# EXAMINING THE RELATIONSHIPS BETWEEN FIRST-ORDER, SECOND-ORDER BARRIERS AND DIGITAL COMPETENCE OF EARLY CHILDHOOD EDUCATORS

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BEGÜM CANASLAN AKYAR

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## ABSTRACT

EXAMINING THE RELATIONSHIPS BETWEEN FIRST-ORDER, SECOND-ORDER BARRIERS AND DIGITAL COMPETENCE OF EARLY CHILDHOOD EDUCATORS

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The study examined the relationship among perceived first-order barriers (access and support; gatekeepers), second-order barriers (teachers' inhibitions and attitudes towards digital technology) and early childhood educators' digital competence, as well as whether the second-order barriers mediated the relationship among first-order barriers and digital competence. Additionally, early childhood educators' (ECEs) digital competence level was identified. The relationship between the variables was examined by testing a model based on the Digital Competence of Educators (DigCompEdu) Framework. To achieve these objectives, the study was designed as a correlational study and data were collected through an online questionnaire. The collected data was analyzed using structural equation modeling (SEM). The statistical analysis showed that among the first-order barriers, there was a positive relationship between gatekeeper barrier which is the most salient factor and ECEs' digital competence, on the other hand, access and support barrier has negative relationship. Moreover, among second-order barriers, attitudes towards using digital technology have a positive and significant relationship while teacher inhibitions have a negative and significant relationship with ECEs' digital competence. Also, second-

order barriers mediate the relationship between first-order barriers and digital competence of ECEs. Moreover, the results indicate that Turkish ECEs exhibit an overall moderate level of digital proficiency aligning with the B1 (integrator) level. In light of the study's findings, it is recommended that school leaders, policymakers, and other stakeholders reduce teacher inhibitions and access and support barriers while increasing positive attitudes toward digital technology. To achieve these goals, a training plan should be developed to improve early childhood educators' digital competence.

**Keywords:** digital competence, DigCompEdu, early childhood education, educators, barriers

# ÖZ

ERKEN ÇOCUKLUK EĞİTİMCİLERİNİN BİRİNCİ DERECE, İKİNCİ DERECE ENGELLER VE DİJİTAL YETKİNLİKLERİ ARASINDAKİ İLİŞKİLERİN İNCELENMESİ

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Doktora, Temel Eğitim, Okul Öncesi Eğitimi Bölümü

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Haziran 2024, 189 sayfa

Çalışma, algılanan birinci dereceden engeller (erişim ve destek; kapı bekçileri), ikinci dereceden engeller (öğretmenlerin dijital teknolojiyi kullanmaya yönelik engelleri ve tutumları) ve erken çocukluk eğitimcilerinin dijital yeterlilikleri arasındaki ilişki ile ikinci dereceden engellerin birinci dereceden ve dijital yeterlilik arasındaki ilişkiye aracılık edip etmediğini incelemiştir. Çalışmada Türkiye'deki erken çocukluk eğitimcilerinin (EÇE) dijital yeterlilik düzeyleri de belirlenmiştir. Değişkenler arasındaki ilişki, Eğitimcilerin Dijital Yetkinliği (DigCompEdu) Çerçevesine dayalı bir model test edilerek incelenmiştir. Bu hedeflere ulaşmak için çalışma korelasyonel bir çalışma olarak tasarlanmış ve veriler çevrimiçi bir anket aracılığıyla toplanmıştır. Toplanan veriler yapısal eşitlik modellemesi (YEM) kullanılarak analiz edilmiştir. İstatistiksel analiz, birinci dereceden engeller arasında, kapı bekçisi engeli, en çok etkiye sahip olan faktör, ile EÇE'lerin dijital yetkinliği arasında pozitif bir ilişki olduğunu, diğer yandan erişim ve destek engelinin negatif bir ilişkiye sahip olduğunu göstermiştir. İkinci dereceden engeller arasında, dijital teknolojiyi kullanmaya yönelik tutumlar pozitif ve anlamlı bir ilişkiye sahipken, öğretmen engelleri EÇE'lerin dijital yeterliliği ile negatif ve anlamlı bir ilişkiye

sahiptir. Ayrıca, ikinci dereceden engeller, birinci dereceden engeller ile EÇE'lerin dijital yetkinliği arasındaki ilişkiye aracılık etmektedir. Türk EÇE'lerin dijital yetkinlik seviyesi ise B1 (bütünleştirici) seviyesine uygun olarak genel olarak orta düzeyde olduğu belirlenmiştir. Çalışmanın bulguları ışığında, okul liderlerinin, politika yapıcıların ve/veya diğer paydaşların dijital teknolojiye yönelik tutumları, öğretmen engellerini ve erişim ve destek engellerini azaltmaları ve ayrıca erken çocukluk eğitimcilerinin dijital yeterliliklerini geliştirmek için eğitim planı geliştirmeleri önerilmektedir.

