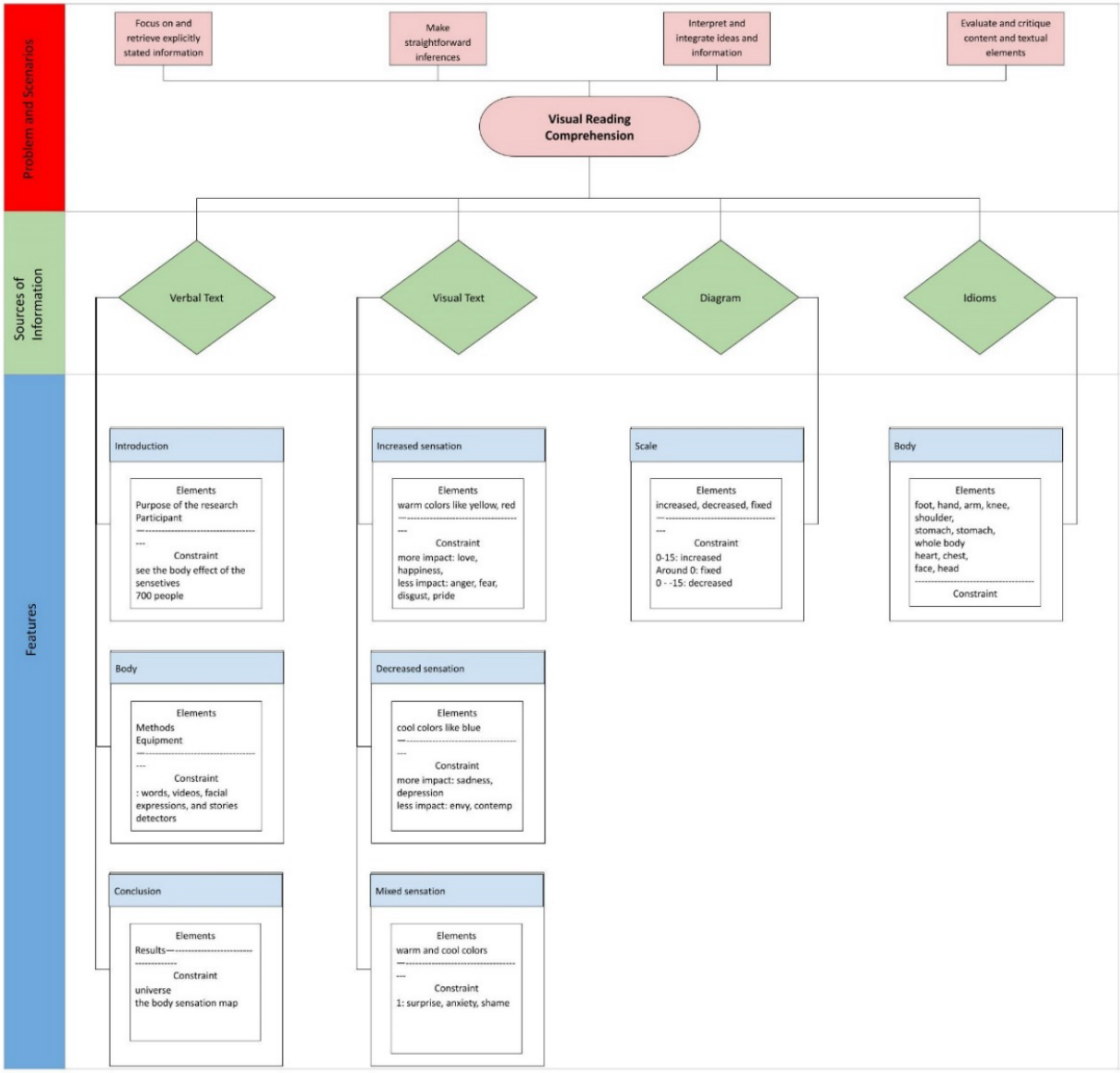


Figure 2. Cognitive Model

Development item model

In the second stage, the item model, which is the item format, was developed and shown in Table 1. As seen in Table 1, the item stem starts with a text. The introduction, development, and conclusion sections in the text were generated and rephrased using the possibilities of the language. In the research, results related to 13 emotions were included (Nummenmaa et al., 2014). Since it was carried to a multiple-choice item, 5 of these emotions were selected in line with the cognitive model. The selection criteria are shown in the item model. Finally, there is a diagram in the item stem. The options include idioms or words expressing emotion, which are commonly used in Turkish.

Table 1. Item Model

Stem	Verbal Text: Body sensation map <Introduction of the research>. Within the scope of research <methods>. The result of the research <result>.
	Visual text: Some emotions of the body sensation map created as a result of the research is shown in the figure below: <Increased1> <Increased2> <Decrased1> <Decrased2> <Mixed>
	Diagram: The colors on this map are interpreted as follows: <Scale>.
Element	*Introduction of the research:* Purpose of the research (see the body effect of the emotions),

participants (700 people) *Methods:* words, videos, facial expressions, and stories detectors *Result:* the sensation universe map Emotions: *Increased1:* love, happiness *Increased2:* anger, fear, disgust, pride *Decrased1:* sadness, depression *Decrased2:* envy, contempt *Mixed:* surprise, anxiety, shame *Part of the body:* foot, hand, arm, knee, shoulder, stomach, whole body, heart, chest, face, head.

Question prompt	In which of the following sentences does the situation expressed correspond to the results of the "body sensation map"?

Options	Idioms including <part of the body> about an <emotions>.

Data Analysis

Item difficulty, discrimination, and point biserial of the pre-applied items were estimated based on the Classical Test Theory (CTT). Since it was requested to prepare items of similar difficulty within the scope of this research, first, the item difficulty index was estimated. Item difficulty refers to the difficulty level of an item in a test or measurement tool. It usually reflects the mental or cognitive skill level required to answer the item correctly (Adedoyin et al., 2008). The item discrimination index is a statistical measure of how effectively a test item discriminates between high and low-performing test takers (Aiken, 1979). A high item discrimination index indicates that the item discriminates more clearly between performance levels, while a low index value makes the item poor at discriminating. This index is used to assess the reliability and effectiveness of the test and is usually calculated by statistical methods such as biserial correlations. Items with high item-total correlations have higher discrimination, while low correlations indicate low discrimination (Brenner, 1964). In this study, based on the data, both the item difficulties and the item discriminations were calculated to determine the level of achievement of the objective. In this study, Python was employed for item development and analysis, particularly in the item generation process, due to its robust computational capabilities and extensive library support. Python's wide array of libraries, such as NumPy for numerical computations, pandas for data manipulation, and SciPy for scientific computing, enables efficient handling and analysis of complex datasets. This facilitates the estimation of item characteristics like difficulty and discrimination indices with precision, adhering to the principles of Classical Test Theory (CTT). Moreover, Python's versatility and ease of integration with statistical packages allow for the implementation of algorithms that can automate the generation of test items while ensuring they meet specified criteria for difficulty and discrimination. This automation not only streamlines the item generation process but also enhances the reliability and validity of the items by applying consistent criteria across all items. The use of Python thus significantly contributes to the methodological rigor of the research, enabling the creation of well-calibrated assessment tools that accurately measure the constructs of interest.

Research Ethics

The ethics committee approval for research was obtained after the decision given by the Gazi University Ethics Committee on 23.05.2023 with the document number E-77082166-604.01.02-665657.

FINDINGS

In this research, the item generation process involved the creation of both verbal and visual texts, along with a manually crafted diagram that merged these elements, serving as a secondary visual text. This integrative approach led to the development of a cognitive model that guided the formulation of the item model and the subsequent algorithmic generation of items. The study further expanded to include the generation of answer choices, with a specific emphasis on the use of contextually relevant idioms to assess advanced reading comprehension abilities. The key features were identified for the creation of effective distractors. In this regard, firstly the generate process is mentioned, and then the evaluation results based on the field test results are included.

Generation Process

The initial step in the process was the selection of the subject matter, which in this case, was the bodily maps of emotions. This thematic focus provided a foundation for the cognitive processes to be explored and represented in the item generation. Following the selection of the subject matter, the study outlined the cognitive processes relevant to visual reading comprehension. Interpreting and integrating ideas and information: Synthesizing various pieces of information to form a coherent understanding. The aim was to develop parallel forms of items, known as isomorphic items, to ensure consistency in both topic and cognitive load across the generated items. Upon establishing the cognitive model, the next phase entailed deciding on the scenario to be covered by the items and identifying specific source of information, features and elements. The generation process is elaborated in three stages: verbal text, visual text, and options generation.

Verbal text generation

As is seen in the cognitive model, the verbal text consists of an introduction, development, and conclusion. The introduction includes information about the purpose of the study and the participants. The development section contains information about the methodology and the process of the study. The conclusion section contains the results of the study. To ensure that the generated items had similar item difficulty, the elements within each part (introduction, development, conclusion) were constrained. These determined elements were placed in the item model. By leveraging the capabilities of language, texts with coherent and fluent introduction, development, and conclusion sections can be generated, each containing information pertinent to the research topic's objective, participants, methodology, and outcomes. As texts are generated in alignment with the cognitive model and item model, the information and flow within the texts exhibit similarities. Here, the same information is presented in different contexts by utilizing the possibilities of language, thereby facilitating the achievement of similar item difficulty. Consequently, the developed items can be used in individually tailored booklets or administered to different students in simultaneously conducted exams. The generated verbal text is displayed in the table, and an examination of the table reveals that both generated texts share similar content. The first production contains 138 words, while the second has 144 words.

The sample verbal text generated is shown in Table 2.

Table 2. Sample Generated Verbal Texts of the Stem

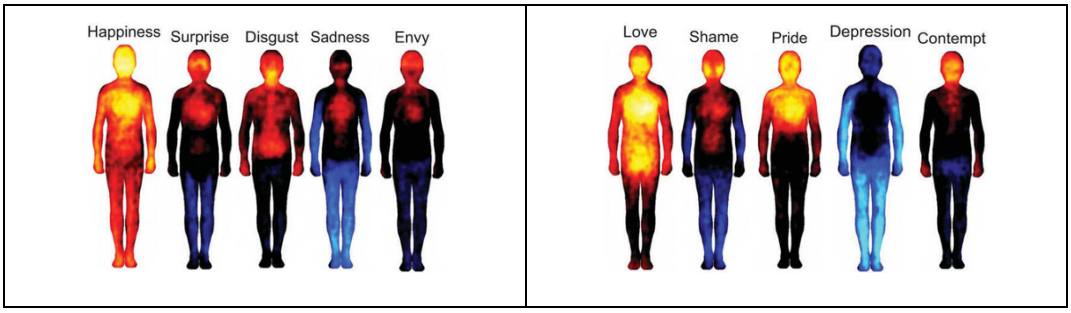
Sample 1	Sample 2
A comprehensive investigation titled "Bodily Maps of Emotions" encompassed a wide participant pool exceeding 700 individuals aged 18-45, hailing from Finland, Sweden, and Taiwan. The primary objective of this study was to delve into the impact of emotionally charged stimuli on these individuals. Diverse contents, such as words, videos, and stories, were presented to the participants, who were then tasked with identifying the specific regions of their bodies that experienced activation and those that remained unresponsive to the stimuli. To augment these findings, advanced computer technology (detectors) was utilized to monitor the participants' bodily reactions, which were subsequently correlated with their self-reported responses. The study yielded intriguing results, revealing striking similarities in the body sensory maps across participants, despite variations in their cultural backgrounds. A segment of the body sensation map is visually presented in the figure below:	In the research entitled "Bodily Maps of Emotions," a vast and diverse cohort of more than 700 individuals between the ages of 18 and 45, originating from Finland, Sweden, and Taiwan, actively participated. This pioneering study sought to uncover the profound impact of emotionally charged materials on the human body. Participants were exposed to a rich array of stimuli, including words, videos, facial expressions, and stories, and were then requested to pinpoint the specific areas of their bodies that exhibited heightened responsiveness, as well as those that remained indifferent. The participants' bodily reactions were meticulously recorded using computer technology (detectors), and these measurements were juxtaposed with the participants' accounts. Intriguingly, despite the diversity in cultural backgrounds, the study remarkably unveiled remarkable similarities in the body sensory maps among the participants. A visual segment of the body sensation map is depicted in the figure below:

Visual text generation

The results of the study are presented with a heat map including body coloring for 13 different emotions. For the visual text, these emotions are grouped in three ways in the context of the heatmap: (i) Emotions that increased sensation: Here, emotions such as love, and happiness have colours that indicate an increase in body temperature. This temperature increase is observed throughout the body in emotions such as love, while in emotions such as anger, it occurs in a certain part of the body. The body parts activated by the emotion are also categorized. (ii) Emotions that decreased sensation: Emotions such as sadness and depression have been found to

decrease the sensation in the body in general. Similarly, in emotions such as sadness, there is a decrease in sensation in the whole body in general, while in emotions such as envy, it is limited in certain areas. Emotions with reduced sensation by body region were also grouped. (iii) Mixed sensation: In emotions such as surprise, anxiety, etc., sensation increases in certain parts of the body and decreases in others. Similarly, these emotions are grouped within themselves to ensure that the images are of similar difficulty. The 13 emotions found at the end of the research were placed in the item model with Python codes in line with the features in the cognitive model (increasing, decreasing and mixed). The sample visual text generated is shown in Table 3.

Table 3. Sample Generated Visual Texts of the Stem



Option Generation

After the text was created, possible correct answers to be associated with the cognitive model were defined. At this point, idioms or commonly used words expressing emotion were chosen so that students could relate what they read to daily life. In this selection process, body parts where body sensation increases were also selected as a source of information. After that, commonly used emotion-body part idioms in Turkish were listed and categorized. In the research, 13 correct answers were prepared for each emotion. The sample options are shown in Table 4.

Table 4. Sample Generated Options

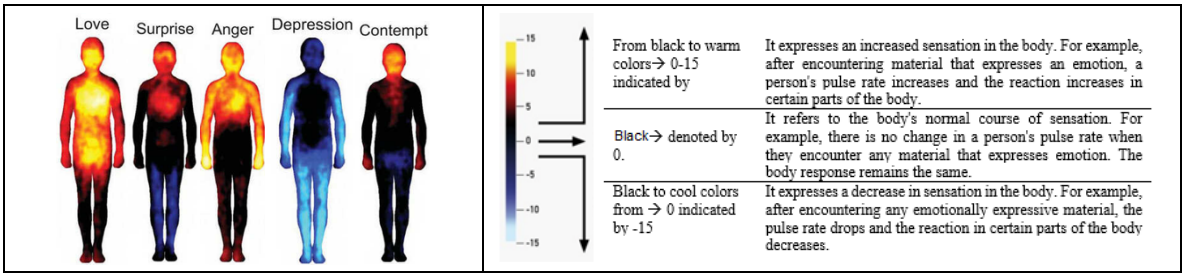
Correct options	I'm head over heels in **love** with you; every time I see you, I get butterflies in my **stomach**.
	When I received the good news, I was over the moon with joy and **happiness** from **head to toe**.
	I was so **saddened** that it felt like **my feet** had become as heavy as lead, and I could barely walk through the mud.
Distracters	I was so **surprised** by my brother's arrival that my **hands** started shaking like a leaf.
	Fear made my **knees** turn to jelly, and I couldn't figure out how to move to approach you.
	As winter approaches, she mentioned feeling blue and experiencing **depression**, and her **heart** races.

Generated items

After the generation of verbal, visual texts, and options, they were compiled in Python to give the items their final form. Although the produced items bear content similarity to the parent item, both the correct answers and visual information differ. This aims to significantly alleviate security concerns for students taking the exam simultaneously. It's important to remember that the goal here is to produce similar items. When the research topic is changed, the standardization facilitated by the cognitive and item models enables the creation of unique texts. For example, if the research topic were "Countries' Perspectives on the Use of Artificial Intelligence," it would be feasible to similarly produce new and unique texts detailing the research's objectives, participants, methodology, and outcomes. The sample item is shown in Table 5.

Table 5. Sample of the Generated Items

The study titled "Bodily Maps of Emotions" involved more than 700 participants aged 18-45 from Finland, Sweden, and Taiwan. The research aimed to explore emotionally charged materials' impact on individuals. Participants were presented with various contents, including words, videos, facial expressions, and stories, and asked to indicate the activated and unresponsive parts of their bodies in response to these stimuli. Additionally, the participants' bodily reactions were measured using computer technology (detectors) and combined with their self-reported answers. The study found that despite cultural differences, the participants exhibited similar body sensory maps. A segment of the body sensation map is presented in the figure below:



Which of the sentences below aligns with the findings of the "Bodily Maps of Emotions"?

A) I was so surprised to see my brother arrive that my hands started shaking like a leaf.

B) She would say her stomach twisted in knots whenever she felt green with envy.

C) I'm so in love with you that every time I see you, I get butterflies in my stomach.

D) She mentioned feeling blue and experiencing depression, and her heart races. *

Results of the field test item

In this study, the aim was to generate items of similar item difficulty for use in the same exam. Accordingly, out of 325 generated items, 5 items were selected for a field trial. These items were placed as the 19th item in a 5 different booklet of a screening test. The test, administered on a computer-based platform, allowed students to take it within a given 2-day period. Following the administration, the psychometric properties of the items were calculated. The item difficulty, item discrimination, and point biserial of the field test items which were generated are shown in Table 6. As can be seen in the Table 6, different emotions constitute the correct options for the five visual reading comprehension items that were generated and pre-applied in the study. In addition, the emotion-body feeling zone also differs. It is seen that the item difficulty indices of the pre-applied items vary between 0.58 and 0.66. In other words, the difficulty of the items that were automatically generated from the same cognitive and item model and had different answer keys were quite close to each other. The discrimination indices of the items were between 0.48 and 0.69. Item-total correlations also vary between 0.40 and 0.57.