**Anahtar Kelimler:** dijital yetkinlik, eğitimcilerin dijital yetkinliği, erken çocukluk eğitimi, eğitimciler, engeller

*To my loving husband*

## ACKNOWLEDGMENTS

Working on this topic was a passion for me when I observed children sitting in front of screens at kindergarten, watching cartoons, sometimes inappropriate content. At that moment, I decided to take action on this issue to ensure these digital tools became activators rather than pacifiers. Of course, it would be a long journey, and this dissertation is just a very small step among the tasks ahead. However, I am proud of myself for pursuing my passion and not giving up in the face of difficulties.

I would like to thank my advisor, Assoc. Prof. Dr. Serap Sevimli-Çelik, who has supported me since my master's degree and has walked with me throughout this journey. It is an honor for me to be her first graduate student at both the master's and PhD levels.

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It has been a long journey, which began not only six years ago but also 24 years ago. Throughout this journey, my parents, Hüsne Canaslan and İcabi Canaslan, have supported, encouraged, and always believed in me. At times, they expressed concerns when I had to work excessively, but now they share in my happiness. I am also grateful to my extended family for their patience and motivation whenever I needed it.

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I would like to thank my friends whom I bothered with my PhD stress. The list is too long to mention names individually.

Unfortunately, the data of the study overlapped with the major Hatay earthquake. At that time, we were gathering data from Gaziantep and Hatay, so it's possible that some of the participants have passed away and are no longer with us. If that is the case, may they rest in peace.

My biggest thanks, of course, go to my dear husband, Fatih Akyar. He shares the stress with me, tries to keep me calm, helps me look to the future with hope, and holds my hand. Many times, he had to set aside his own desires and stay at home with me. I know that I owe you some years... But thank goodness you were here; without you, I wouldn't have achieved this title today. I am infinitely grateful to you for all your support.

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| | |
|---|---|
| ECEs | : Early childhood educators |
| DigCompEdu | : Digital competence of educators |
| AS | : Access and support |
| GT | : gatekeepers |
| ATT | : Attitudes towards digital technology |
| TI | : Teacher inhibitions |
| BTU | : Barriers to technology usage |
| DC | : digital competence |
| PE | : Professional engagement |
| DR | : Digital resources |
| TL | : Teaching and learning |
| ASSESS | : Assessment |
| EL | : Empowering learners |
| FL | : Facilitating learners' digital competence |

# CHAPTER 1

## INTRODUCTION

The increasing popularity of digital technology among children today is a phenomenon that is worthy of further investigation. The ubiquity and easy accessibility of digital technology are likely the primary reasons for the current situation. Recent updates indicate that an estimated 5.18 billion people (64.6% of the world's population) will have access to the Internet in 2023 as a result of the advancement of technology (Petrosyan, 2023).

In addition, according to the World Metrics Reports, 73% of children aged six and under use mobile devices (2024). In parallel with global developments, there is an increasing trend in the use of digital technology in Türkiye. According to the Turkish Statistical Institute (TÜİK), 87.1% of the population aged 16-74 use the internet (2023). As indicated in the Turkish Statistical Institute's (TUIK) “Research on the Use of Information Technologies in Children” report, which assesses the online and digital device usage of children aged 6-15, 82.7% of children engage in online activities. These activities are primarily divided into the following categories: taking an online course (86.2%), completing homework or educational tasks (83.6%), playing or downloading digital games (66.1%), watching videos (61%), and making video calls over the internet (55.5%) (TUIK, 2021). The Internet provides a multitude of opportunities to engage children in educational activities, facilitate their independent learning, and integrate them into a social environment.