Table 6. Item Statistics of the Generated Items

Items	Correct answer (in the idiom)		Item difficulty	Item discrimination	Biserial correlation
	Emotion	Part of the body			
1	Love	Abdomen	0.61	0.69	0.57
2	Pride	Breast	0.58	0.68	0.54
3	Surprise	Knee	0.59	0.57	0.51
4	Anxiety	Heart	0.66	0.48	0.40
5	Anger	Face	0.60	0.57	0.56

DISCUSSION AND CONCLUSION

This research aimed to automatically generate visual reading comprehension items used in the high school transition system in Türkiye and to evaluate the results. In the production with the template-based AIG, a cognitive model and item model were first developed for verbal and visual text, and then the items were automatically generated with the Python codes.

Five items selected among the generated items were field tests. As a result of the field test, it was determined that the difficulty indices of the items ranged between 0.58 and 0.66. In other words, a total of 1168 students answered 58-66% of the visual reading comprehension items correctly. This result shows that the item was slightly easier than the average for the students. The findings of this study align with previous research. It was determined that the average difficulty of the language test for high-school entrance including visual reading comprehension items generated in this study varied between 0.46 and 0.62 in the last five years (Author, 2023). Similarly, Freedle and Kostin (1991) found that the item difficulties of the main idea questions on the SAT ranged from 46% to 59%. In reading comprehension questions, there is research showing that items containing visual text are more difficult than those containing only verbal text (Santi et al., 2015), as well as studies indicating that visual content increases the proficiency level of the item but does not affect its difficulty (Caldwell & Pate, 2013). For instance, Khasawneh and Al-Rub (2020) stated that the difficulties of the visual reading comprehension items they developed to increase the reading skills of students with learning difficulties were still moderate or easy. In summary, the field test results demonstrate that the selected visual reading comprehension items were slightly easier than average for the students. This aligns with previous research highlighting the variation in item difficulty and the impact of visual content on reading comprehension tasks. In addition, the difficulty indices of the items were similar to each other in this study, which shows the usability of AIG for parallel test construction. Parallel questions are made so that each examinee gets a different question but has the same level of difficulty (Adji et al., 2018). The created parallel tests are useful for accurately assessing students' reading comprehension skills, especially in digital tests. Adji et al. (2018) found that with the AIG system, he was able to generate parallel math questions for 55% of the problems with the help of a flexible math editor. Similarly, Fu et al. (2022) generated isomorphic questions from the same cognitive model using AIG. It is also known that items of different difficulty can be created using AIG depending on the purpose. Gierl et al. (2016) generated items with item difficulties ranging from 19-95% from the same item model from a model they developed in the field of medical education. Similarly, Lai, Gierl, Touchie, et al. (2016) estimated the difficulty index of the 13 generated items between 0.13 and 0.91. These results show that AIG can generate items of different difficulty or similar difficulty depending on the purpose.

The discrimination indices of the visual reading comprehension items ranging from 0.48 to 0.69 showed a high level of discrimination. This shows that the items effectively discriminated against students with different levels of reading comprehension skills (Brennan, 1972). Furthermore, item-total correlations ranging from 0.40 to 0.57 provided additional evidence for the validity of these visual reading comprehension items. The research shows that in general, AIG-generated items are perceived to be of comparable or higher quality than manually written items (Falcão et al., 2023; Gierl et al., 2016; Gorin & Embretson, 2012; Harrison et al., 2017).

In conclusion, the automatic generation and evaluation of visual reading comprehension items revealed promising results in terms of difficulty and discrimination indices. The findings of this study highlight the potential of an automated generation approach using template-based AIG in the development of visual reading comprehension items. The high discrimination indices also demonstrate the effectiveness of the generated items in discriminating between students with different levels of reading comprehension skills. In addition, it is important to note that the success of the AIG approach is highly dependent on the quality and accuracy of the cognitive and item models used in the AIG process. Therefore, it is recommended that these models are continuously refined and improved to ensure the generation of high-quality items using verbal and visual text that are aligned with the desired assessment objectives.

Implications

This research demonstrates the application of AIG in efficiently generating a large pool of visual reading comprehension items. The study provides evidence of the effectiveness of AIG-generated visual reading comprehension items by examining their psychometric properties, including item difficulty and discrimination. The generated items show comparable difficulty levels, making them suitable for constructing personalized assessments for students with different reading comprehension skills. The use of visuals in reading comprehension assessments has the potential to enhance students' motivation and engagement during exams. This also shows that the items generated in using AIG can be asked to the students at different times in computer-based tests, thus avoiding the security problem.

Limitations

This study, while shedding light on the promising outcomes of employing AIG for the efficient creation of visual reading comprehension items, acknowledges certain limitations. The effectiveness of AIG is contingent on the precision and quality of the cognitive and item models, introducing a potential vulnerability should any

shortcomings exist in these models. Furthermore, the study's focus on Türkiye's high school transition system prompts a consideration of the generalizability of these findings to diverse educational systems and cultural contexts. Addressing these limitations calls for the need for further research to refine and enhance the applicability of the AIG approach in diverse educational settings.

Statements of Publication Ethics

The author has provided a clear and concise statement of their ethical practices, and their manuscript complies with the journal guidelines.

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1	☒	☒	☒	☒	☒	☒

Conflict of Interest

The authors declare that there is no conflict of interest.

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Examination of the Predictive Effect of Attachment Styles and Loneliness Levels on Internet Addiction of University Students

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Abstract

Nowadays, university students tend to spend more time in the virtual world and virtual friendships, which has caused them to create changes in their socialisation and interaction habits despite the virtual crowds, thus causing them to become lonely. It is thought that this situation observed in university students may also be effective in increasing the tendency towards attachment and technology use. Based on this idea, this study aims to examine the predictive effect of attachment styles and loneliness levels of male university students on internet addiction. The study was conducted with male students attending universities in Konya province, and 354 male students (61.6% associate degree, 38.4% undergraduate) attending universities in Konya who wanted to participate in the study were included. Research data were collected with general information form, Young internet addiction scale, three-dimensional attachment scale, UCLA loneliness scale. The data obtained in the study were analysed using SPSS (Statistical Package for Social Sciences) software. According to the results of the study, a positive and low level relationship ($p<0.01$) was found between the loneliness levels of the university students participating in the study and internet addiction (r=,275) and avoidant attachment (r=,329), a positive and moderately significant relationship ($p<0.01$) was found between anxious-ambivalent attachment (r=,446), while a negative and moderately significant relationship ($p<0.01$) was found between loneliness and secure attachment (r=-,338). While a positive and low level significant relationship ($p<0,01$) was found between internet addiction and avoidant attachment (r=,277) and anxious-ambivalent attachment (r=,301), a negative and low level significant relationship ($p<0,01$) was found between internet addiction and avoidant attachment (r=,277) and anxious-ambivalent attachment (r=,301), a negative and low level significant relationship ($p<0,01$) was found between internet addiction and secure attachment (r=,241). The results of the study revealed that attachment styles and loneliness levels of university students have a predictive effect on internet addiction.

Keywords: Internet addiction, attachment styles, loneliness, pandemic process

Bağlanma Stilleri ve Yalnızlık Düzeylerinin Üniversite Öğrencilerinin İnternet Bağımlılığı Üzerindeki Yordayıcı Etkisinin İncelenmesi

Öz

Üniversite öğrencileri günümüzde daha çok sanal alemde vakit geçirmeye ve sanal arkadaşlıklara yönelmekte, bu durum onların sanal kalabalıklara rağmen sosyalleşme ve etkileşim alışkanlıklarında değişiklikler yaratmasına, dolayısıyla yalnızlaşmalarına neden olmuştur. Üniversite öğrencilerinde gözlenen bu durumun bağlanma ve teknoloji kullanımına yönelimi artırmada da etkili olabileceği düşünülmektedir. Bu düşünceden hareketle araştırmada üniversitede okuyan erkek öğrencilerin bağlanma stilleri ile yalnızlık düzeylerinin internet bağımlılığı üzerindeki yordayıcı etkisinin incelenmesi amaçlanmaktadır. Çalışma Konya ilindeki üniversitelere devam eden erkek öğrencilerle gerçekleştirilmiş, çalışmaya katılmak isteyen Konya'daki üniversitelere devam eden 354 erkek öğrenci (%61,6'sı ön lisans, %38,4'ü lisans) dahil edilmiştir. Araştırma verileri genel bilgi formu, Young internet bağımlılığı ölçeği, üç boyutlu bağlanma ölçeği, UCLA yalnızlık ölçeği ile toplanmıştır. Araştırmada elde edilen veriler SPSS (Statistical Package for Social Sciences) programı kullanılarak analiz edilmiştir. Araştırma sonuçlarına göre, araştırmaya katılan üniversite öğrencilerinin yalnızlık düzeyleri ile internet bağımlılığı (r=,275) ve kaçınan bağlanma arasında (r=,329) pozitif ve düşük düzeyde ilişki ($p<0,01$), kaygılı-kararsız bağlanma arasında (r=,446) pozitif ve orta düzeyde anlamlı ilişki ($p<0,01$) bulunurken, yalnızlık ile güvenli bağlanma arasında (r=-,338) ise negatif ve orta düzeyde anlamlı ilişki ($p<0,01$) saptanmıştır. Araştırmaya katılan öğrencilerin internet bağımlılığı ile kaçınan bağlanma (r=,277) ve kaygılı-kararsız bağlanma arsında (r=,301) pozitif ve düşük düzeyde anlamlı ilişki bulunurken ($p<0,01$), internet bağımlılığı ile güvenli bağlanma arasında (r=,241) ise negatif ve düşük düzeyde anlamlı ilişki ($p<0,01$) bulmuştur. Araştırma sonuçları üniversite öğrencilerinin bağlanma stilleri ve yalnızlık düzeylerinin internet bağımlılığı üzerindeki yordayıcı etkisi olduğunu ortaya koymuştur.

Anahtar kelimeler: İnternet bağımlılığı, teknoloji, gençlik, ergenlik, bağlanma stilleri, yalnızlık.

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INTRODUCTION

The Internet is used to obtain information continue education and training activities and have fun and enjoyable time. While information and communication technologies are one of the effective ways of accessing information, they are also seen as a means of entertainment and leisure for young people and adolescents. There are results (Günel, Turhal & İmal, 2011) showing that young people and adolescents use the internet mostly to follow social media and play online games. According to TÜİK data, it was determined that the internet usage rate among individuals in the 16-74 age group was 79.0% in 2020 and increased to 82.6% in 2021 (TÜİK, 2021). Studies emphasize that there is a high rate of both internet and gaming disorders in adolescents and young adults (Gentile, 2009; Kaess et al., 2014; McGonigal, 2011; Noyan et al., 2015; Tarhan and Nurmedov, 2013; UNICEF, 2017; Yalçın- Irmak & Erdoğan, 2016; Kadan & Aral, 2021). While the use of technological devices provides some convenience, excessive use can lead to technology addiction. It is claimed that widely used technological devices or the internet alone are not effective in addiction and that applications on technological devices or the internet are more effective in addiction (Aral & Keskin, 2018; Young, 1999). Kwon et al. (2013) defined technology addiction as excessive use of the internet and technological devices, inability to satisfy the desire to use these tools, neglect of activities due to excessive use, damage to social relationships due to excessive use, using it as a means of escape from negative emotions and life stress, reducing use and They defined it as having problems stopping use, being tense and angry when use is not possible, and lying about the duration and amount of use.

Along with the fun side of technology, emotional needs, attachment patterns, socialization needs, loneliness, peer influences, desire to learn and spend free time, and risk-taking behaviors may be effective in the formation of addiction (Günay, 2011; Irmak and Erdoğan, 2015; Odacı and Çıkrıkçı, 2017; Shaw and Black, 2008). Regardless of the reason, loss of control as a result of addiction (Arslan- Durna, 2015; Gonzalez- Bueso et al., 2018); antisocial behaviors (Adanır et al., 2016; Ergül, 2015; Stockdale and Coyre, 2018; Stavropoulos et al., 2015); physical health problems (Han et al., 2010; Kuzu et al., 2008); obesity (Akçay and Özcebe, 2012); musculoskeletal problems (Mustafaoğlu et al., 2017); Problems such as poor social relationships (Hyun et al., 2015) and depressive symptoms (Han and Renshaw, 2012; Musluoğlu, 2016) arise. Attachment patterns, which are among the factors that are effective in the formation of addiction, start from infancy and affect the whole life. According to attachment theory, while the primary caregiver or parent meets children's physical needs, a social and psychological bond is established between the child and the parent or primary caregiver (Bolwlby, 2003). If this bond is secure, it may cause individuals to experience fewer psychological problems, and if it is insecure, it may cause individuals to experience more psychological problems (Vertue 2003; Hamarta 2004; Bar-Haim, Dan Eshel & Sagi-Shwartz, 2007). Individuals' attachment patterns and the efforts of adolescents and young people to live an independent life from their families in social environments increase their tendency towards internet addiction and their level of loneliness (Damarlı, 2006). Loneliness, defined as emotional emptiness reactions accompanying the individual's lack of close and social relationships (Asher & Paquette, 2003; cited in Yıldız & Duy, 2014), is caused by the lack of a social communication network or not being a member of a group where common interests and activities are shared and is intense during adolescence. It is experienced in some way (Duy, 2003). It is emphasized that adolescents and young people who are disconnected from social life and have problems with skills such as self-expression, developing a positive personality, and reaching psychological satisfaction live in the virtual world, which is far from reality (Zorbaz, 2013; Öztabak, 2018), but it seems that there are no studies that demonstrate its predictive power. It is considered important to take precautions by examining the internet addiction levels, attachment styles and loneliness prediction power of individuals who use the internet or technological tools excessively. From this point of view, the aim of the study was to examine the predictive power of university students' internet addiction levels, attachment styles and loneliness.

METHOD

In this section, the research model, study group, data collection tools, ethical dimension, data collection method and evaluation and analysis of the data are included.

Model of the Research

The research is a study of the relational screening model. Among the general scanning model types, the relational scanning model; It is a research model that aims to determine the existence and/or degree of co-variation between two or more variables (Fraenkel & Wallen, 2009; Karasar, 2005).

Working Group of the Research

The study group consists of male university students who studied at public and private universities between May 2021 and October 2021 and agreed to participate in the research voluntarily. A total of 354 male university students who voluntarily participated in the study and filled out the scales were included. Of the 354 male university students participating in the research, 61.6% are associate degree students and 38.4% are undergraduate students. The study group consists of male university students who studied at public and private universities between May 2021 and October 2021 and agreed to participate in the research voluntarily. A total of 354 male university students voluntarily participated in the study and filled out the scales were included. Of the 354 male university students participating in the research, 61.6% are associate degree students and 38.4% are undergraduate students.

Gender	Number of Participants	Total Number of Participants	Percentage %
Male	354	354	100

Data Collection Tools

The study used the Internet Addiction Scale, Three-Dimensional Attachment Scale, and UCLA Loneliness Scale as data collection tools.

Internet Addiction Scale

Dr. It is a 20-question self-assessment scale created by Kimberley Young (1996), adapted from the "Pathological Gambling" criteria of DSM-4. The Internet Addiction Scale (IAD), adapted to Turkish by Balta et al. (2008), is a Likert-type scale and each item is scored between 0-5 points. Those who score 80 or more in total on the scale are defined as internet addicts (IB), those who score between 50-79 are defined as people who frequently have problems with the internet in their daily lives and have difficulty controlling themselves, and they are called risky internet users (RIK), and those who score 49 and below are defined as people who frequently have problems with the internet in their daily lives and have difficulty controlling themselves. Those who score are defined as average internet users (AUI). In the adaptation study to Turkish, the internal consistency coefficient of the data obtained with the scale, calculated by Cronbach's alpha test, was found to be 0.895, and the calculated values showed that the scale is a valid and reliable scale (Balta & al., 2008).

Three-Dimensional Attachment Scale

The scale was developed by Erzen (2015) and consists of three subscales and 18 items measuring secure, avoidant and anxious-ambivalent attachment styles. Experts' opinions were used in the content and language validity studies of the scale, and using the Cohen Kappa agreement index, agreement index scores of .87 for language and meaning validity and .72 for content validity were obtained. Confirmatory and exploratory factor analyses were used for construct validity, and three dimensions emerged: secure, avoidant, and anxious-indecisive. Confirmatory factor analysis results showed that the model was compatible (GFI=.93, AGFI=.90, RMSEA=.05, $\chi 2/sd=2.48$, CFI=.90). According to the sub-dimensions of the scale, the internal consistency coefficient was found to be .69 for secure attachment style, .80 for avoidant attachment style and .71 for anxious ambivalent attachment style.

UCLA Loneliness Scale

Validity and reliability studies of the scale in our country were conducted by Demir (1989). In this study, the Cronbach alpha internal consistency coefficient regarding scale's internal consistency was calculated as .96. The test-retest reliability coefficient of the scale, administered at five-week intervals, was found to be .94.