Digital technology usage and digitalization have accelerated from early childhood to higher education during the COVID-19 pandemic. Almost all education levels conducted online education during the COVID-19 pandemic (TEDMEM, 2021). To give some examples of using digital devices in education, smart systems are a service that can monitor and measure children's learning process in real time to collect

information about children's learning gap. Mobile devices such as tablets, smartphones or laptops provide learning content to educators or children anywhere and anytime. *Social media* allows users to interact with all stakeholders to share and discuss information through virtual communities. Virtual reality offers children experiences to understand their world in a tactile way. Artificial intelligence can support each learner with virtual assistance, self-learning, personal interest and analysis of personal data based on learner interaction with data. *Game* is an educational tool to motivate children to learn through video games design or game elements. *Hardware* is innovative equipment such as projectors, smart boards, cameras, etc. that ensure interactivity and increase children's motivation to participate in learning activities. *3D printing* is equipment that enables materials to be printed in three dimensions; these technological devices enable the creation and design of creative educational materials (Huawei, n.d).

To be able to use these digital technologies, certain skills and abilities are required. European Union defined the requisite skills and abilities as the concept of digital competence and described it as follows: “Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, work and participation in society” (2019, p.5). The essence of digital competence is the understanding of digital technologies to serve oneself and society through appropriate use pathways. In the new digital world, people need to be equipped with the ability to use digital technologies for different purposes, such as learning, socializing, earning money, or exercising their citizenship rights (Lucas et al., 2021). As a result, many countries have made improving digital competence a top priority (European Parliament, 2018; Monteiro et al., 2021).

In the 21st century, these skills are essential in every profession and in everyday life, and being an educator is one of them. The European Commission has highlighted the importance of digital competence through its Digital Education Action Plan 2021-2027 (2020), which prioritizes the development of digital skills for societal transformation. Furthermore, the United States (US) places a high value on the acquisition of digital skills and has initiated studies on technological transformation as part of the National Educational Technology Plan (NETP, 2017). As reported by

the Office of Educational Technology (2017), the success of digital transformation in education hinges on educators' ability to possess the requisite technical knowledge and skills to equip classrooms with technology-enhanced activities. Education is widely regarded as a means of fostering digital competence within communities and the creation of a digitally literate society.

Recent developments in the field of digital competence have underscored the crucial need for educators to be digitally skilled, enabling them to make effective use of digital technologies in their teaching practice (Redecker, 2017; UNESCO, 2018). Ultimately, educators are expected to have basic skills that go beyond technical competence. This is because raising digitally competent individuals depends on how educators equip children with the necessary social and professional skills to succeed in the digital age (Lucas et al., 2021). In line with these goals, the International Society for Technology in Education (ISTE) has set core standards for educators, emphasizing their roles as learners, leaders, citizens, collaborators, designers, facilitators and analysts (2016). To fulfill these standards, educators need to have a deep understanding of technology that will enable them to create professional learning goals through technological tools. They should serve as leaders among their peers in adopting new digital resources and providing technology-driven opportunities for all children. Furthermore, educators should actively participate in digital communities, fostering collaboration with colleagues to enhance learning experiences and address technology-related challenges. They should enrich the classroom environment by skillfully incorporating technology into their teaching methods (ISTE, 2016).

Krumsvik provides a comprehensive definition of digital competence for educators, emphasizing that it requires more than technical competence and includes the ability to use ICT competently in a professional context, together with sound pedagogical judgement (2011). It includes an awareness of the impact of technology on learning strategies and children's digital development. In this definition, Krumsvik emphasizes that educators as professionals should not only have a broad understanding of technology, but also a specific pedagogical understanding of how to effectively integrate technology into educational settings (Redecker, 2017). In

addition, educators should be role models for technology users, demonstrating how to make the best use of technology both for educational purposes and for their own use (Çebi & Reisoğlu, 2022). Further exploration of digital competence suggests that it should encompass creative skills, a nuanced understanding of children's ability to use technology to create knowledge (Erstad, 2010; van Dijk, 2013), and a critical awareness of the social implications of technology (Buckingham, 2006). As a result, digitally competent educators can effectively combine their digital skills with their content and pedagogical knowledge to provide a more comprehensive and effective educational experience for their learners.

There is a lack of a comprehensive framework to provide educators with a unified reference point (Redecker, 2017). The Digital Competence of Educators (DigCompEdu) framework has emerged as a response to this need. It is the result of a comprehensive project spanning Europe, covering local, regional and national contexts, and its main aim is to provide a framework for developing the digital competence of educators. According to DigCompEdu, the effective integration of technology in learning environments requires the smooth integration of technology, pedagogical expertise and content knowledge (Çebi & Reisoğlu, 2020). Specifically, DigCompEdu outlines how educators can blend their personal digital competences with pedagogical approaches to create learning environments that provide children with more innovative, personalized, effective, and comprehensive educational experiences (Ghomi & Redecker, 2019).

However, it is important to note that educators' ability to implement these changes is not completely independent. They are constrained by the limitations of the education system. Educators must adhere to the parameters of the school calendar, standards, and national policies, which collectively serve as critical determinants of their success (Mishra & Warr, 2021). These factors collectively shape the context in which educators navigate their journey towards digital competence and effective technology integration in education.

In this context, numerous factors have been identified as influential in shaping educators’ digital competence. For example, external factors, also called first-order

barriers, are school-based barriers, play an important role, including access and support which is lack of proper type of technological tools, and technical support for digital technologies in educational institutions (Pettersson, 2018). Although access to digital technology tools is increasing (Ertmer et al., 2012), it is still a barrier according to some studies (Makki, et al., 2018). For instance, around the world, a large percentage of the world's population does not have access to the Internet or digital tools, mainly due to economic issues (Val, S & López-Bueno, 2024). In addition, the perspectives and attitudes towards digital technology usage in education of gatekeepers can also have a significant impact on educators' digital competence (Masoumi & Noorozi, 2023). In this study, the term "gatekeepers" refers to school leaders and children's guardians. School leaders play an important role in providing access to software and hardware, as well as creating a shared school culture in terms of digitization. They are the main enablers, as they are responsible for explaining the guidelines, creating collaboration between educators, and allocating time to realize the digitization in education (Reis-Andersson, 2024). In the school environment at all levels, digital competence is of critical importance, even for school leaders, in order to organize and lead the utilization of technology practices in schools (Pettersson, 2021). Guardian involvement is considered a very important component of early childhood education as their participation promotes the long-term benefits of high-quality early childhood education (Reynolds et al., 2022). Therefore, guardians' involvement and attitudes can be considered as an important factor regarding digital technology integration and their attitudes towards the use of digital technology in early childhood education could be both advantages and disadvantages (Zakaria et al., 2022). It is important to consider the attitudes of school leaders and guardians towards digital technology usage in early childhood education as a key factor in understanding the digital competence of early childhood educators.

In addition, educators' personal factors, which are referred to as second-order factors, also play a role in influencing their level of digital competence. As emphasized by Cattaneo et al. (2022), these include educators' attitudes towards digital technology in education, which can be either favorable or unfavorable. Educators' positive attitudes towards digital technology usage were indicative of their proficiency level in this domain (Štemberger & Čotar Konrad, 2021). Conversely, some early

childhood educators have expressed suspicion about the use of digital technology in education, citing concerns about its potential negative effects on children's development. For instance, digital technology usage has been linked to negative effects on children's motor development, self-regulation, eyesight problems, and other developmental issues (O'Connor & Fotakopoulou, 2016). Consequently, educators who favor the use of digital technology in education are also willing to enhance their digital competence. Conversely, educators who are not in favour of using digital technology may be reluctant to improve their digital competence.

It is evident that self-efficacy in teaching is a crucial factor in the implementation of effective teaching practices. Moreover, the integration of digital technology in education is significantly associated with educators' self-efficacy in digital education (Hatlevik, 2016). In addition to educators' knowledge of digital competence, their self-efficacy in using technology, and time constraints in learning about the use of digital technology in education, factors such as teacher inhibitions can also enhance or hinder their digital competence (García-Vandewalle García et al., 2023; Yada et al., 2022). In order to enhance their digital competence, educators require time to engage in practice and training (Reis-Andersson, 2024) and to prepare themselves to integrate digital technologies into education. When educators are burdened with numerous instructional and/or non-instructional responsibilities, they encounter significant challenges in identifying the necessary time to learn about digital technologies and comprehend how to integrate them effectively within an educational framework. It is therefore of the utmost importance to understand and address these different factors if educators are to develop their digital competence and be better able to prepare children for the digital age.

### 1.1. Statement of the Problem

Educators must undergo a significant transformation in order to adapt to the evolving educational landscape, which necessitates the integration of technology into traditional pedagogical practices (Pettersson, 2018). The significance of technology integration in education has been further underscored, particularly in the wake of the global pandemic. Educators must now prioritize the development of knowledge,

skills, and attitudes over the mere mastery of tools (Mishra & Warr, 2021). This shift necessitates the effective incorporation of technology into various aspects of the teaching process, including problem-solving with digital tools (Sailer et al., 2021), the selection of appropriate digital media and content, the integration of content and pedagogical knowledge through digital literacy (Guggemos & Seufert, 2020), the nurturing of competence beliefs (Rubach & Lazarides, 2021), and the development of reasoning skills (Tondeur & Howard, 2020).