Ethical Dimension

Permission to use the Internet Addiction Scale adapted to Turkish by Balta et al. (2008), the Three-Dimensional Attachment Scale developed by Erzen (2015) and the UCLA Loneliness Scale adapted by Demir (1989) were received via e-mail from the researchers who own the scale. Additionally, ethical approval was received from KTO Karatay University Publication Ethics Committee. Finally, informed consent was obtained from the university students participating in the study.

Data Collection Method

Data was collected via Google Forms. In this regard, the items of the Internet Addiction Scale, Three-Dimensional Attachment Scale and UCLA Loneliness Scale were transferred to the electronic environment via Google Form, one of the online data collection tools. The data of the research was collected between May 2021 and October 2021. Participation in the research was provided voluntarily. Participation in the research took approximately 15-20 minutes.

Evaluation and Analysis of Data

The SPSS package program was used to analyze the data. Mean and standard deviation were used when analyzing the data. The assumption of normality regarding the study's variables was examined using skewness and kurtosis values. The fact that kurtosis and skewness values are between +2 and -2 indicates that the data is normally distributed (Tabachnick and Fidell, 2013). As a result of the analysis, it was seen that the data was normally distributed. In the first stage of the analyses whether the scale scores were reliable or not was examined. Cronbach's Alpha internal consistency coefficients for the scale scores were found in the UCLA loneliness scale (α=.889), the Young Internet addiction scale (α=.885), the attachment styles scale's secure attachment (α=.628), avoidant attachment (α=.882) and It was found to be sufficiently reliable for the anxious-ambivalent attachment (α=.785) subscales. Pearson Correlation analysis was used to examine the relationships between scale scores, and Regression analysis was used to examine whether the scales predicted each other. P<0.005 was accepted as a statistical significance value.

FINDINGS

The results obtained from the study examining the predictive power of university students' internet addiction levels, attachment styles and loneliness are given below.

The students participating in the research had low levels of internet addiction (Mean: 28.22) and loneliness (Mean: 38.50), secure attachment (Mean: 19.43), avoidant attachment (Mean: 15.08), and anxiety. It was determined that the levels of ambivalent attachment (Mean: 16.91) were at a medium level.

Table 1. Pearson Correlation Analysis Results for the Relationships Between the Scale Scores of the Students Participating in the Research

	UCLA loneliness	Internet addiction	Secure attachment	Avoidant attachment
Internet addiction	,275**	-		
Secure attachment	-,338**	-,241**	-	
Avoidant attachment	,329**	,277**	-,213**	-
Anxious, indecisive attachment	,446**	,301**	-,095	,454**

**p<0,01

When the table is examined, it can be seen that the loneliness levels of the students participating in the study are positively and lowly related to internet addiction (r=.275), avoidant attachment (r=.329), positively and moderately between anxious ambivalent attachment (r=.446), and secure attachment (r=.446). =-.338), there is a negative and moderately significant relationship (p<0.01). There was a positive and low significant relationship between the internet addiction of the students participating in the research and avoidant attachment (r=.277) and anxious ambivalent attachment (r=.301), and a negative and low significant relationship between secure attachment (r=.241) (p<0, 01) is seen to be present.

Table 2. Simple Linear Regression Analysis Results for Internet Addiction Predicting Loneliness

Variable	B	SE	B	t	P
Stable	29,088	1,835		15,849	,000**
Internet addiction	,334	,062	,275	5,367	,000**
r= ,275; r^2= ,073; F(1, 352)=28,803; p= ,000**					

**p<0,01

When the table is examined, it is seen that internet addiction predicts loneliness at a level of 7.3% and at a statistically significant level (r2=.073; p<0.01).

Table 3. Simple Linear Regression Analysis Results for Internet Addiction Predicting Avoidant Attachment

Variable	B	SE	β	t	p
Stable	10,452	,896		11,670	,000**
Internet addiction	,164	,030	,277	5,403	,000**
r= ,277; r^2= ,074; F(1, 352)=29,198; p= ,000**					

**p<0,01

When the table is examined, it is seen that internet addiction predicts avoidant attachment at a level of 7.4% and at a statistically significant level (r2=.074; p<0.01).

Table 4. Simple Linear Regression Analysis Results for Internet Addiction Predicting Anxious Ambivalent Attachment

Variable	B	SE	B	T	P
Stable	11,991	,869		13,804	,000**
Internet addiction	,174	,029	,301	5,929	,000**
r= ,301; r^2= ,088; F(1, 352)=35,151; p= ,000**					

**p<0,01

When the table is examined, it is seen that internet addiction predicts anxious ambivalent attachment at a level of 8.8% and at a statistically significant level (r2=.088; p<0.01).

DISCUSSION

In the study, which aims to examine the predictive effect of attachment styles and loneliness levels on internet addiction of university students, it is seen that attachment styles and loneliness levels have a predictive effect on internet addiction. In the literature reviews conducted before the research design (Morahan-Martin and Schumacher, 2000; Balta and Horzum, 2008; Kelleci et al., 2009; Gündeç, 2009; Odacı and Kalkan, 2010; Esen and Siyez, 2011; Liberatore et al., 2011; Gençer 2011; Üneri and Tanıdır, 2011; Durkee et al., 2012; RTÜK 2012; Çuhadar 2012; Sırakaya and Seferoğlu, 2013; Eroğlu, Pamuk and Pamuk, 2013; Akdağ et al., 2014; Aksoy 2015; Şahin 2016; Kabaklı-Çimen, 2018) in the gender variable regarding internet addiction, it was observed that male students had a higher level of internet addiction than female students. Based on the results of this research, this study aimed to carry out a more in-depth research design for male students studying at the university. Considering the results of the research conducted in line with this goal, it is seen that internet addiction predicts secure attachment, avoidant attachment and loneliness at a statistically significant level. Additionally, it was determined that internet addiction predicted anxious-ambivalent attachment at a statistically significant level. One of the concepts related to internet addiction is attachment, and it is stated that, as in many behavioral addictions and substance addictions, the level of internet addiction is closely related to the individual's attachment styles (Chang et al., 2015; Ronnie & Heather, 2016). It is stated that individuals with a secure attachment style are willing to establish and maintain relationships because they perceive themselves as lovable and others as reliable and consistent (Bartholomew & Shaver, 1998; Sümer & Güngör, 1999). In other words, these people's socialization levels and social skills may have improved. Individuals with a secure attachment style can establish quantitatively and qualitatively satisfying relationships because their social skills are developed and they perceive themselves as lovable and others as reliable (Birgün & Çelik 2021). In this study, the result that internet addiction predicts secure attachment, avoidant attachment and loneliness at a statistically significant level is integrated with this idea.

In the results of the research regarding insecure attachment styles, it was determined that there was a relationship between internet addiction and insecure attachment styles. In studies supporting this result and conducted with large samples in the Far East (Li & Wu, 2017; Min & Lin, 2011), it was found that there is a relationship between insecure attachment and internet addiction. In these studies, it has been observed that the internet emerges as an attachment figure or as an environment where new attachment figures are sought. In addition, according to some studies, it is stated that internet addiction is only associated with anxious attachment situations, and according to others, it is only associated with avoidant attachment style (Jia & Jia, 2016). On the contrary, studies also show that both styles are related (Schimmenti et al., 2014). In their study, Jia & Jia (2016) found that anxious attachment to parents significantly predicted internet addiction but did not find a significant relationship between avoidant attachment style and internet addiction (Jia & Jia, 2016).

According to research, individuals who are described as internet addicts; Workplace and school performances are negatively affected by this situation, sleep disturbance, a life without the internet seems boring and meaningless, intense loss of willpower, extreme irritability, anxiety and loneliness when deprived of the

internet are observed (Nalwa & Anand, 2003). It is also stated that problematic internet use leads to an increase in pathological thoughts such as obsession, anxiety, depression, hostile, phobic and paranoid thoughts. A study shows that young people and adolescents who exhibit problematic internet use behavior become increasingly lonely and have difficulty establishing face-to-face relationships (Odabaşıoğlu et al., 2007). In addition to this, one of the important reasons for the increase in internet usage rates among young people and adolescents is social networks such as Facebook, Twitter and Instagram, which tend to constantly develop and increase their member profiles (Gülbahar, Kalelioğlu & Madran, 2010). In a study, young people under the age of 25 stated that they could abandon their sleep and neglect their social and family relationships to follow social networks, and those of school-age could neglect their academic homework and responsibilities (Ofcom, 2008). Therefore, considering that the people who use these networks the most are young people (Retrevo, 2010), the concept of internet addiction has been the subject of many studies with the increase in the rate of internet use at national and international levels. In the studies conducted, internet addiction; personality traits (Batıgün & Kılıç, 2011; Ekşi, 2012; Shepherd & Edelmann, 2005), loneliness (Esen & Siyez, 2011; Mitchell, 2000), aggression and peer pressure (Satan, 2013; Yükselgün, 2008) and cyberbullying (It has been associated with concepts such as Özdemir & Akar, 2011; Ybarra, 2004).

In another study, Young & Case (2004) examined the relationship between internet addiction and individuals' purposes for using the internet, frequency of use, and attitudes, and stated that adolescents' family and friend relationships weaken due to the excessive time they spend on the internet (Morsünbül, 2014). Işık (2007), in his study with 563 university students, stated that the duration and frequency of internet use are gradually increasing.

It is stated that internet addiction is the source of many psychological problems. Young & Rogers (1998) state that as a result of excessive, uncontrolled and irregular use of the internet, psychosocial variables (such as social isolation and depression) and negative consequences occur in school, work and home life (Young & Rogers, 1999). Having a large circle of friends and not feeling lonely is an important factor in a person's happiness (Cheng & Furnham, 2002). Excessive use of the internet and computers causes adolescents to experience loneliness (Çakır & Oğuz, 2017; Yalçınkaya et al., 2021).

While there is a positive and low significant relationship between the loneliness levels of the students participating in the research and their internet addiction levels and their avoidant attachment levels, there is a positive and moderate significant relationship between the loneliness level and the anxious-ambivalent attachment level and a negative and moderate significant relationship between the loneliness level and the secure attachment level. There is a significant relationship at the level. There is data in the literature that the lack of social support increases the susceptibility to internet addiction (Yeh & colleagues, 2008). It is stated that individuals who experience obstacles in their social relationships often resort to the Internet to rebuild and maintain their personal relationships and replace the Internet with face-to-face communication (Inderbiten, et al., 1997; Kubey, et al.s, 2001).

Individuals who cannot receive support from the people around them may develop internet addiction to meet their interpersonal relationship needs and create alternative social channels (Papacharissi & Rubin, 2000). At this point, it should not be overlooked that lack of social support may be closely related to loneliness. There are many studies showing that the loneliness scores of individuals with pathological internet use are significantly high (Batıgün & Hasta, 2010; Eijnden, et al., 2008; Erdoğan, 2008; Morahan-Martin & Schumacher, 2000). In the relevant literature, there are research findings showing that loneliness is associated with insecure, indifferent, fearful, obsessive attachment and hopelessness, stress and life satisfaction (Deniz, et al., 2005; Wiseman, et al, 2005: Özkaya, 2017; Satici, 2020; Bingül & Çelik 2021).

Having a secure first attachment relationship allows the individual to transition easily to new relationships during adolescence and feel comfortable with new discoveries. In addition to these studies, there are also studies showing that people with insecure attachment (obsessive, dismissive, fearful attachment) have low levels of well-being (Kobak, et al., 1991; Priel & Shamai, 1995; Kafetsios & Sideridis, 2006; Berber Çelik, 2018). While there is a positive and low significant relationship between the internet addiction levels of the students participating in the research and their avoidant attachment levels and their anxious-ambivalent attachment levels, there is a negative and low significant relationship between their internet addiction levels and secure attachment levels.

Adolescence is seen to be more difficult for individuals with insecure attachment. It is stated that while securely attached adolescents try to solve the problems they encounter instantly, insecurely attached ones face problems. Peer attachment during adolescence is important as it provides support and emotional security to the

individual and sets an example for subsequent relationships (Lee, 2002). The environment of associate degree students studying in regular education complains more about internet use. In addition, they can become more aggressive and hurtful with internet use (Söylemez & Söylemez, 2020).

It appears that attachment styles predict loneliness at a statistically significant level. When the sub-dimensions are examined, it is seen that the biggest effect is in the anxious-ambivalent attachment, secure attachment and avoidant attachment sub-dimensions, respectively. Children and adolescents who have developed a secure attachment can establish relationships easily, show less aggression in their relationships, and cope with stress better (Sroufe, 2005). In the study conducted by Berber Çelik, 2018, as a result of the research, it was found that securely attached students had high psychological well-being levels; Students with obsessive attachment have low levels of psychological well-being. It has been revealed that secure and preoccupied attachment predicts psychological well-being.

In other studies examining whether attachment styles predict loneliness, it is stated that anxious, avoidant and ambivalent attachment styles also predict loneliness (Spence, et al., 2018; Suri, et al., 2019; Şeremet, 2019). Göçener (2010) states that individuals with a fearful attachment style tend to stay distant from close relationships because they fear rejection and do not find other people reliable. When definitions of loneliness are examined, it can be said that deficiencies in social relationships characterize it. Since the fearful attachment style predicts loneliness, which can be explained by the fact that these individuals avoid interacting with others and thus establish inadequate and/or unsatisfactory social relationships, it may be concluded that it predicts loneliness.

It appears that attachment styles predict loneliness at a statistically significant level. When the findings are examined based on of sub-dimensions, it is seen that the biggest effect is in the anxious-ambivalent attachment, secure attachment and avoidant attachment sub-dimensions, respectively. Wei, et al., (2005) observed feelings of depression, loneliness, and shame in insecurely attached college students. In a study, it was stated that insecurely attached individuals experienced more problems in their interpersonal relationships in the future and that adolescents with an insecure attachment style experienced feelings such as antisocial behavior, low self-esteem, difficulty in establishing close relationships, and feelings of loneliness (Cooper et al., 1999).

Ko et al. (2009) found that the triggers of internet addiction are psychological factors such as depression, attention deficit, hyperactivity, social phobia and aggression. In other words, rising internet addiction means that a person moves away from his social environment, becomes isolated, and ultimately weakens his social relationships (Müezzin, 2017). At this point, it is understood that social loneliness is both the cause and the result of internet addiction. As a person becomes lonely, he will turn to the internet, and the more he connects to the internet, the more lonely he will become (Esen, 2010).

CONCLUSION AND RECOMMENDATIONS

According to the results obtained in the study, it was seen that there were significant relationships between the three variables, and attachment styles and loneliness predicted internet addiction significantly and positively. The loneliness and internet addiction levels of the students participating in the research were low, and their secure attachment, avoidant attachment and anxious-ambivalent attachment levels were moderate. It was determined that there was a moderate negative relationship between the level of internet addiction and the level of loneliness, and as the internet addiction levels of university students increased, their loneliness levels decreased.

While there is a positive and low significant relationship between the loneliness levels of the students participating in the research and their internet addiction levels and their avoidant attachment levels, there is a positive and moderate significant relationship between the loneliness level and the anxious-ambivalent attachment level and a negative and moderate significant relationship between the loneliness level and the secure attachment level. There is a significant relationship at the level.

While there is a positive and low significant relationship between the internet addiction levels of the students participating in the research and their avoidant attachment levels and between their anxious-ambivalent attachment levels, there is a negative and low significant relationship between their internet addiction levels and secure attachment levels.

It is seen that internet addiction significantly predicts loneliness, secure attachment, avoidant attachment and anxious-ambivalent attachment.

It appears that attachment styles predict loneliness at a statistically significant level. When the sub-dimensions are examined, it is seen that the biggest effect is in the anxious-ambivalent attachment, secure attachment and avoidant attachment sub-dimensions, respectively.

In line with the results obtained in the research,

- Depending on the results, future studies can be conducted on adolescents with different demographic and cultural characteristics, single siblings and multiple siblings based on loneliness, and family structures with different attachment patterns.

- To strengthen the findings regarding attachment patterns, a different dimension of this research can be conducted on adolescents raised under protection.

- The predictive power of the internet on loneliness and attachment patterns can be studied by conducting similar studies with adolescents growing up in fragmented families and maintaining family integrity.

- Studies can be planned for individuals in different age groups regarding the sub-dimensions of internet addiction and attachment.

- Studies can be conducted on real communication and loneliness levels in the virtual environment.

- Intergenerational studies can be conducted on attachment levels of individuals, focusing on parents and individuals regarding their ability to manage their addictions.

- Educational programs focused on combating internet addiction can be written by experts in the field and applied to adolescents, educators and parents.

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Abductive Reasoning Tendencies of Graduate Students in the Context of Qualitative Research: A Q Methodology Study

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Abstract

The aim of this research is to reveal the tendencies of graduate students towards abductive reasoning in the context of qualitative research. To this end, the study is designed within the Q methodology pattern, which is one of the mixed research methods. Q methodology is a research method aimed at systematically analyzing the views of participants on the research question. The study group of the research consists of 11 graduate students determined by criterion sampling. As a data collection tool, 14 sentences related to three themes measuring abductive reasoning tendency were used. The data collection process was carried out using a structured Q sorting. As a result of the research, it has been observed that the tendencies of graduate students towards abductive reasoning in the context of qualitative research are grouped under four factors. These four factors consist of the harmonious creative group, which has a high tendency towards creative abductive reasoning and excessively coded abductive reasoning; the preferring group, which has a high tendency towards under coded abductive reasoning; the descriptive group, which has a high tendency towards excessively coded abductive reasoning; and the exploratory creative group, which has a high tendency towards under coded abductive reasoning and creative abductive reasoning.

Keywords: Abductive reasoning, qualitative data analysis, graduate student.

Lisansüstü Öğrencilerin Nitel Araştırmalar Bağlamında Abdüktif Akıl Yürütme Eğilimleri: Bir Q Metodoloji Çalışması

Öz

Bu araştırmanın amacı, lisansüstü öğrencilerin nitel araştırmalar bağlamında abdüktif akıl yürütme eğilimlerini ortaya koymaktır. Bu amaç doğrultusunda, çalışma karma araştırma yöntemlerinden Q metodoloji deseninde tasarlanmıştır. Q metodoloji, katılımcıların araştırma sorusuna ilişkin görüşlerini sistematik şekilde analiz etmeyi amaçlayan bir araştırma yöntemidir. Araştırmanın çalışma grubunu, ölçüt örnekleme ile belirlenmiş 11 lisansüstü öğrenci oluşturmaktadır. Veri toplama aracı olarak, abdüktif akıl yürütme eğilimini ölçen üç temaya ilişkin 14 cümle kullanılmıştır. Yapılandırılmış Q dizgisi kullanılarak veri toplama işlemi gerçekleştirilmiştir. Araştırma sonucunda, lisansüstü öğrencilerin nitel araştırmalar bağlamında abdüktif akıl yürütme eğilimlerinin dört faktör altında toplandığı görülmüştür. Yaratıcı abdüktif akıl yürütme ile aşırı kodlanmış abdüktif akıl yürütmeye ilişkin eğilimin yüksek olduğu uyumlu yaratıcı grubu; yetersiz kodlanmış abdüktif akıl yürütmeye ilişkin eğilimin yüksek olduğu tercih eden grubu; aşırı kodlanmış abdüktif akıl yürütme eğiliminin yüksek olduğu betimsel grubu; yetersiz kodlanmış abdüktif akıl yürütme ile yaratıcı abdüktif akıl yürütme eğiliminin yüksek olduğu keşfedici yaratıcı grubu söz konusu dört faktörü oluşturmaktadır.

Anahtar kelimeler: Abdüktif akıl yürütme, nitel veri analizi, lisansüstü öğrenci

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INTRODUCTION

Qualitative research, like all other research, begins with the identification of a research problem and continues with a cyclical process involving data collection, analysis, and interpretation. The nature of this process, based on interpreting the subjective meanings of participants, especially necessitates deeper examination during the data analysis stage. Various researchers (Marecek & Magnusson 2020; Wertz, 2011; Wertz, 2014) highlight that qualitative studies once seen as a deviant discipline under the influence of quantitative research for many years, began to gain acceptance in the 1970s. Simultaneously, the data analysis stage, considered the darkest area of the qualitative research process, started to emerge as a field of study.

Qualitative data analysis, viewed as an interpretative process by which a researcher makes sense of and imbues meaning to a data set (Rinehart, 2021), relies on synthesizing data into meaningful information and reconstituting it in a form that is meaningful to the reader (Miles & Huberman, 1994; Morse & Field, 1995). This process requires both data collection and analysis, as well as the establishment of solid and repetitive connections between theory and data. These connections are established through scientific reasoning processes (Kennedy & Thornberg, 2018). Accordingly, it can be said that reasoning processes are one of the fundamental elements of the qualitative data analysis process.

Scientific reasoning can be defined as a systematic thinking process that includes forming hypotheses, designing experiments to test hypotheses, distinguishing definitive evidence from uncertain evidence, and interpreting results as evidence that supports or refutes hypotheses (Chen, 2020). Traditionally, this process has been addressed in terms of deduction and induction. In inductive reasoning, which is on one side of this axis, a researcher starts with empirical data and tries to develop a theory based on this data. Conversely, in deductive reasoning, a researcher starts with a theory and makes explanations about a specific case. However, the path followed in qualitative data analysis cannot always be explained solely by deduction and induction, and researchers often need to transcend these boundaries, particularly in the discovery of new understandings. Deduction or induction alone is not sufficient for the discovery of new insights (Ezzy, 2002). Within these limitations, philosopher Charles Sander Peirce has stepped outside this binary axis, stating that the logic of scientific research advances on three types of reasoning processes. The additional path of reasoning, although originally attributed to Aristotle, is most commonly associated with Peirce and is known as abductive reasoning (Halpin & Richard, 2021; Raholm, 2010).

Abductive reasoning refers to a thought process that involves making predictions about the current situation by considering signs (existing or observed), which is a way of thinking that entails creating an explanatory hypothesis to propose a new idea (Kapitan, 1990). This process starts with an observation requiring explanation and leads to the hypothesis that best explains the gathered data. With this structure, it can be seen as both data-focused and domain-bound, representing a falsifiable act of insight (Peirce, 1958, cited in Hidayah et al., 2020). Consequently, it can be said that the new hypotheses generated as a result of abductive thinking are the most plausible predictions that need to be validated with new data (Tavory & Timmermans, 2014; Walton, 2014).

To better understand abductive reasoning, it is useful to compare it with other forms of reasoning. In such a comparison, deductive reasoning starts with a rule and progresses through a case to reach an observed conclusion that either proves or disproves the rule. In contrast, inductive reasoning begins with a set of circumstances and develops an inference about some universal rules based on the outcomes indicated by these circumstances. Abductive reasoning, however, starts the process with conclusions and then constructs causes (Timmermans & Tavory, 2012). Therefore, while deductive inferences are certain as long as their premises are true, and inductive inferences are probable, abductive inferences are only characterized as plausible (Shank, 2008). The goal of the abductive process is to discover data, find a pattern, and propose plausible hypotheses using appropriate categories. In summary, it can be said that deduction focuses on explanation, induction on verification, and abduction on creation (Yu, 1994).

Within the specified framework, it can be said that the significance of abductive reasoning stems from it being the point where innovation and creativity enter the scientific method. This is because with deduction, conclusions are derived from premises, but their origins cannot be fully explained. Induction leads to conclusions from observations, but the significance of these conclusions cannot be proven. However, abductive reasoning provides the possibility of explanation and new knowledge (Mingers, 2012). In this context, it would not be incorrect to say that abductive reasoning stands out as the only logical process in the scientific research process that introduces

new ideas (Hidayah et al., 2020; Raholm, 2010; Timmermans & Tavory, 2014). Nevertheless, it is observed that much of the literature focuses more on induction and deduction, and does not adequately address abductive reasoning (Lipscomb, 2012; Moscoso, 2019; Thagard, 2007). In a sense, it is stated that responses to calls for action to make the abductive reasoning process more concrete have not been received (Vila-Henninger et al., 2022).

At this point, it can be said that there is a need for research related to the aspect of abductive reasoning in the process of qualitative data analysis. No studies in the national literature focusing primarily on abductive reasoning in qualitative data analysis have been encountered. This study addresses this need by centering on the abductive reasoning process. The research focuses on the tendencies of graduate students in abductive reasoning processes within the context of qualitative research. This is because the applicability of the abductive reasoning process is contingent upon qualitative researchers utilizing this process.

Kuczynski and Daly (2003) emphasize the challenging nature of the interpretative process in qualitative data analysis, underscoring the need to focus on training especially young researchers in this process. Li and Seale (2007) highlight the necessity of examining students' approaches to the data analysis process within this challenging context. Studies in the literature support these views. It is indicated that graduate students find it very difficult to construct a theoretical framework within the qualitative research process (Sölpük & Karadağ, 2019), experience uncertainties about where to start coding in qualitative data analysis (Li & Seale, 2007), have negative emotions in deciding on data analysis and research type (Çepni et al., 2019), and struggle with identifying and analyzing codes and themes (Blank, 2004; Wang, 2013). At this point, it is thought that the abductive reasoning process, due to its contribution to creating hypotheses by reading signs and generating new ideas in qualitative research, has the potential to offer a solution to the difficulties experienced in the qualitative analysis process. It can be said that the emerging picture indicates the need for research to determine the tendencies of graduate students regarding the abductive reasoning process.

Considering these reasons, this research aims to investigate the tendencies of graduate students who have experienced the qualitative research process towards the abductive reasoning process, seeking answers to the following sub-problems:

- Do graduate students show similarities in their tendencies towards abductive reasoning in the context of qualitative research?
- What sub-dimensions emerge as prominent in the tendencies of graduate students towards abductive reasoning in the context of qualitative research?

METHOD

Research Design

In this study, the Q methodology pattern from mixed research methods was employed. Q methodology is a mixed research method used to uncover and define different views and thoughts on a subject. It consists of a series of qualitative and quantitative stages intertwined, designed to bring out and define the different opinions and consensus on a subject (Ramlo, 2015). Q methodology facilitates the examination of human subjectivity. Participants are presented with a series of statements related to the topic and are asked to rank them. Each ranking represents the participant's viewpoints. When participants arrange these statements in a manner such as agreeing, disagreeing, or neutral, they interpret events, objects, or people related to their personal experience world. The data obtained this way are related to the participants' personal experiences and thoughts, and while expressing their thoughts on a specific subject, they convey their subjective interpretations. Q methodology systematically collects these subjective interpretations, and by identifying the commonalities and differences in these interpretations, it provides researchers with a broad spectrum of views on the subject. Therefore, Q methodology is particularly used to gain a deeper understanding of human behaviors, attitudes, and beliefs. The ranking done by participants according to their perspectives forms the qualitative part of the methodology (Brown, 1993). The analysis of data collected with the Q sorting using a statistical program, and the determination of which group the participants belong to through principal component analysis, constitute the quantitative part of the methodology (Çakmak et al., 2022).

Participants and Procedure

In Q methodology, it is recommended that the number of participants in the study group be less than the number of Q statements (Aydoğan et al., 2022). In this context, as 14 sentences related to abductive thinking were developed for this study, the research group consists of 11 graduate students selected through criterion sampling. Criterion sampling ensures the formation of the study group according to predetermined criteria to provide in-depth cases rich in knowledge related to the research question (Merkens, 2004). In the study, since the tendencies of graduate students towards abductive reasoning in the context of qualitative research are to be examined, one of the criteria for the participants forming the study group was that they must have conducted at least one qualitative research.

Participants were coded using their gender, educational level, number of qualitative research conducted, and sequence number. For example, a male doctoral student who has conducted one qualitative study and is the first in the sequence was coded as "MD11". The personal characteristics of the participants forming the study group are shown in Table 1.

Table 1. Personal Characteristics of Participants

Participant Code	Gender	Graduate Level	Number of Qualitative Research Conducted
MD11	Male	Doctorate	1
FD12	Female	Doctorate	1
FD33	Female	Doctorate	3
FD34	Female	Doctorate	3
FD35	Female	Doctorate	3
FD16	Female	Doctorate	1
MM17	Male	Master's Degree	1
FD28	Female	Doctorate	2
FD19	Female	Doctorate	1
MM110	Male	Master's Degree	1
FD411	Female	Doctorate	4

Upon examining Table 1, it is observed that among the participants, three are male and eight are female. Two of the participants are master's degree students, and nine are doctoral students. The number of qualitative research studies conducted by them varies between 1 and 4.

Instruments

In this study, a pool of judgment sentences related to abductive reasoning in the context of qualitative research was created by reviewing the literature. While constructing the sentence pool, a structural design was employed. Structural design refers to the process of forming the sentence pool by considering predetermined themes (Yıldırım, 2017). In this regard, the study used a structural design and considered themes identified in the literature related to abductive reasoning (Eco, 1983; Magnani, 2009).

In the literature, abductive reasoning is examined under two themes: creative and selective abductive reasoning. Creative abductive reasoning is the situation where a new assumption is made instead of making a choice based on previously acquired knowledge and experiences. Selective abductive reasoning refers to selecting the hypothesis that provides the best explanation among the generated hypotheses. Within selective abductive reasoning, there are subcategories of over-coded and under-coded abductive reasoning. Over-coded abductive reasoning includes choices related to judgments that are naturally accepted within the culture or without conscious effort in daily life practices, whereas under-coded abductive reasoning involves choosing an assumption when there are two or more rules to choose from (Eco, 1983; Magnani, 2009). Therefore, in the study, the tendencies of abductive reasoning in the context of qualitative research were examined under three themes: creative abductive thinking, over-coded abductive reasoning, and under-coded abductive reasoning, and judgment sentences were formed under these three themes.

In Q methodology, ensuring diversity of opinions under maximum variety (Webler et al., 2009) is recommended, and for this purpose, writing both positive and negative judgment sentences for each theme is suggested (Yıldırım, 2017). However, since the subthemes of abductive reasoning can be defined as opposing tendencies, a total of 14 sentences have been written, including four positive sentences for over-coded abductive reasoning and five positive sentences each for under-coded abductive reasoning and creative abductive reasoning. The created sentence pool was presented to two experts who have conducted research on qualitative research, and

the sentences were structured and semantically adjusted according to expert recommendations. Subsequently, a pilot application was conducted with two graduate students, and feedback was obtained from the students regarding the understandability of the sentences. The randomly numbered items are shown in Table 2.

Table 2. Q Sentences

Dimensions	Questions
Over-Coded Abductive Reasoning	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.
	11. I code the data I collected under the headings of the questions I asked.
	8. When analyzing the data, I utilize frequently repeated expressions.
	5. When analyzing the data I collected, I attempt to validate the theory on which the study is based.
Under-Coded Abductive Reasoning	2. When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory.
	9. For the data analysis, I base my approach on the assumption that I find suitable from the many hypotheses previously formed about the problem.
	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.
	13. Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses.
	7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.
Creative Abductive Reasoning	3. When I collect data and find surprising information outside the theoretical framework of the research, I focus on this surprising data to expand the theory or create a new theory.
	6. In data analysis, I try to find implicit meanings and create new assumptions related to the research problem.
	10. When I find new and surprising data, I formulate a new hypothesis for the research to explain the data.
	14. In data analysis, I code without basing it on any theory.
	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.

The Q sort technique allows participants to arrange items in a way that reflects their personal perspectives, placing the items they find most significant at the extreme ends and the items they consider neutral in the center. Participants define each item within a sorting order, but this order is different from the ranking in a Likert scale survey. In the Q sort technique, each item is evaluated in comparison with the others, requiring participants to internalize each item before placing it in the grid. This demands a reflective process (Stephenson, 1936). The data were collected using a symmetric Q-sort that fits a normal distribution in the range of ±2. Table 3 shows the Q sort.

Table 3. Q-sorting

DISAGREE		NEUTRAL	AGREE	
-2	-1	0	+1	+2

The Q sorting presented in Table 3 was used for participants to place the Q statements. Participants were given a form with randomly ordered Q statements and small papers with the Q statements, designed according to the Q sort. Additionally, a second paper with the Q sort grid was prepared, and below this, a table was included for participants to mark the items they agreed with, disagreed with, and found neutral. Participants were asked to note down the items they agreed with (5 items), disagreed with (5 items), and found neutral (4 items) in the table before placing them in the Q sort grid. They then compared the items in their tables and pasted them onto the Q sort grid presented in Table 3. This process is important as it allows participants to reflect on their thoughts. Furthermore, two open-ended questions were asked regarding the reasons for choosing the items they most agreed and least agreed with, to collect participant views.

As there are sequential steps to be followed in the Q sort technique, and to explain the process to participants, all data for the study were collected in a face-to-face setting. Before filling out the data collection tool, participants were informed about the topic and explained how to fill out the form.

Validity and Reliability

Q methodology is a research method used for understanding subjective evaluations and different perspectives among individuals. This methodology is typically utilized to identify and rank various viewpoints of individuals who are relevant to the subject. Q methodology is based on individuals making evaluations according to their own perspectives, thereby representing a relatively subjective approach. Consequently, Q methodology differs from standard scaling practices, as it focuses on allowing individuals to make their own evaluations and express these evaluations through rankings. The assessments made by individuals are aligned with their own subjectivity and cannot be compared with an external standard. Therefore, this approach does not rely on traditional psychometric issues of validity and reliability (McKeown & Thomas, 2013). Hence, it is argued that validity and reliability should not be considered in relation to problems resolved through Q methodology (Stephenson, 1936).

Data Analysis

In the scope of the research, the data collected were analyzed using the PQMethod 2.35 software. Principal component analysis was used to evaluate the opinions of the participants. Factor load values were calculated using the formula proposed by McKeown and Thomas (1988), "Standard error = 2.58 x (1/√(number of Q statements))". In this context, the significance value for the 14 Q statements used in the study was determined to be 0.67. To compare the views of the participants, the averages of the Z scores were calculated. Since the sentences forming each sub-dimension consist of positive sentences that define the sub-dimension, the averages related to the factors were calculated by dividing the total of the Z scores by the number of sentences. For the weighted average related to the sub-dimensions, the factor averages were multiplied by the number of participants in the factor, and these products were summed across all factors and then divided by the total number of participants.

The explanations given by participants regarding the statements they agreed with most and least were subjected to content analysis, allowing for an in-depth evaluation of the factors.

Research Ethics

The ethical approval for the research was granted by Mimar Sinan Fine Arts University with protocol number E-15207191-050.06.01-134755.

FINDINGS

A principal component analysis was conducted to examine whether there is a common tendency in the abductive reasoning abilities of graduate students in the context of qualitative research. The analysis revealed that the factor loads related to the participants were grouped under four factors. Rotations of 10 degrees in the negative direction between Factor 1 and Factor 3, and 14 degrees in the positive direction between Factor 3 and Factor 4, were made to observe the distributions of the factors. The findings related to the factor loads are presented in Table 4.