Digitally competent educators play an important role in informed pedagogical decision-making process regarding the integration of digital technologies into the classroom environment. Additionally, they are instrumental in preparing learning tools that facilitate the development of children's digital competence (Krumsvik, 2014). In particular, educators' digital competence should encompass the pedagogical dimensions of technology use. Simply having the ability to use technology in one's personal life is insufficient to qualify an educator as digitally competent. In addition, educators should be able to discern how digital technology can be employed effectively for educational purposes and to utilize technology as an educational tool (Johannesen et al., 2014). In essence, educators become digitally competent when they are confident in their ability to use a range of digital tools and make informed decisions about how to integrate them into the learning environment for transformation. This is why becoming digitally competent professionals is so important (Johannesen et al., 2014).

A study has once again highlighted the significance of this issue. It has been demonstrated that, despite the fact that early childhood educators have access to digital technology and are trained in its use in education, this does not always result in the appropriate use of digital technology by children (Rosen & Jaruszewicz, 2009). A further study conducted in Türkiye revealed that although early childhood educators utilize digital technologies in their personal lives, they lack the requisite knowledge and experience to apply digital tools in the context of early childhood education (Demirtaş-İlhan, 2023).

In light of the aforementioned circumstances, it is evident that there is a pressing need to enhance the digital competence of early childhood educators. However, the

matter is not as straightforward as it may appear. As the concept is multifaceted, certain factors can either facilitate or impede the development of digital competence. Although there may be other factors that influence digital competence, this study focused on the first-order barriers, which are access and support, as well as gatekeepers, and second-order barriers, which are attitudes towards digital technology and teacher inhibitions.

### 1.2. Purpose of the Study

The aforementioned reasons serve as the foundation for this study, which aims to contribute to the development of digital competences among early childhood educators. The study's aim was to test a hypothesized structural model presented in Figure 1, which investigated the relationship between barriers, including first-order barriers, which are external factors such as access and support and gatekeepers, and also second-order barriers, which are internal factors such as attitudes towards digital technology and teacher inhibitions and digital competence of early childhood educators.