Table 4. Participant Factor Loads

Participant	Factor 1	Factor 2	Factor 3	Factor 4
MD11	**0.76X**	0.34	0.30	-0.09
FD12	0.25	-0.36	**0.83X**	0.03
FD33	**0.75X**	-0.50	0.12	-0.05
FD34	**0.83X**	-0.19	-0.33	-0.00
FD35	-0.13	**0.73X**	0.06	0.37
FD16	0.00	**0.86X**	-0.11	0.04
MY17	0.45	**0.72X**	0.09	-0.23
FD28	**0.75X**	-0.21	-0.46	0.04
FD19	0.44	-0.11	-0.21	**0.70X**
MY110	**0.70X**	0.42	0.25	0.25
FD411	0.17	0.25	-0.17	**-0.69X**
Explained Variance	31%	24%	11%	11%

Upon examining Table 4, it is observed that participants with factor loads above the significance value are grouped under four factors. Of the 11 graduate students who participated in the research, five are grouped under Factor 1, three under Factor 2, one under Factor 3, and two under Factor 4. The total variance is explained by Factor 1 at 31%, Factor 2 at 24%, Factor 3 at 11%, and Factor 4 at 11%. The Q statements, according to the rankings of the participants, the priority order of the statements, and their Z scores, are presented in Table 5.

Table 5. Z Scores and Importance Rankings in Factors for Q Statements

Q Statements	Harmonious Creative		Preferring		Descriptive		Exploratory Creative	
	Z	Rank*	Z	Rank*	Z	Rank*	Z	Rank*
1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	0.16	7	0.70	4	0.77	5	-1.02	12
2. When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory.	-1.03	12	0.71	3	-1.54	14	1.54	2
3. When collecting data, if I find surprising data outside the theoretical framework of the research, I focus on this surprising data to expand the theory or create a new theory.	0.75	5	-0.73	10	0.00	9	0.02	5
4. Before analyzing the data, I decide which theoretical perspective could better explain	0.06	8	1.86	1	-0.77	12	-1.54	14

the research and conduct the analysis according to this framework.								
5. When analyzing the data I collected, I attempt to validate the theory on which the study is based.	-1.80	14	-0.93	11	0.00	9	-0.52	11
6. In data analysis, I try to find implicit meanings and create new assumptions related to the research problem.	1.51	1	0.23	6	1.54	2	2.04	1
7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.	-1.03	12	1.63	2	-0.77	12	-0.22	8
8. When analyzing the data, I utilize frequently repeated expressions.	0.79	4	-0.00	8	0.77	5	1.00	3
9. For the data analysis, I base my approach on the assumption that I find suitable from the many hypotheses previously formed about the problem.	-0.68	10	-1.18	13	0.00	9	-1.04	13
10. When I find new and surprising data, I formulate a new hypothesis for the research to explain the data.	0.70	6	-0.93	12	0.77	5	0.00	7
11. I code the data I collected under the headings of the questions I asked.	0.93	2	0.22	7	0.00	9	-0.48	10
12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	0.86	3	0.25	5	-1.54	14	-0.48	10
13. Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses.	-1.26	13	-0.45	9	1.54	2	0.00	7
14. In data analysis, I code without basing it on any theory.	0.02	9	-1.38	14	-0.77	12	0.50	4

* It shows the participants' order of importance for the item.

In naming the factors, the rankings of Q statements by the participants forming the factors were considered. For participants grouped under Factor 1, the statements they agreed with most were: (1) In data analysis, I try to find implicit meanings and create new assumptions related to the research problem, (2) I code the data I collected under the headings of the questions I asked, (3) When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research, (4) When analyzing the data, I utilize frequently repeated expressions.

Examining these statements, it is seen that while participants have a high tendency towards creative abductive reasoning, they also show a tendency towards some statements related to over-coded abductive reasoning. Therefore, this factor has been named "Harmonious Creative."

For participants grouped under Factor 2, the highest agreed upon statements were: (1) Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework, (2) To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework, (3) When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory, (4) I try to code the data I collected for the research in accordance with the theoretical framework of the study. These statements indicate a tendency towards under-coded abductive reasoning. Hence, this factor is named "Preferring."

For participants grouped under Factor 3, the highest agreed upon statements were: (1) Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses, (2) In data analysis, I try to find implicit meanings and create new assumptions related to the research problem, (3) I try to code the data I collected for the research in accordance with the theoretical framework of the study, (4) When analyzing the data, I utilize frequently repeated expressions. These statements indicate a tendency towards over-coded abductive reasoning. Therefore, this factor is named "Descriptive." For participants grouped under Factor 4, the highest agreed upon statements were: (1) In data analysis, I try to find implicit meanings and create new assumptions related to the research problem, (2) When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory, (3) When analyzing the data, I utilize frequently repeated expressions, (4) In data analysis, I code without basing it on any theory. These statements indicate a tendency towards under-coded and creative abductive reasoning. Thus, this factor is named "Exploratory Creative."

To interpret holistically the abductive reasoning tendencies of participants named Harmonious Creative, Preferring, Descriptive, and Exploratory Creative, and to understand which sub-theme of abductive reasoning is prominent in each group, the average Z scores for each sub-theme and overall, for the groups have been calculated. The relevant findings are presented in Table 6.

Table 6. Average Z Values Related to Abductive Reasoning Tendencies

Factor / Theme	Harmonious Creative (5 People)	Preferring (3 People)	Descriptive (1 People)	Exploratory Creative (2 People)	Weighted Average
Over-Coded	0.02	-0.0025	0.385	-0.255	-0.003
Under-Coded	-0.258	0.514	-0.308	-0.252	0.005
Creative	0.768	-1.456	0	0.416	0.028

Upon examining Table 6, it can be seen that all participants exhibit the highest tendency towards creative abductive reasoning, followed by under-coded abductive reasoning, and finally, over-coded abductive reasoning. When considering the participant groups, it is observed that those in the Harmonious Creative and Exploratory Creative groups show a high tendency towards creative abductive reasoning; participants in the Preferring group have a high tendency towards under-coded abductive reasoning; and those in the Descriptive group show a high tendency towards over-coded abductive reasoning.

Pairwise comparisons have been made to see the distinctions between the groups, and the statements with the highest difference (Z scores above 1) are presented in Table 7.

Table 7**.** Divergences Between Factors

Factors	Sentence	Difference in Z scores
Harmonious Creative vs Preferring	10. When I find new and surprising data, I formulate a new hypothesis for the research to explain the data.	1.635
	3. When collecting data, if I find surprising information outside the theoretical framework of the research, I focus on this surprising data to expand the theory or create a new theory.	1.469
	14. In data analysis, I code without basing it on any theory.	1.396

	6. In data analysis, I try to find implicit meanings and create new assumptions related to the research problem.	1.286
Harmonious Creative vs Descriptive	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	2.398
Harmonious Creative vs Exploratory Creative	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.	1.602
	11. I code the data I collected under the headings of the questions I asked.	1.405
	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	1.337
	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	1.181
Preferring vs Descriptive	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.	2.625
	7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.	2.398
	2. When analyzing the data I collected, I choose one of the theories related to the data and conduct the analysis based on that theory.	2.244
	12. When coding the data I collected, I also consider codes that do not fit the theoretical framework of the research.	1.787
Preferring vs Exploratory Creative	4. Before analyzing the data, I decide which theoretical perspective could better explain the research and conduct the analysis according to this framework.	3.397
	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	1.721
	7. To analyze the data, I select a predetermined theoretical framework and interpret the data in accordance with this framework.	1.651
Descriptive vs Exploratory Creative	1. I try to code the data I collected for the research in accordance with the theoretical framework of the study.	1.788
	13. Before collecting data, I formulate hypotheses, then collect and analyze data in line with these hypotheses.	1.537
	9. For the data analysis, I base my approach on the assumption that I find suitable from the many hypotheses previously formed about the problem.	1.042

Upon examining Table 7, it is observed that participants in the Harmonious Creative group differ from those in the Exploratory Creative group in terms of statements related to over-coded abductive reasoning. Meanwhile, participants in the Preferring and Descriptive groups differ in statements related to creative abductive reasoning. When examining the statements where participants in the Preferring group differ most from those in the Descriptive group, it is found that they diverge in statements related to under-coded abductive reasoning. However, participants in the referring group also differ from those in the Exploratory Creative group in statements related to over-coded abductive reasoning. Lastly, it is noted that participants in the Descriptive group differ from those in the Exploratory Creative group in statements related to over-coded abductive reasoning.

The findings related to the explanations given by participants for the statements they agreed with most and least are presented below, based on the factors.

Harmonious Creative

The Harmonious Creative factor is comprised of five participants (MD11, FD33, FD34, FD28, MM110). Participants identified as Harmonious Creatives indicate that data analysis in qualitative research assists in creating new perspectives and hypotheses, therefore, surprising data with the potential to illuminate different aspects of the research problem are important for achieving original results and should not be excluded. Some opinions from participants on this topic are as follows:

When coding, the different codes we obtain can reveal aspects of the research problem that we hadn't noticed before. This can lead to richer results. Therefore, I think we should not immediately exclude these codes (MD11).

Participants under this factor also note that in the data analysis process, identifying frequently occurring expressions is essential, and contributing to the literature by basing on a specific theory is important.

I believe that the most crucial dimension in qualitative research is towards data analysis. Repeated data and determined question headings are significant for a meaningful and consistent data set (MD34).

Therefore, the surprising nature of the data, examining the implicit and deeper meanings beneath it, can be seen as valuable for providing a new perspective to the research topic, contributing differently to the literature, and potentially charting alternative paths for subsequent similar research (MM110).

Preferring

The Preferring factor includes three participants (FD35, FD16, MM17). Participants in this factor believe that basing data analysis on a theoretical foundation will solidify the scientific basis of the research, enhance the clarity of the data, and create awareness about the focus of the data collection process. Some opinions from participants on this topic are as follows:

I think that conducting the analysis according to a specific theoretical framework will simplify the process and better serve the problem and sub-problems of the research. Additionally, analyzing according to the theoretical framework also enables a more meaningful, consistent, and systematic interpretation of the data (FD16).

Because conducting analysis within a certain framework will prevent the research from straying off focus. Also, the narrow space that this framework creates for me both guides me in what to do and imposes a positive limitation on my codes. This makes it easier to establish relationships between the created codes (MM17).

Descriptive

The Descriptive factor consists of one participant (FD12). The participant under this factor emphasizes that in order to achieve the objectives of qualitative research, it is necessary to not deviate from the scope of the research and that the research boundaries should be predetermined and not exceeded. The participant's opinion is presented below:

Although qualitative research types vary, the framework of scientific research to be conducted by the researcher should be predefined and its boundaries established. Otherwise, bias can occur. If the scope of the study expands too much, it will not be possible to achieve the necessary depth to explain the 'how' (FD12).

Exploratory Creative

The Exploratory Creative factor includes two participants (FD19, FD411). Participants in this factor state that associating the obtained data with a selected theoretical framework will make the results more meaningful. However, they also highlight the importance of codes that fall outside the theoretical framework of the research, as they provide opportunities to present different perspectives on the research problem and expand the research question. They also point out that adhering strictly to a single theory during data analysis can lead to overlooking potential new findings. Therefore, they focus on the presence of different expressions that will diversify the research findings, rather than repeatedly used expressions. The participants' views on the topic are as follows:

I take note of the codes that emerge, thinking that they will contribute to the study from a different angle (FD411).

Conducting data analysis in research based only on predetermined assumptions can lead to the neglect of potential new findings (FD19).

DISCUSSION AND CONCLUSION

Abductive reasoning is the outcome of a process of forming insights related to observed situations or events. Considering this in the context of qualitative research, it would not be incorrect to say that science is not only about observed phenomena but also significantly involves the human mind and logic (Plutynski, 2011). Although assumptions made with such insight may not definitively explain the research problem, they are important for the development of scientific knowledge. Therefore, researching the tendencies of graduate students toward abductive reasoning in qualitative data analysis is considered significant in understanding the needs of these new researchers

to gaining new perspectives and foster creative and innovative thinking within the context of qualitative data analysis.

The results of the study show that graduate students have high tendencies towards creative abductive reasoning and low tendencies towards over-coded abductive reasoning in the context of qualitative research. The high tendency for creative abductive reasoning in qualitative data analysis may imply that the researcher has a heightened awareness in discerning relationships and connections that are not obvious or apparent. Indeed, Meyer and Lunnay (2012) note that such reasoning allows the researcher to think about something in a different context, create new ideas, and present unexpected relationships. In addition, in the context of qualitative research, graduate students have been categorized under four factors based on their abductive reasoning characteristics. Given the direction of students' qualitative research as well as sub-themes of abductive reasoning, these factors have been called Harmonious Creative, Preferring, Descriptive and Exploratory Creative.

The groups that score high in tendencies to engage in creative abductive reasoning are the Harmonious Creatives and Exploratory Creatives. Participants in the Harmonious Creative factor score highly in tendencies towards creative abduction, but also show a tendency towards over-coded abduction when faced with qualitative data. In qualitative data analysis, they are used to focus on surprising or novel data for new and creative results. But in the end, after all this is done, their findings tend to be based on existing theories. The trends of the researchers in this group called Harmonious Creative reflect the attributes of adaptable creatives described by Kim and Pierce (2020). In this section, these authors define adaptable creative thinkers as those more capable of producing original ideas yet seen against existing paradigms and with the ability to take an existing technique or solution and modify it for a new scenario. Looking at it from this angle, Harmonious Creative researchers are probably going to come up with new findings that fit contemporary paradigms.

There are also in the Exploratory Creative factor people with high tendencies towards creative abductive reasoning. However, participants in this group also exhibit tendencies towards under coded abductive reasoning. This indicates that participants identified as Exploratory Creative relate data to a chosen theoretical framework yet tend to use codes that go beyond the theoretical limits of the research to present different perspectives and broaden the research problem. Exploratory Creatives, defined as such, can be said to approach problems from an unusual perspective and are more flexible in basing data on a theory compared to Harmonious Creatives. They tend to base their findings on one of the theories they can substantiate. Kim and Pierce (2020) mention that individuals they defined as innovative creatives put forward innovative solutions and tend to do things differently. Thus, it is possible to say that Exploratory Creative researchers exhibit characteristics similar to innovative creative thinkers.

Creative abductive reasoning is used in qualitative data analysis to understand and explain unexpected findings. In this context, it is important for a researcher to be open to surprising data rather than strictly adhering to a specific theoretical framework (Timmermans & Tavory, 2022). This approach enables the researcher to develop a more creative and in-depth understanding that transcends existing theoretical structures. However, it is quite natural for graduate students, who are new to the research process and have conducted a limited number of qualitative studies, to show a tendency to adhere to a certain theory during data analysis. Ertugay (2019) states that competence in qualitative research develops as one continues to conduct qualitative studies, describing it as a dynamic process that allows for continual improvement. In this context, it is possible to say that Harmonious Creative and Exploratory Creative researchers conduct data analysis with a certain degree of flexibility. Timmermans and Tavory (2022) describe this as 'controlled flexibility.' They define this term as based on a theoretical framework while also being receptive to unexpected findings emerging from the data. Thus, the researcher can develop a richer and more detailed understanding. A fundamental criticism in qualitative data analysis is the tendency of the researcher to evaluate data only within the theoretical framework in which the research is structured and to neglect data that is not directly connected to the phenomena or events (Coryn et al., 2011). Kuhn (2021) emphasizes that innovative creativity in science is rare and that most scientists are fundamentally traditional. He points out that scientific research is framed within the assumptions of an existing paradigm and is more a type of repetitive work aimed at deepening the existing paradigm rather than laying the groundwork for an innovation. Therefore, it is plausible to say that Exploratory Creative researchers might have the potential to discover unusual, exceptional, or strange findings that could facilitate a paradigm shift.

In the Descriptive factor, participants exhibit a high tendency towards over-coded abductive reasoning. In over-coded abductive reasoning, there is an automatic acceptance based on common sense (Eco, 1983). The researcher quickly infers a conclusion based on existing knowledge and experience. In the context of qualitative data analysis,

Descriptive researchers with a high tendency towards over-coded abductive reasoning will search for codes in the data set based on themes they have developed related to the research question. It might be thought that sticking to a theory during qualitative data analysis does not lead to abductive reasoning. However, Coffey and Atkinson (1996) argue that theories should be considered as heuristic tools, and the regularities created by theories in form or content can be associated with ideas that go beyond these data. Therefore, conducting the analysis process while adhering to a theory can also enable the expansion of scientific knowledge. In this context, the importance of researchers' knowledge about theories or models becomes evident. Fundamentally, abductive reasoning aims to present new information by relying on existing knowledge and following clues (Patakorpi, 2006). From this perspective, it is important for Descriptive researchers to utilize their knowledge of theoretical information and models and integrate this knowledge into the analysis process.

The Preferring factor consists of participants showing a tendency towards under-coded abductive reasoning. In under-coded abductive reasoning, there is also a choice based on previous knowledge and experience. However, new interpretive connections are made to approach the event or phenomenon. Therefore, this type of abductive reasoning is not a mechanical or automatic process. It involves the researcher using previous knowledge and inferences to make a new interpretation. However, since it includes a choice process based on previous inferences, it offers a limited range of options (Bertilsson, 2004). In the context of qualitative data analysis, Preferring researchers will carry out data analysis by choosing the most reasonable theoretical framework. Here, theories are used as tools that provide reference points for learning and give meaning to experiences, as Gustavsen (1996) pointed out. Lipscomb (2012) states that conducting sequential interviews in the data collection process of a qualitative study or observing a participant in sequential situations plays a significant role in validating hypotheses proposed through abductive reasoning. Thus, such sequential analysis can be used to check the validity of the selected most reasonable hypothesis.

In the qualitative data analysis process, considering the similar tendencies of participants grouped into four categories based on their abductive reasoning tendencies, it can be said that they could be further categorized into two groups in terms of reasoning methods. Harmonious Creative researchers and Exploratory Creative researchers with high tendencies towards creative abductive reasoning use similar reasoning methods in the process of qualitative data analysis, while Descriptive researchers and Preferring researchers also have similar reasoning methods. Magnani (2009) states that abductive reasoning is conducted in a theory-based and/or guided manner. He defines theory-based reasoning as forming hypotheses that explain an observation or phenomenon, and guided reasoning as a non-theoretical reasoning method aiming to create meaning between past and new experiences. From this perspective, it can be said that Harmonious Creative and Exploratory Creative researchers employ guided abductive reasoning methods, while Descriptive and Preferring researchers use theory-based reasoning.

In conclusion, encouraging graduate students to use abductive reasoning in qualitative data analysis will contribute to the production of creative and innovative thinking. Acting with a tendency towards abductive reasoning in qualitative data analysis will increase the questionable evidence about reality, and this will likely enhance the confidence of graduate students, who are new researchers, in their pursuit of truth. Although the results of the research are limited to graduate students, they provide an important perspective in identifying different abductive reasoning tendencies in qualitative data analysis processes. Based on these results, the following recommendations can be offered.

Implications, and Suggestions for the Future Research

Abductive reasoning can enhance the capacity for exploratory and creative thinking, and thereby the likelihood of identifying surprising data in qualitative data analysis, facilitating the development of scientific knowledge. Therefore, it is important to develop these skills in graduate students. In this context, to enhance graduate students' tendencies towards abductive reasoning and increase their competencies in qualitative data analysis, it is advisable to conduct qualitative research courses in graduate programs in a practical manner.

The study employed Q methodology, which enables an in-depth examination of subjective opinions. Therefore, conducting new studies using Q methodology to determine tendencies towards the qualitative research process is thought to be significant in illuminating the qualitative research process.

It can be said that there is a need for new research to better understand the abductive reasoning process. Replicating this research with different study groups, comparing the results emerging from different study groups, and discussing the similarities or differences are seen as important.

Conducting studies to develop inventories related to the abductive reasoning process can more clearly reveal researchers' tendencies towards this type of reasoning. It would also contribute to determining the relationship of this reasoning type with different variables attributed to scientific researchers.

Limitations

In this study, the tendencies of graduate students towards abductive reasoning in the context of qualitative research were identified using Q methodology. To ensure reliability in Q methodology, studies should be conducted to assess how consistent the Q statements are across different samples. Obtaining empirical evidence is critically important for establishing confidence in the reliability and consequently the validity of Q methodology. This represents a limitation of the study.

Statements of Publication Ethics

The ethical approval for the research was granted by the …….

Researchers' Contribution Rate

Authors	Literature review	Method	Data Collection	Data Analysis	Results	Conclusion
Author 1's name	☒	☒	☒	☒	☒	☒
Author2's name	☒	☒	☒	☒	☒	☒
Author 3's name	☒	☒	☒	☒	☒	☒

Conflict of Interest

There are no conflicts of interest.

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Examining the Knowledge Levels of Middle School Students Regarding Kırşehir's Cultural and Historical Values in Terms of Various Variables

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Abstract

This study was conducted to reveal the knowledge levels of middle school students regarding Kırşehir's cultural and historical values based on variables such as gender, grade level, parental education status, and whether they travel with their families or not. The study group consisted of 163 middle school students. The quantitative research method using a survey model was employed in the study. The data were obtained by administering the Kırşehir tourism values knowledge test, which was developed by the researchers with the support of expert teachers and measurement and evaluation specialists. During the pilot application phase, nine test items with item discrimination indices below 0.30 were excluded from the final test, leaving a total of 18 test items. The data were analyzed using independent samples t-test, one-way analysis of variance (ANOVA), and Scheffe multiple comparison test. According to the analyzed data, there was a significant difference in the knowledge levels of middle school students regarding the cultural and historical values of Kırşehir based on gender (favoring female students), parental education level (high school or university), and whether they traveled with their families. However, no significant difference was found based on grade levels. The study was conducted using the quantitative research method, and it is recommended that in-depth studies be conducted in line with the qualitative paradigm.

Keywords: Kırşehir, middle school students, cultural and historical values, knowledge level.

Ortaokul Öğrencilerinin Kırşehir'in Kültürel ve Tarihi Değerlerine İlişkin Bilgi Düzeylerinin Çeşitli Değişkenler Açısından İncelenmesi

Öz

Bu çalışma, ortaokul öğrencilerinin Kırşehir'in kültürel ve tarihi değerlerine ilişkin bilgi düzeylerini ortaya çıkarmak amacıyla yapılmıştır. Çalışma grubu 163 ortaokul öğrencisinden oluşmaktadır. Araştırmada tarama modelinin kullanıldığı nicel araştırma yöntemi kullanılmıştır. Veriler, araştırmacılar tarafından uzman öğretmenler ve ölçme ve değerlendirme uzmanlarının desteğiyle geliştirilen Kırşehir turizm değerleri bilgi testi uygulanarak elde edilmiştir. Pilot uygulama aşamasında, madde ayırt edicilik indeksi 0.30'un altında olan dokuz test maddesi son testten çıkarılmış ve geriye toplam 18 test maddesi kalmıştır. Veriler, bağımsız örneklem t testi, tek yönlü varyans analizi (ANOVA) ve Scheffe çoklu karşılaştırma testi kullanılarak analiz edilmiştir. Analiz edilen verilere göre, ortaokul öğrencilerinin Kırşehir'in kültürel ve tarihi değerleri hakkındaki bilgi düzeylerinde kız cinsiyeti, anne ve baba eğitim düzeyi lise veya üniversite olan öğrenciler ve aileleri ile seyahat etme durumları lehine anlamlı bir farklılık bulunurken, sınıf seviyesine göre anlamlı bir fark bulunamamıştır. Çalışma nicel araştırma yöntemi kullanılarak gerçekleştirilmiş olup, nitel paradigma doğrultusunda derinlemesine araştırmaların yapılması önerilmektedir.

Anahtar kelimeler: Kırşehir, ortaokul öğrencileri, kültürel ve tarihi değerler, bilgi düzeyi

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INTRODUCTION

In the 21st century, the changes and transformations in individual, social, and societal fields, especially technological developments, have led people and communities to travel intentionally and knowingly. This situation causes the development and diversification of the tourism sector.

Tourism is defined as a type of activity that involves individuals traveling from one place to another for any purpose (Bayer, 1992). It is also expressed as travels with unique features that include staying in one place for a certain period without being related to employment (Vanhove, 2002). When the literature related to tourism is examined, it is seen that the definitions regarding the field involve constant interaction with the economic, cultural, social, and natural environment, including transportation, food and beverage, accommodation, shopping, entertainment, and all services during the trip (Tuyluoğlu, 2003). Furthermore, trips made for purposes such as entertainment, relaxation, recognition, sightseeing, participation as a spectator or in sports activities, and increasing knowledge and experience are referred to as tourism (Doğanay & Zaman, 2021). Berber (2003) approaches the issue from a different perspective and explains tourism as situation that arises from meeting the needs of people who temporarily stay in places they have traveled from their permanent residences. Karabulut and Kaynak (2016) describe tourism as a travel activity for vacation, rest, entertainment, culture, and belief, which constitute the escape and direction of people from the places they are in. From the definitions mentioned above, it is seen that it is not easy to explain a complex and versatile activity like tourism with only one definition. This situation arises from the differences in the authors' perspectives and priorities in defining tourism. Therefore, this difference is reflected in the definitions of tourism (Aydın, 2012). This situation is consistent with the view that "definitions have emerged in this context because tourism was previously considered only from an economic dimension, but over time, the social dimension of tourism has also emerged, and thus definitions have diversified" (Berber, 2003).

In today's world, due to various reasons such as the increase in people's welfare levels, technological developments in transportation and communication, the desire of individuals to spend their leisure time (Özdemir & Kervankıran, 2011), and the emergence of travel freedom with globalization, both domestic and international tourism activities and participation rates are constantly increasing (Milne & Ateljevgc, 2001). These activities produce positive economic results in the countries, regions, or destinations where tourism develops and contribute to employment (Akpulat, 2020). According to Gunn (1988), attractiveness and the potential for job creation are one of the most important elements of tourism. Tuyluoğlu (2003), on the other hand, approached the issue from a different perspective and stated that tourism is a balance factor in national income distribution and an important employment source that contributes to the development of regions outside the industrial centers. The tourism sector is seen as a service area that strengthens national economies and has a significant impact on solving some of the problems in the economy in today's world (Gülüm & Artvinli, 2010). In this context, considering the development and diversity of different tourism areas in the world, it can be seen that Turkey is quite rich in terms of its tourism resources and diversity and is one of the leading countries in the world tourism with its income in this field (Karakuş, Çepni, & Kılcan, 2011).

Turkey, which has hosted various civilizations from ancient times to the present day and carries the traces of different civilizations in almost every corner, has great potential in terms of cultural tourism (Bandeloğlu, 2015). According to Kılcan & Çetin (2017), the remnants of civilizations, the traditions, and customs of the relevant societies, their lifestyles, types of food, music, and entertainment activities are among the prominent elements in cultural tourism. According to Richards (2014), cultural tourism includes people's visits to cultural attractions or their participation in events related to them. Although coastal tourism in our country comes to mind first when tourism is mentioned, the desire of individuals to seek a different activity plays an important role in the development of cultural tourism activities. As tourism activities increase in the inland tourism areas of Turkey that are important in terms of historical and natural beauties, spatial changes occur, and as a result, the impact of tourism on the environmental and cultural structure continues to increase (Özdemir & Kervankıran, 2011). Cities that can be evaluated in terms of cultural tourism stand out with their unique qualities due to the different tourist destinations of these cities. As a result of these qualities, even a concept, phenomenon, or word about the city can provide sufficient information about its identity (Karabulut & Kaynak, 2016).

The level of knowledge of the people living in cities regarding the tourism values of the places they live and the natural, historical, and cultural tourism values of the region is considered important in the preservation and development of these values. In order to achieve this, efforts are made to raise awareness through the gains in the

lessons taught in educational institutions from a young age. For example, the social studies lesson, which plays a leading role in this regard, aims to raise awareness and develop protection consciousness of natural, historical, and cultural assets in the environment where students live by including different gains in the curriculum, such as "investigating and giving examples of elements that reflect national culture in their family and surroundings", "comparing cultural elements from different countries with the cultural elements of our country", "realizing the significant contributions of Anatolian and Mesopotamian civilizations to human history by starting from their tangible remnants", "introducing natural assets and historical places, objects, and works in their surroundings", "determining the similar and different elements between the cultural features of various regions of our country and the cultural features of the environment they live in by comparing them", "analyzing the role of cultural elements in people living together", "evaluating the historical development of cultural elements in daily life", and "explaining the importance of tourism in international relations". In this context, when the studies in the literature are examined, it is seen that various studies have been conducted to examine individuals' information (Çetin & Gürgil, 2014; Akkaya, 2017;Aksoy, Karakuş & Çetin, 2013; Bahtiyar Karadeniz, Sarı & Kabacık, 2018; Ablak, Dikmenli & Çetin, 2014; Torun & Yıldırım, 2022), awareness (Akkuş, Karaca & Polat, 2015; Akpirinç & Mancı, 2019; Karaca, Şahbudak, Akkuş & Işkın, 2017;), opinion (Karakuş, Çepni & Kılcan, 2011; Sidekli & Karaca, 2013) and interests (Dinç, Erdil & Keçe, 2011;) towards the protection of natural, historical, and cultural tourism values of the regions where they live. Therefore, this study stands out from other studies as it is a current study that aims to examine the knowledge of middle school students about the tourist attractions in Kırşehir, which has many historical and cultural riches.

The problem statement of the current research is determined as "What is the level of knowledge of 7th and 8th grade students continuing their education in Kırşehir about its cultural and historical values?" It is believed that male students are more likely to travel frequently, students in higher grades have higher cognitive development, the parents' education levels support the child's historical and cultural awareness, and students' level of interest varies as the number of places they travel to increases. The sub-problems of the study aim to determine whether the total knowledge scores of middle school students regarding Kırşehir's cultural and historical values differ according to their gender, grade levels, their families' vacationing status, and their parents' education levels.

METHOD

Research Model

This study was designed using a quantitative research method and a cross-sectional survey model to examine the level of knowledge of middle school students in Kırşehir regarding its cultural and historical values across various variables. In this study, the aim was to identify the existing knowledge of middle school students without altering the current conditions. Therefore, a cross-sectional survey model was utilized. The survey model aims to describe the event, individual, or object under investigation in its existing state. The purpose of this model is to define the current conditions in their natural form without any modification (Karasar, 2017). The survey model is a quantitative research design in which data is obtained by applying a survey to a sample group or the entire population in order to reveal the attitudes, opinions, behaviors, or characteristics of a population (Creswell, 2017).

Sample Group

The study group consisted of a total of 163 seventh (73 individuals) and eighth grade (90 individuals) students, 87 of whom were male and 76 were female, who were continuing their education in a middle school located in the central district of Kırşehir province, determined using an appropriate sampling method. The appropriate sampling method was utilized in determining the study group. This method is known to provide researchers with economy and practicality during the application phase of their research (Yıldırım & Şimşek, 2021).

Data Collection Tool

For data collection purposes in this study, the Kırşehir cultural and historical tourism values knowledge test developed by the researchers was used. In the development phase of this test, 27 items were first created and 4 options were determined for each item. The opinions of 3 subject matter experts and 2 measurement experts were taken into account in the creation of the test items. In addition, the items created were examined by 2 Turkish language teachers in terms of semantic properties and grammatical proficiency. To ensure the applicability of the data collection tool, a pre-application was conducted on a group of 287 individuals in a middle school identified as the pilot school, to examine the statistical data of the items prepared. Subsequently, 13 data collection tools were removed from the pilot application data set because they were marked incorrectly or incompletely. Thus, 274

knowledge test data from the pilot application data set were analyzed, and the item difficulty and item discrimination indices for these analyses are presented in Table 1.

Table 1. Statistical Data of The Items in the Kırşehir Tourism Values Knowledge Test.

Items	Item distinctiveness index (rjx)	Item difficulty (pj)	Items	Item distinctiveness index (rjx)	Item difficulty (pj)
1	0,14	0,09	15	0,62	0,68
2	0,10	0,09	16	0,14	0,17
3	0,68	0,64	17	0,64	0,69
4	0,61	0,67	18	0,69	0,69
5	0,12	0,16	19	0,62	0,68
6	0,18	0,91	20	0,08	0,16
7	0,52	0,73	21	0,54	0,68
8	0,14	0,11	22	0,65	0,56
9	0,41	0,74	23	0,75	0,57
10	0,56	0,72	24	0,47	0,82
11	0,57	0,70	25	0,54	0,63
12	0,14	0,18	26	0,48	0,62
13	0,62	0,68	27	0,20	0,93
14	0,50	0,73			

Based on the information provided above, it has been decided to remove 9 questions (1, 2, 5, 6, 8, 12, 16, 20, and 27) from the measurement tool, considering the item discrimination index and item difficulty values, to ensure the validity and reliability of the test. When the literature is reviewed, Gençtürk (2009) mentions that when the item difficulty index approaches 0, the item is considered difficult, and when it approaches 1, the item is considered easy. Turgut & Baykul (2019) also state that an item difficulty value between 0-0.39 is difficult, between 0.40-0.69 is moderately difficult, and between 0.70-1 is easy. Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel (2010), on the other hand, suggest that the item difficulty index should be around 0.50, items with discrimination indexes of 0.20 and below should be removed from the test, items between 0.20-0.29 should be further developed and included in the test again, and items with values of 0.30 and above are considered good and can be used without any further processing. Within this context, after the necessary items were removed from the measurement tool based on the aforementioned criteria, 18 questions were remaining in the knowledge test.

Data Collection

The researchers visited a middle school that had been previously selected using appropriate sampling methods and conducted a preliminary interview with the school administration. During the interview, the researchers shared information with the school administration about the purpose of the research and how long it would take to complete. After the school administration scheduled a suitable time for the research, the researchers entered different classrooms and provided information to the students about the purpose, importance, and implementation of the research. They also reminded the students that they had the freedom not to participate if they wished. The implementation phase of the study was completed in approximately 15 minutes. The researchers then left the implementation environment, promising to inform the students and school administration about the results of the study.

Data Analysis

Before proceeding to the analysis phase of the data obtained from the participants, the normal distribution of the data was checked. To check for normality, the Kolmogorov-Smirnov test was applied to the data obtained from the implementation. The Kolmogorov-Smirnov test is a precise statistical technique used to examine the normality of data (Strunk & Mwavita, 2021; Mertler & Vannatta, 2016). As a result of the Kolmogorov-Smirnov normality test performed on the data set, it was concluded that the data set (p=0.087) showed normal distribution. Then, the necessary analyses were performed on the normally distributed data set using t-tests and ANOVA statistics for independent groups. To determine which variable the statistically significant results favored, post hoc tests, specifically the Scheffe test, were used.

Research Ethics

Participation was carried out entirely on a voluntary basis, and no information regarding their identities was requested from the students. Furthermore, necessary ethical approval was obtained from the university, and the required information was provided to the school in order to utilize the data collection tool.