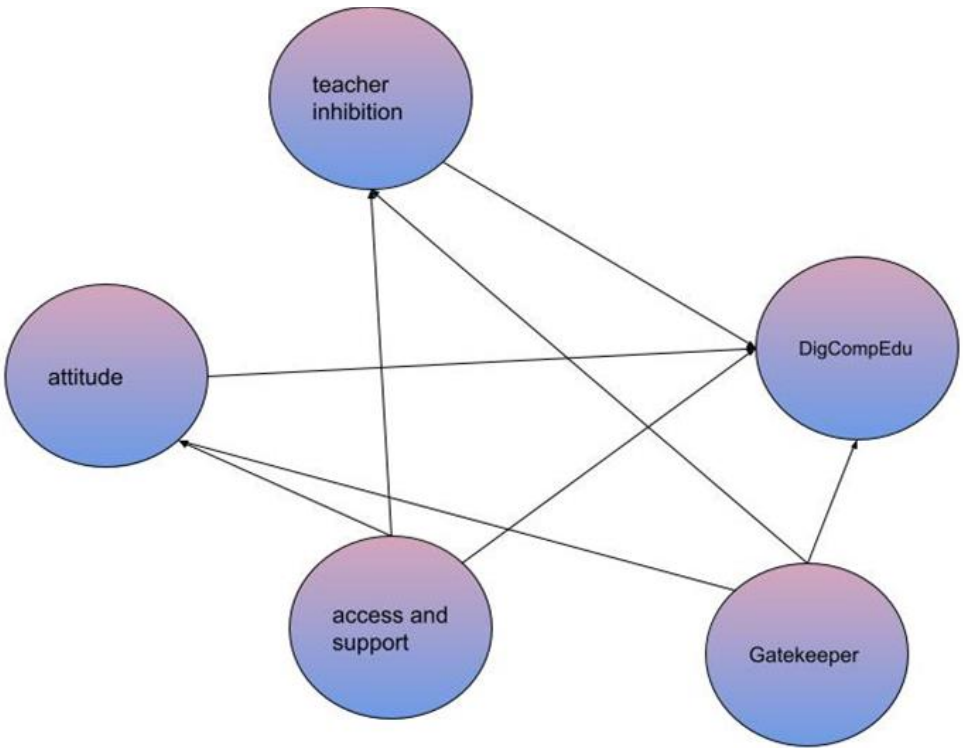



**Figure 1.** Barriers of educators' digital competence model

In this regard, the aims of the study can be divided into three categories. The first aim is to identify the first-order barriers due to organizational factors that affect the digital competences of early childhood educators. The second aim is to identify the second-order barriers related to the educators themselves, which are associated with the digital competence development of early childhood educators (ECEs). Finally, this study aims to investigate whether second-order barriers mediate the relationship between first-order barriers and educators' digital development and to investigate the factors affecting ECEs' digital competence development with a comprehensive analysis method. In addition, the aim of this research is to determine the digital competence levels of early childhood educators (ECEs) and to identify the digital competence areas in which they require improvement in order to effectively integrate digital technology into the field of early childhood education.

### 1.3. Research Questions

To this end, the following questions were formulated for investigation:

RQ1: What is the relationship between first-order barriers and the digital competence of early childhood educators?

> RQ1.1: What is the relationship between access and support and the digital competence of early childhood educators?
>
> RQ1.2: What is the relationship between gatekeepers and the digital competence of early childhood educators?

RQ2: What is the relationship between second-order barriers and the digital competence of early childhood educators?

> RQ.2.1: What is the relationship between educators' attitudes towards digital technology and digital competence of early childhood educators?
>
> RQ.2.2: What is the relationship between teacher inhibitions and digital competence of early childhood educators?

RQ3: To what extent do second-order barriers mediate the relationship between first-order barriers and digital competence of early childhood educators?

Additionally, from the relationships presented in Figure 1, the following hypotheses were formulated in the research model on account of evidence obtained from previous research (e.g., Lucas et al., 2021).

Two hypotheses address how first-order barriers namely access and support and gatekeepers are related to digital competence of early childhood educators (ECEs):

**H1.** Access and support barriers predict ECEs' digital competence.

**H2.** Gatekeeper barriers predict ECEs' digital competence.

The two next hypotheses address how second-order barriers namely teacher inhibitions and attitudes towards digital technology are related to digital competence of ECEs:

**H3.** Attitudes towards digital technology predict digital competence.

**H4.** Teacher inhibitions predict their digital competence.

Finally, the six hypotheses address how second order barriers play mediating role between first-order barriers and digital competence of ECEs;

**H5.** Access and support predict teacher inhibitions.

**H6.** Gatekeepers predict teacher inhibitions.

**H7**. Access and support predict attitudes toward digital technology.

**H8.** Gatekeepers predict attitudes toward digital technology.

**H9.** Attitudes towards digital technology plays mediating roles in the relationships between access and support, and digital competence of ECEs.

**H10.** Attitudes towards digital technology plays mediating roles in the relationships between gatekeepers and digital competence of ECEs.

**H11**. Teacher inhibitions play mediating roles in the relationships between access and support, and digital competence of ECEs.

**H12.**Teacher inhibitions play mediating roles in the relationships between gatekeepers and digital competence insert gatekeepers of ECEs.

### 1.4. Significance of the Study

Education plays a key role in equipping citizens with the necessary digital life skills and in fostering the development of a digital society. This societal transformation largely depends on the digital competence of educators. When educators have digital competence and implement it in the classroom, children benefit from a digitally enriched pedagogical approach that shapes their moral, ethical and societal sensibilities regarding the use of digital technologies (Passey et al., 2018). Numerous studies over the past decades have investigated the digital competence of educators (Falloon, 2020; From, 2017; Janssen et al., 2013b, Krumsvik 2011; 2014, Mishra & Koehler, 2006; Redecker, 2017) and the relationship between their digital competence and the integration of digital technologies in education (Antonietti et al., 2022; Basilotta-Gómez-Pablos et al., 2022; Demissie et al., 2022; Peng et al., 2023; Runge et al., 2023). Considering the positive relationship between digital competence and technology integration in education (Peng et al., 2023), understanding educators' digital competence is critical not only for effective technology integration, but also for meaningfully supporting children's acquisition of digital competence from early childhood to higher education (Redecker, 2017).