FINDINGS

Findings related to the first sub-problem

The independent samples t-test results to determine whether there was a significant difference in the average scores of middle school students on the knowledge test related to Kırşehir's cultural and historical values according to gender variable are presented in Table 2.

Table 2. Results of the t-test for Total Scores of the Knowledge Test Related to Kırşehir's Cultural and Historical Values According to Students' Genders.

Gender	n	$\bar{x}$	S	sd	t	P
Male	87	9,09	3,55	,38	2,638	,009
Female	76	10,71	4,28	,49		

When Table 2 is examined, it is observed that the arithmetic mean of the total scores of female students ($\bar{x}$ =10.71) on the knowledge test related to Kırşehir's cultural and historical values is higher than the arithmetic mean of male students' scores ($\bar{x}$ =9.09). The relationship between students' total scores on the knowledge test related to Kırşehir's cultural and historical values and the gender variable was examined, and a statistically significant difference was found (t=2.638, p<.05). Based on these data, it can be interpreted that the gender factor is significant in students' knowledge of Kırşehir's cultural and historical values, and that female students have higher knowledge of Kırşehir's cultural and historical values than male students.

Findings related to the second sub-problem

The independent samples t-test results regarding whether there is a significant difference in the average scores of middle school students on the knowledge test related to Kırşehir's cultural and historical values according to the grade level are presented in Table 3.

Table 3. Independent Samples t-test Results for Total Scores of Students on the Knowledge Test of Kırşehir's Cultural and Historical Values by Grade Level.

Grade	n	$\bar{x}$	S	sd	t	P
7^{th} grade	73	10,42	3,45	,40	1,680	,095
8^{th} grade	90	9,37	4,33	,46		

When Table 3 is examined, it is observed that the arithmetic mean of the total scores of the students attending seventh grade in the knowledge test related to Kırşehir's cultural and historical values ($\bar{x}$ =10.42) and the arithmetic mean of the scores obtained by the students attending eighth grade from the knowledge test ($\bar{x}$ =9.37) can be seen. The relationship between the total scores of the students in the knowledge test related to Kırşehir's cultural and historical values and the variable of grade level has been examined, and no statistically significant difference has been found (t=1.680, p>,05). Based on these data, it can be interpreted that the grade level did not cause any differentiation in the students' knowledge of Kırşehir's cultural and historical values.

Findings related to the third sub-problem

The independent groups' t-test results of whether the average scores of middle school students in the knowledge test related to Kırşehir's cultural and historical values differ significantly depending on whether they go on vacation with their families to touristic places or not are presented in Table 4.

Table 4. T-test Results of the Total Scores of the Students in the Knowledge Test Related to Kırşehir's Cultural and Historical Values Depending on the Variable of Going on Vacation with Family During Holidays

Situation of Going to Touristic Places with the Family	n	x̄	ss	sd	t	p
Yes	85	10,84	3,59731	,39018	3,463	,001
No	78	8,75	4,10949	,46531		

When Table 4 is examined, it can be seen that the arithmetic mean of the total scores of the students who went to tourist attractions with their families in relation to their knowledge test about Kırşehir's cultural and historical values (x̄ =10.84) is higher than the arithmetic mean of the scores of the students who did not go (x̄ =8.75). The relationship between the total scores of the students on the knowledge test about Kırşehir's cultural and historical values and they are going to tourist attractions with their families was examined, and a statistically significant difference was found (t=3.463, p<.05). Based on these data, it can be interpreted that the factor of going to tourist attractions with their families is significant in the students' knowledge about Kırşehir's cultural and historical values, and that students who go to tourist attractions with their families have higher knowledge about Kırşehir's cultural and historical values than those who do not.

The findings related to the fourth sub-problem

One-way analysis of variance (ANOVA) was used to determine whether there was a significant difference between groups based on the mother's education level. Before using the one-way ANOVA test, the homogeneity of the groups was tested by examining the Levene test results. According to the results of the Levene test, the groups are homogeneous (p=0.44, p>0.05). The data related to the one-way ANOVA test are presented in Table 5.

Table 5. One-way Analysis of Variance (ANOVA) Results Regarding the Total Scores of the Knowledge Test on Kırşehir's Cultural and Historical Values of the Students According to Their Mothers' Educational Level.

Variable				N	$\overline{X}$	S	
Mother's educational status	(1) Primary school			33	8,55	3,12	
	(2) Secondary school			54	8,69	3,91	
	(3) High			56	10,80	3,85	
	(4) University			20	12,35	4,03	
	Source of Variance	KT	Sd	KO	F	p	Difference Scheffe
	Between groups	315,546	3	105,182	7,434	,000	1-2, 1-4, 2-3, 2-4

According to Table 5, there is a significant difference between the total scores of students on the cultural and historical knowledge test of Kırşehir and the variable of mother's education level [F(3-159)=7.434; p<.05]. To determine which groups this difference exists between, the Scheffe multiple comparison tests were performed. According to these results, the average of the total scores of the students whose mother's education level is primary school on the knowledge test for the cultural and historical values of Kırşehir (x̄ =8.55) and the average of the total scores of the students whose mother's education level is secondary school on the knowledge test about the cultural and historical values of Kırşehir (x̄=8,69) and the average of the total scores of the students whose mother's education is university (x̄= 12,35) on the knowledge test on cultural and historical values of Kırşehir; A significant difference was found between the participants whose mother's education level was secondary school and those whose mother's education level was high school (x̄=10.80) and university, in favor of the participants whose mother's education level was high school and university. This finding can be interpreted as an increase in students' knowledge levels about the cultural and historical values of Kırşehir as their mothers' education levels increase.

Findings related to the fifth sub-problem

One-way analysis of variance (ANOVA) was used to determine whether there was a significant difference between groups based on father's education level. Before conducting the one-way ANOVA test, the homogeneity of the groups was tested and the Levene test data was examined. According to the results of the Levene test, the groups are homogeneous (p=0.267, p>0.05). The data for the one-way ANOVA test is presented in Table 6.

Table 6. One-way Analysis of Variance (ANOVA) Results for the Total Scores of Students' Knowledge Test on the Cultural and Historical Values of Kırşehir According to Their Father's Education Level.

Variable				N	$\bar{x}$		S
Father's Educational Status	(1) Primary School			25	7,68		4,01
	(2) Secondary School			48	8,25		2,94
	(3) High School			49	10,55		3,80
	(4) University			41	12,20		3,84
	Source of variance	KT	Sd	KO	F	p	Difference Scheffe
	Between groups	490,164	3	163,388	12,520	,000	1-3,1-4 2-3, 2-4
	In-groups	2075,001	159	13,050			
	Total	2565,166	162				

According to Table 6, there is a significant difference between the total scores of students on the Kırşehir's cultural and historical values knowledge test and the variable of father's educational level [F(3-159)=12,520; p<.05]. To determine which groups this difference exists between, the Scheffe multiple comparison tests were conducted. According to these results, the average of the total scores of the students whose father's education level is primary school on the knowledge test for the cultural and historical values of Kırşehir ($\bar{x}$ =7.68) and the average of the total scores of the students whose father's education level is high school on the knowledge test regarding the cultural and historical values of Kırşehir ($\bar{x}$=8.25) and the mean score of the students whose father's education level is university ($\bar{x}$= 12.20) on the knowledge test on cultural and historical values of Kırşehir; A significant difference was found between the participants whose father's education level is secondary school and those whose father's education level is high school and university, in favor of the participants whose father's education level is high school and university. This finding can be interpreted as an increase in students' knowledge level of Kırşehir's cultural and historical values as their fathers' educational level increases.

DISCUSSION AND CONCLUSION

Looking at the results of this study, which aimed to determine whether the knowledge levels of middle school students about Kırşehir's cultural and historical values differ according to various variables, it was found that female students have a higher level of knowledge about Kırşehir's cultural and historical values compared to male students. Other studies that determined the perceptions and attitudes of university students regarding cultural tourism in the literature also found significant differences according to gender (Dinç, Erdil & Keçe, 2011; Bahtiyar Karadeniz, Kabacık & Sarı, 2018). It is noteworthy that the significant differences were generally in favor of males in these studies. In this respect, it can be said that the results of the current research differ from some of the research results shown above. However, when the literature is examined, it is found that there is no significant difference between male and female students at the university level (Ablak, Dikmenli & Çetin, 2014), no significant difference was detected between 8th grade female and male students in terms of their knowledge about Nazilli's historical and cultural tourism (Akkaya, 2017), there is no significant difference between genders in terms of regional awareness of the local people (Akpirinç & Mancı, 2019), and there are studies that evaluated students' views on tourism and found no significant difference between gender and views on tourism (Karakuş, Çepni & Kılcan, 2011).

One of the other results of the study revealed that the grade level of the participants did not cause a significant difference in the average scores they obtained from the knowledge test about Kırşehir's cultural and historical values. In a study by Aksoy, Karakuş, & Çetin (2013), which is included in the literature, no significant difference was found in the perception of cultural tourism among 6th and 7th-grade students based on class. On the other hand, in studies conducted by Karaca, Şahbudak, Akkuş, & Işkın (2017) and Akkuş, Karaca, & Polat (2015) at the university level, it was found that the participants' knowledge of cultural tourism was in favor of 2nd, 3rd, and 4th-grade students, and 1st-grade students had lower knowledge compared to others. This result differs

from the result of the current study. This difference is believed to stem from university students having more tendencies and opportunities to explore their surroundings.

It has been determined that there is a significant difference between middle school students' average scores on the knowledge test about the cultural and historical values of Kırşehir and the variable of their tourism trips with their families during vacation periods. This finding differs from the results of the study conducted by Ablak, Dikmenli, & Çetin (2014), where there was no significant difference between the average scores of university students based on their participation in trips. It is believed that this difference stems from the fact that middle school students do not have other opportunities besides traveling with their families.

On the other hand, it was found that the average scores of students in the knowledge test about Kırşehir's cultural and historical values differed according to the education levels of their mothers. This result differs from the conclusion of Akkaya (2017) and Ablak, Dikmenli, & Çetin's (2014) studies, which found that mothers' education levels did not cause any differentiation. Furthermore, it was determined that the average scores of participants in the knowledge test about Kırşehir's cultural and historical values varied according to the education levels of their fathers. This result, like the one on maternal education level, differs from the findings of Akkaya (2017) and Ablak, Dikmenli, & Çetin's (2014) study. Based on the results of the research, informative activities aimed at increasing the knowledge of the cultural and historical values of Kırşehir should be organized for the parents of students whose parents have elementary and middle school education levels, as well as male students. In addition, quantitative studies covering different socio-economic conditions such as villages, towns, and districts, and qualitative studies suitable for a qualitative paradigm can be conducted to obtain more in-depth information, which can include schools located in Kırşehir city center. It is believed that male university students tend to travel more frequently, hence it is recommended to support the tendency of female students to travel from a young age. Since middle school students do not have the opportunity to travel to distant places alone, it is suggested that families travel together with their children and introduce them to historical and cultural landmarks.

Statements of Publication Ethics

This study received ethical approval from the Ethics Committee of Gazi University Rectorate with reference number 619549, and the principles of the research and publication ethics were followed by the authors.

Researchers' Contribution Rate

The contribution of each researcher in the article is equal.

Conflict of Interest

The authors declare that there is no conflict of interest.

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An Investigation of Mathematics Education Studies Conducted with Turkish Primary Teachers

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Abstract

The studies utilized with inservice and preservice primary teachers in the field of mathematics teaching are among the research areas that are important and will not lose their importance soon as the outcomes of these research areas are critical for teaching mathematics in primary education and restructuring teacher education programs. As the number of studies in this field conducted in recent years increases, the necessity of reference research that will guide future studies and evaluate the status of current ones comes to the front. Using the method of systematic reviewing, research studies on mathematics education, that are published in the journals indexed in ULAKBİM, conducted between 2010-2021 years, and conducted with in-service and preservice primary teachers in Turkey, were examined. A total of 100 research studies were analyzed by utilizing content analysis. All the studies were examined focusing on their research area, learning area, research method, data collection instruments, samples, sample size, and their data analysis methods. This study aimed to reveal the research trends in Turkey first. The secondary goal of the study is to guide the future research studies by revealing what is highlighted and missing in the field. Considering research results, researchers can expand and improve research in primary mathematics education.

Keywords: Primary teachers, preservice primary teachers, primary education, mathematics, mathematics education.

Türkiye'deki Sınıf Öğretmenleriyle Yapılan Matematik Eğitimi Çalışmalarının İncelenmesi

Öz

Matematik öğretmenliği alanında hizmet içi ve öğretmen adayları ile yapılan çalışmalar, önemli araştırma alanları arasındadır ve bu araştırma alanlarının çıktıları ilkokul matematik öğretimi ve öğretmenin eğitimi programlarının yeniden yapılandırılması için kritik olduğu için önemini kaybetmeyecektir. Bu alanda son yıllarda yapılan çalışmaların sayısı arttıkça, gelecekte yapılacak çalışmalara yön verecek ve mevcut olanların durumunu değerlendirecek referans araştırmaların gerekliliği ön plana çıkmaktadır. Sistematik inceleme yöntemi kullanılarak, Türkiye'de 2010-2021 yılları arasında ULAKBİM'de indekslenen dergilerde yayınlanan, matematik eğitimi ile ilgili hizmet içi ve öğretmen adayları ile yürütülen araştırmalar incelenmiştir. Toplam 100 araştırma çalışması içerik analizi kullanılarak analiz edilmiştir. Tüm çalışmalar öğrenme alanı, araştırma alanı, veri toplama araçları, araştırma yöntemi, örneklem büyüklüğü, örneklem ve veri analiz yöntemlerine odaklanarak incelenmiştir. Bu çalışma, öncelikle Türkiye'deki araştırma eğilimlerini ortaya koymayı amaçlamıştır. Çalışmanın ikincil amacı, alanda vurgulanan ve eksik olan yönleri ortaya çıkararak gelecek araştırmalara yön vermektir. Araştırma sonuçları dikkate alındığında, araştırmacılar ilköğretim matematik eğitiminde araştırmaları genişletebilir ve geliştirebilir.

Anahtar kelimeler: Sınıf öğretmenleri, sınıf öğretmeni adayları, matematik, matematik eğitimi

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INTRODUCTION

Content analysis studies are performed to reveal the themes mentioned and not referred to in the literature and to describe the profiles for the contents of these themes (Fraenkel and Wallen, 2000). These studies present important data for researchers and educators as they illustrate themes that are studied extensively or left incomplete. Content analysis studies help to systematize existing studies, which are essentially independent of each other, by establishing a relationship within the scope of their themes, methods, frameworks, and research questions dealt with. For content analysis studies to contribute to the field, the studied field should be reviewed regularly, and systematically, and its scope should be broadened and updated. Staton-Spicer and Wulff (1984) stated that the most appropriate way to define a field is to study research trends in that field. By examining the research studies conducted in any discipline, the research trends in that discipline can be determined. Lee, Wu, and Tsai (2009) indicated that analyzing the scientific studies on a topic can provide substantial information about the depth and extent of that topic and it unveil a panorama of the studied field. Studies conducted on research trends can be used to describe the past status of the discipline investigated or to predict the future status of the field.

Content analysis studies in Turkey differ in their fields and scopes. Several sub-disciplines in educational research have been reviewed (Çalık and Sözbilir, 2015) in these studies. Review of research on educational science (Erdem, 2011), research on educational technologies (Alper and Gülbahar, 2009; Küçük, Aydemir, Yıldırım, Arpacık, and Göktaş, 2013), research on science education and environmental education (Çalık, Ünal, Coştu, and Karataş, 2008; Erdoğan, Uşak, and Bahar, 2013; Sözbilir, Kutu, and Yaşar, 2012) has been conducted as content analysis studies. The scope of these studies has some similarities. Though the period of studies and databases that selected field of research studies published varied, there were commonalities in the methods of analysis of content. Years, designs of research, types of data collection methods and tools, samples and populations, types of data analysis methods, and the subject matters under the research fields are the common parameters focused on those studies.

In the field of mathematics education, though limited in number, there are some content analysis studies conducted in Turkey. In these studies, the mathematical education research studies published from 1987 to 2014 in journals in Turkey had been analyzed at various time intervals and with various dimensions. For example, Kayhan and Özgün-Koca (2004) examined the research done in mathematics education between 2000-2002. Their research samples consist of research articles on mathematics education in the Current Index to Journals in Education (CIJE) database, doctoral dissertations and master's thesis in the Dissertation Abstract database, and theses on mathematics education in the Turkish Higher Education Institution–Türkiye Yüksek Öğretim Kurumu (HEI-YÖK) database. According to the findings of this study, research articles in 2000-2002 were carried out mostly by focusing on cognitive aspects, subjects in the mathematics curriculum, and methods of teaching. In another study, Tatar and Tatar (2008) analyzed the articles published in Turkey on mathematics and science education descriptively. They explored the keywords of the 680 articles that were published in 26 refereed journals between 2000 and 2006. Researchers revealed that keywords specific to science and mathematics curriculum subjects had a low frequency of use. Besides, subjects in science and mathematics curriculum at the primary level were found less studied than those at the secondary and university level. It was also revealed that the researchers focused more on the misconceptions in the field of science education and attitude studies in the field of mathematics education. In another study, 129 articles on mathematics education published in four journals between 2000-2006 were analyzed by Ulutaş and Ubuz (2008). Based on their findings, much of the studies done in the field of mathematics education between 2000 and 2006 were conducted with elementary school students and preservice teachers as samples; and conducted on cognitive and affective dimensions, and teaching methods as research topics. It was determined that many of the investigated studies were experimental, done by using quantitative methods, used tests and questionnaires as data collection instruments, and conducted on the topics of numbers and geometry. And most of the publications were found to belong to the education faculty members of universities in the Central Anatolia Region. Another content analysis study with articles published in mathematics education by Turkish researchers conducted by Çiltaş, Güler, and Sözbilir (2012). Researchers examined a total of 359 articles on mathematics education published in 32 different international journals between 1987 and 2009. Result of their analysis indicated that there was an important increase in mathematics education research studies after 2002. Researchers also found that there was a dominance of quantitative methods in the field; learning studies

were indicated as the forefront research subject; use of a single data collection instrument was more prevalent and utilizing descriptive statistical techniques (percentage and frequency) stand out primarily.

Considering the studies conducted, it can be claimed that content analysis studies on mathematics education were not conducted in regular time intervals. With different research, trends in mathematics education until 2009 were investigated. Limited amount of research focused research after 2010. Moreover, existing studies are not consistent in the manner of analyzes conducted; the journals and themes focused on the studies seemed to differ from each other. Consequently, studies are inadequate in terms of describing general trends in mathematics education and its' change over the years and demonstrating a detailed analysis of specific areas (for example, primary teaching) in mathematics education studies conducted in Turkey. Additionally, existing studies suggested that more comprehensive studies should be done. Based on these premises, the present study intended to determine the research trends between 2010-2021 in mathematics education studies carried out with in-service and preservice primary teachers in Turkey. Many of the eligible studies conducted in Turkey were taken part in the journals indexed in the ULAKBİM database so that mathematics education research studies published in these journals were examined.

Research Questions

The followings are the research questions guiding this study.

1. How is the distribution of the studies according to learning areas?
2. In which research areas are the studies conducted frequently?
3. What are the research methods commonly used in the studies?
4. What are the data collection instruments frequently used in the studies?
5. What are the samples and sample sizes frequently used in the studies?
6. What are the methods for analysis data frequently used in the studies?

METHOD

The goal of this study is to investigate research studies in the field of mathematics education performed with in-service and preservice primary teachers. This study is a qualitative case study in nature. The study uses document analysis to identify relevant research studies and content analysis to identify themes and concepts covered in those studies. The mathematics education research studies conducted with Turkish primary teachers published in journals indexed in ULAKBIM database between 2010-to-2021 were identified and they constitute the data collection instrument of the present study.

Sample and Data Collection

For obtaining the research studies as samples for this study, the ULAKBİM database was used. The method of selection for the ULAKBİM database was purposive. Since this database contains quite a lot of research studies conducted by researchers in Turkey, it is convenient to use it to portray the status of research in the selected field. The ULAKBİM database was searched both in an inductive and deductive manner. First, a list of journals indexed in the database was attained. The journals in which an educational research study can be published were investigated. Then, journals were surveyed from 2010 to 2021. That is all issues of each journal published between 2010 to 2021 were examined one by one and article by article. The articles which were related to mathematics education and conducted with in-service or preservice primary teachers were selected and included in this study. Besides this deductive searching technique, an inductive searching technique was adapted, too. The keywords, such as 'teacher', 'primary school teacher', 'school mathematics', 'primary teacher', 'primary school', 'mathematics', 'education', 'mathematics education', 'mathematics teaching', 'mathematics learning', 'preservice teacher', in-service teacher', 'preservice primary teacher', 'in-service primary teacher' and 'teacher education' were determined. Each keyword and all combinations of keywords were used to search the ULAKBİM database. Using two searching techniques allows us to cross-check and not leave any related article outside of this study. A total of 100 mathematics education research articles, conducted with preservice and in-service primary teachers, published in 36 different journals were obtained (check Appendix for the list of articles). In Table 1, the frequencies of the distribution of the 100 articles for each year are given.

Table 1. Distribution of Articles

Year	# of Articles
2010	7
2011	12
2012	9
2013	14
2014	6
2015	17
2016	12
2017	9
2018	2
2019	6
2020	6

As presented in the Table 1, the highest number of related articles in the ULAKBIM database was published in 2015. The number of articles decreased gradually after this year. The least number of articles was published in 2018. The list of the articles is given in the appendix with references. In Table 2, journals names and the number of articles attained in each journal are presented.

Table 2. ULAKBIM Journal List

	Name of the journals	# of Articles
1.	"Abant İzzet Baysal University Journal of Faculty of Education"	4
2.	"Adıyaman University Journal of Educational Sciences"	1
3.	"Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi"	4
4.	"Mediterranean Journal of Educational Research (MJER)"	1
5.	"Bartın University Journal of Faculty of Education"	2
6.	"Bayburt Eğitim Fakültesi Dergisi"	2
7.	"Cumhuriyet International Journal of Education"	6
8.	"Dumlupınar University Journal of Social Sciences"	1
9.	"Ege Journal of Education"	3
10.	"Education and Science"	6
11.	"Journal of Education and Humanities: Theory and Practice"	1
12.	"Electronic Journal of Social Sciences"	2
13.	"Erzincan University Journal of Education Faculty (EUJEF)"	2
14.	"Gazi University Journal of Gazi Educational Faculty"	3
15.	"Gaziantep University Journal of Social Sciences (GAUN-JSS)"	2
16.	"Hacettepe University Journal of Education"	3
17.	"International Journal of Eurasia Social Sciences (IJOESS)"	3
18.	"Elementary Education Online"	4
19.	"Inonu University Journal of the Faculty of Education (INUJFE)"	2
20.	"Kastamonu Education Journal"	11
21.	"Journal of Theoretical Educational Science (JTES)"	4
22.	"Marmara University Atatürk Education Faculty Journal of Educational Sciences"	2

23.	"Mehmet Akif Ersoy University Journal of Education Faculty"	2
24.	"Mersin University Journal of The Faculty of Education"	2
25.	"Milli Eğitim Dergisi"	2
26.	"Mustafa Kemal University Journal of Social Sciences Institute"	2
27.	"Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education"	1
28.	"Ondokuz Mayıs University Journal of Education Faculty"	1
29.	"Pegem Journal of Education and Instruction"	2
30.	"Sakarya University Journal of Education"	1
31.	"The Journal of Turkish Educational Sciences"	3
32.	"Trakya Journal of Education"	1
33.	"Turkish Journal of Computer and Mathematics Education (TURCOMAT)"	8
34.	"Turkish Journal of Giftedness and Education (TJGE)"	1
35.	"Journal of Uludag University of Faculty of Education (JUUFE)"	3
36.	"International Journal of Curriculum and Instructional Studies (IJOCIS)"	2
	Total Number of Articles	100

Table 2 shows the journal names which were used during the content analysis. A total of 36 journals were searched and as a result, 100 articles which were published in these journals were determined and included for the analysis. The number of articles in each journal was between 1 and 11.

Data Analysis

In the process of data analysis, categorical analysis, which is one of the content analysis processes, was utilized. A form developed by Sözbilir et al. (2012) as Publishing Classification Form was used to analyze the research articles included in the study. The Publishing Classification Form has originally been developed to classify articles related to educational sciences and sub-domains. For this study, however, the form was revised for mathematics education research studies and used to classify 100 research articles performed with in-service and preservice primary teachers. Using the publication classification form for mathematics education studies, articles were classified according to their 'learning areas', 'research areas', 'research methods', 'data collection tools', 'samples and sample sizes', and 'data analysis methods'. Microsoft Excel program was used to organize the data obtained from the articles. Each article was investigated and coded separately by two researchers. The degree of agreement between the categories that each researcher identified for articles means that the inter-coder reliability (Miles & Huberman, 1994) of this study was 0.92. After the consensus was reached between differently coded categories, frequency and percentage tables were formed.

FINDINGS

The results obtained from the analysis of the 100 research articles published in 36 journals are presented in this study. Related articles were investigated in terms of their mathematics learning areas, research areas, research designs, data collection tools (instruments), sample and sample size, and data analysis methods. Results related to each of these domains are given in the following sections, respectively.

Learning Area and Research Area

100 research articles published in 36 journals are explored by learning areas. These learning areas are related to the Turkish National Mathematics Curriculum learning areas. The distribution of articles by learning areas is given below.

Table 3. Distribution of Articles by Learning Areas

Learning Area	# of Articles	(%)
Arithmetic	1	1
Geometry	15	14.9
Fractions	4	4
Numbers	2	2
Operations, Ratio-Proportion	4	4
Statistics and Probability	1	1
Graphs	1	1
Logic	1	1
Measurement	1	1
No Learning Area	71	70.3

According to the findings presented in the Table 3, 70.3 % (n = 60) of the studies examined did not address a mathematics learning field. When looking at the articles about a mathematics learning area, it is noteworthy that the number of articles about geometry (14.9 %) is more than other learning areas. The proportion of articles in other learning areas is very low, varying from 1 to 4 %. The distribution of the articles according to their research areas is given in Table 4.

Table 4. Article Distribution across the Research Areas

Research Areas	# of Articles	(%)
Subject Matter and Pedagogical Content Knowledge	24	22.9
Perception-View	29	27.6
Anxiety-Attitude-Belief	26	24.8
Mathematics Achievement-Knowledge – Ability	19	18.1
Scale Development	5	4.76
Teaching Practices	2	1.9

As indicated in the Table 4, six research areas were found as a result of analysis. The studies focus mostly on perception-view (27.6%) as a research area. This research area was followed by anxiety-attitude-belief (24.8%) and subject matter knowledge and pedagogical content knowledge (22.9%) areas.

Research Designs

In Table 5, The distribution of articles by their research designs is presented.

Table 5. Distribution of Articles According to Their Research Designs

Research Designs	# of Articles	(%)
Semi-Experimental Study	3	3
Phenomenology	6	6
Relational Survey	26	26
Content Analysis	12	12
Case Studies	22	22
Descriptive Survey	26	26
Factor Analyses	5	5

In line with the data obtained and presented in Table 5, it was revealed that many of the studies used non-experimental designs (97%). When the designs of the studies were analyzed, almost all the experimental studies were semi-experimental designs (weak experimental design) (3%), while in non-experimental studies the survey designs (52%) (Descriptive survey design 26%; relational survey design 26%) were used more than other designs.

Data Collection Tools

The distribution of articles in line with their data collection tools is given in Table 6 and Table 7.

Table 6. Distribution of Articles Using one or more Data Collection Tools

# of Data Collection Tools	Data Collection Tools	# of Articles	(%)
Articles using one data collection tool	Survey	28	58
	Interview	15	
	Test	15	
Articles using multiple data collection tools	Survey	29	42
	Interview	15	
	Test	12	
	Observation	5	

As indicated in Table 6, it was discovered that 58% of the research studies use only one data collection tool (instrument); mainly survey, interview, and test. 42% of the studies on the other hand use more than a single data collection tool (instrument) together. It should be noted that different than studies using one data collection tool, observation is used by studies using multiple data collection tools

Table 7. Article Distribution across the Data Collection Tools

Data Collection Tools	# of Articles	(%)
Survey	57	45.2
Interview	30	23.8
Test	26	20.6
Observation	5	3.9
Alternative measuring tools	8	6.3

As observed in the Table 7, the most preferred data collection tools by the research studies are survey (45.2%), interview (23.8%), and test (20.6%), respectively. While alternative measurement tools (such as diary, picture, concept map, field notes, lesson plan, reflective report, etc.) were used in 9.3% of studies, the least used data collection tool was observation (5.8%).

Sample and Sample Size

The distribution of articles along with the sample is given in Table 8.

Table 8. Article Distribution across Sample

Sample	# of Articles	(%)
Preservice Primary Teachers and Primary Teachers	2	2
Primary Teachers	28	28
Preservice Primary Teachers	70	70

The findings as presented in Table 8 show that research studies were mostly conducted with preservice primary teachers (70%). While studies involving primary teachers constitute nearly one-fourth of the studies (28%), studies

involving both groups (2%) are quite rare. Table 9 shows the distribution of the articles according to their sample size.

Table 9. Distribution of Articles by Their Sample Size

Sample Size	# of Articles	(%)
From 1 to 10	13	13
Between 11-30	11	11
Between 31-100	21	21
From 101 to 300	39	39
Between 301-1000	14	14
Over 1000	2	2

Table 9 indicates the sample size of the research studies. It was exposed that the most preferred sample size was a group of 101-300 participants (39%). This sample size was followed by studies in which 31-100 (21%) and 301-100 (14%) participants were included. It was observed that very large sample sizes (2%) were avoided while very small sample groups were 13% in sample selection.

Data Analysis Methods

Distribution of articles concerning their research method is given in Table 10.

Table 10. Article Distribution concerning Data Analysis Method

Data Analysis Method	# of Articles	(%)
Quantitative	53	53
Qualitative	42	42
Mixed	5	5

As presented in Table 10, it was revealed that in the data analysis of the studies examined quantitative methods were used in 53% of and qualitative methods were used in 42% of the articles according to the results of the analysis. Articles using mixed methods were very low (5%).

DISCUSSION AND CONCLUSION

Research trends between 2010-2021 in mathematics education studies carried out with in-service and preservice primary teachers in Turkey were aimed to investigate in this study. For this content analysis of related research articles obtained from the ULAKBİM database was carried out focusing on learning areas, research areas, research designs, data collection instruments, samples and sample size, and data analysis methods.

Within the scope of this research, firstly, the distribution of the studies according to their learning areas was investigated. The results showed that no learning area has been targeted in most of the research studies on mathematics education conducted with preservice and in-service primary teachers. In studies where a learning area is specified, geometry, as a learning area comes to the forefront. However, articles in other learning areas were inadequate. Similarly, in Ulutaş and Ubuz (2008)'s study investigating the research trends and tendencies in mathematics education, numbers and geometry was found as learning areas that many research studies were focused on. They stated that studies on other subjects were quite insufficient. The results reached about learning areas in this research have similarities with Çiltaş, Güler, and Sözbilir (2012)'s study. They found that subject-based studies were few (Çiltaş, et al., 2012).

In addition to their learning areas, it was unveiled that the studies were conducted mostly with the preservice teachers. This result is quite consistent with the results of the study conducted by Çiltaş et al. (2012). Also, this result supports the findings of the research made by Lubiensky and Bowen (2000). In both research, the main factor in conducting mathematics education studies mostly with preservice teachers was explained in such a way

that the researchers mostly work in universities, and it is easy to reach preservice samples as a convenient sampling methodology.

When looking at the distribution of the research methods utilized in the articles, the general trend was toward the use of non-experimental research designs. While the most prominent methods among these were descriptive and relational surveys, the case study design was also observed to be widely used in the research studies. Additionally, quantitative analysis methods were mostly conducted while the use of mixed methods (quantitative and qualitative together) were very rare. These results are consistent with the results proposed in the other studies. Çiltaş et al. (2012) stated that quantitative methods (59.6%) were used more than qualitative methods (35.1%) followed, and mixed studies were very rarely. Moreover, Ulutaş and Ubuz (2008) determined that many of the studies published similarly are quantitative studies. Hart, Smith, Swars, and Smith (2009), on the other hand, reached a different conclusion in their study examining the methods in the research studies conducted until 2005. Researchers stated that approximately half of the studies were built on the qualitative research design and the most used research pattern after qualitative research is mixed designs, not quantitative. In other words, contrary to studies in Turkey, mixed patterns and qualitative studies are given more importance in international literature, while quantitative methods are mostly used in studies in Turkey.

Besides the data analysis method of the studies, data collection tools were also examined. According to the results obtained, surveys were used more than other data collection tools. In addition to surveys, interviews and tests were frequently used in studies as the main data collection tools. On the other hand, alternative assessment tools were less used. Also, the distribution of data collection methods of the studies is another dimension examined. Results showed that more than half of the research studies rely on only a single data collection instrument.

In conclusion, the present study was conducted to investigate the trends in the field of mathematics education research focusing on inservice and preservice primary teachers in Turkey between 2010 and 2021. As stated at the beginning, content analysis studies portray the themes mentioned and those remain missing in the literature. This research highlighted that mathematics education research studies in Turkey, conducted with preservice and inservice primary mathematics teachers are surveyed studies and half of them were descriptive. As revealed, these studies generally used preservice teachers as samples, conducted with a sample size of 101-to-300 participants. Additionally, studies specific to a learning area were very rare. Research areas such as “perception-view” and “anxiety-attitude” constituted more than half of the existing studies. Moreover, in more than half of the studies, single data collection instrument (mostly surveys), and quantitative data analysis methods were utilized.

With these results in hand, several recommendations for future research studies can be made. First, more studies conducted with in-service teachers are needed. Also, the dominance of non-experimental study designs put forward a necessity for experimental design studies in the field. Besides these, studies conducted with larger sample sizes would be designed. Another important suggestion can be made on the teachers’ classroom practice which is a research area very much neglected in previous studies. More studies are needed on in-service primary teachers’ classroom practice and future studies should focus more on this area.

Statements of Publication Ethics

The authors declare that they obey the principles of publication ethics. Since this study involves open-access journals in the ULAKBİM database, Ethics Committee approval is not required.

Researchers’ Contribution Rate

Researchers’ Contribution Rate

Authors	Literature review	Method	Data Collection and Analysis	Results	Conclusion	Translating English	Editing English version
Author 1	☒	☒	☒	☒	☒	☐	☒
Author 2	☐	☒	☒	☐	☐	☒	☒

Conflict of Interest

The authors declare that they have no conflicts of interest.

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APPENDIX

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