The integration of digital technology into early childhood education necessitates the inclusion of digital competence as a pivotal requirement. Educators who demonstrate good digital competence are more likely to be able to utilize digital technology effectively (Runge et al., 2023). However, the relevant literature shows that digital competence studies in early childhood education contexts are rare, and most of the

studies were conducted with pre-service educators (Casillas-Martin et al., 2020; Madsen et al., 2023; Romero-Tena et al., 2020; Su & Yang, 2024). Most studies are also based on children's and educators' success or participants' perceptions of digital competence and these studies tend to be conducted with small sample sizes (Su & Yang, 2024).

There is also a lack of studies investigating the digital competence of early childhood educators in Turkish context, especially with an international framework (i.e. DigcompEdu) (Kuş & Mert, 2024). The DigCompEdu framework has been accepted as a common framework for studying early childhood educators up to higher education level and has been translated into 24 languages for data collection in European Union countries (EU Commission, n.d.). The tool has also been translated into Turkish, more details about the tool can be found in the instruments section of method chapter. The use of this international tool in the Turkish context is important in order to examine the level of early childhood educators in Türkiye as it allows to criticize the situation by comparing it with other countries using the same measurement tool. Furthermore, there is a lack of studies in the Turkish context that only focus on early childhood educators and measure their level of competence with this international framework. The study result is important as the Turkish Ministry of Education (MoNE) is interested in increasing the digital competence of educators in order to fulfil the Education Strategy 2023 (MoNE, 2018).

It is known that educators' digital competence is a multifaceted process as it has both technological and pedagogical aspects (Ilomäki et al., 2016; Redecker, 2017) and is influenced by various interrelated factors (Lucas et al., 2021; Pettersson, 2018; Tondeur et al., 2021). Understanding these factors is essential for the development of digital competence among educators. These factors can be categorized as first-order barriers such as infrastructure, technical support, access to technology and availability (Lucas et al., 2021; Atman Uslu & Usluel, 2019; Lawrence & Tar, 2018; Masoumi & Noroozi, 2023) and second-order barriers such as age (Almerich et al., 2016; Tondeur, et al., 2018), gender (Scherer & Siddiq, 2015; Teo, 2014; Tondeur, et al., 2018), educational background (Mumtaz, 2000; Scherer et al., 2017), and general attitudes towards technology (Al-Zaidiyeen et al., 2010; Casillas Martín et al., 2020;

Yulisman et al., 2019). Although there are some numerous factors that explain the relationship between demographic factors, namely age, gender, years of teaching experience, teaching areas (Cattaneo et al., 2022; Hinojo-Lucena et al., 2019; Inamorato dos Santos et al., 2023; Lucas et al., 2021) and digital competence of educators, there are limited studies on factors such as attitudes towards using digital technology, self-efficacy, access to digital technology and support (Krumsvik et al., 2016; Cattaneo et al., 2022), workload of educators and institutional culture (Masoumi & Noroozi, 2023). Furthermore, Lucas et al. pointed out that the available study results are contradictory and require further investigation (2021).

This deeper understanding can contribute to the existing literature on this topic. In order to address this gap, the current study focused on examining the relationship between first-order barriers, also known external barriers, second-order also known internal barriers and digital competence of educators through a structural model. The study result is expected to bear both theoretical and practical importance considering the field of research, benefit of early childhood educators, and early childhood education. Regarding the relevant literacy, there is no model examining these relationships that has been hypothesized and tested until thus far.

First of all, theoretically, the educators' digital competence is a multifaceted skill set that includes both technical proficiency and pedagogical proficiency to be able to efficiently integrate technology into education (Casillas Martín et al., 2020; Krumsvik, 2011; Leoste et al., 2022; Pettersson, 2018). By investigating the relationship between first-order, second-order barriers and digital competence of ECEs, researchers and practitioners can gain deeper insight and understanding of the complexity of educators' digital competence (i.e., Durff & Carter, 2019; Guillén-Gámez et al., 2022). The researchers and practitioners can also identify where the educators may have struggle whether its external factors such as accessing technological infrastructure or support (also called as first-order barriers) or in the personal factors such as attitudes towards using technology into education (which is also called as second order barriers).

The study also investigated the mediating impact of second-order barriers on the relationship between first-order barriers and the digital competence of educators. As

Ertmer indicated, second-order barriers are more complex to overcome, as they are often derived from educators' underlying beliefs about teaching and learning, and sometimes educators may not even recognize them (1999). Second-order barriers are identified as having the most significant impact on technology integration (Ertmer & Ottenbreit-Leftwich, 2010) and are recognized as more formidable obstacles, persisting even when first-order barriers are removed (Abedi et al., 2023). Therefore, the study investigated the mediating effect of second-order barriers to illuminate if these more complex and deep-rooted barriers may intervene the relationship between first-order and digital competence of educators. Understanding the mediation role becomes important for developing support mechanisms for improving educators' digital competence. If second-order barriers significantly mediate the relationship between first-order and digital competence, it implies that tackling only the environmental or external challenges may not ensure the expected outcomes.

Practically, by being aware of these barriers and struggles, educators could begin to develop strategies and skills to overcome these difficulties (Ertmer, 1999). This knowledge is crucial for designing targeted professional development, support, policy development that address the specific needs of ECE as they strive to develop digital competence in a holistic manner as well. Additionally, this study may inform the enhancement of theoretical frameworks such as DigCompEdu to the practical domain.

### 1.5. Definition of Terms:

*Early childhood education* refers to learning and educational activities that focus on the holistic development of children. These activities aim to support children's social, emotional, language, and physical growth through organized instruction outside of the family context. The goal is to prepare children for a smooth transition into primary schools (UNESCO, n.d.).

*Early childhood educator* is an individual who is responsible for caring and promoting the learning and development of children from birth through 8 years old in

all early childhood education institutions. This role requires the knowledge, skills, and competence to meet the qualifications of the profession (UNESCO, n.d.).

*First-order barriers,* also known as extrinsic barriers, define factors external to educators and include institutional resources such as school leaders' support and expectations for technology integration (Ertmer, 1999). The definition was also expanded to cover resource barriers i.e. access to digital technology devices in education settings, availability of technology support teams, as well as institutional barriers i.e. school leaders' priorities and plans for technology integration into education (Hew & Brush, 2007; Kopcha, 2012).

*Second-order barriers***,** also referred to as intrinsic barriers, encompass factors specific to educators themselves. These include their confidence in using technology, their beliefs about the benefits of technology integration for children's learning (Hatzigianni & Kalaitzidis, 2018), and their attitudes towards the use of digital technology (Hew & Brush, 2007).

*Digital competence of educators* refers to the competence of educators to use digital technology tools in the professional context harmonizing with pedagogical and didactic purpose to aim for learning activities and facilitating learners' digital competence development (Krumswik, 2011).

*Technology access and support* refer to the insufficient availability of appropriate digital technology for conducting educational activities and providing assistance. It also encompasses the ability to address technological issues without disrupting the educational implementation (Hew & Brush, 2007).

*Gatekeepers* refer to the group of people with the authority to make decisions about implementing digital technology, namely school leaders and parents/guardians (Blackwell et al., 2013) in this study.

*Teacher inhibitions* is an umbrella term that encompasses internal factors, namely self-efficacy and preparedness for technology integration (Blackwell et al., 2013).

*Attitudes towards digital technology* refer to educators' favorable or unfavorable feelings about using digital technology in education (Lawrence & Tar, 2018).

### 1.6. Summary

To sum up, the present study proposed a research model in order to investigate the relationship among first-order (access and support; gatekeepers), second-order (teacher inhibitions and attitudes) barriers and early childhood educators' digital competence and also whether the second-order barriers mediate the relationship between first-order barriers and educators' digital competence. Additionally, the study aims to examine the digital competence of Turkish early childhood educators.

In light of these research questions, the study contributes to the existing literature on early childhood educators' digital competences by integrating the DigCompEdu framework with the analysis of barriers to the use of digital technology in education. The findings offer a more comprehensive understanding of educators' digital competence, which is highly complex and particularly magnifies the situation in the Turkish context. Moreover, the study findings enable researchers, educational policymakers, and other early childhood education decision makers to ascertain the current level of digital competence among Turkish early childhood educators and to develop an appropriate plan to enhance their digital skills, should the need arise.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1. Technology Integration in Early Childhood Education

The use of technology is not a new topic, for example, rulers and scales have been used in the classroom for many years to enhance children's learning (Puerling & Fowler, 2015). However, there has been an increase in the development of technology and, in conjunction with this change, the types of technology materials are now varied. The changes in technological development are shown in Figure 2. According to Figure 2, after the 20th century, the slope shows a sharp increase in educational technology development. The new technologies can provide information in many forms, such as pictures, films, animations and graphics (Huang et al., 2019).

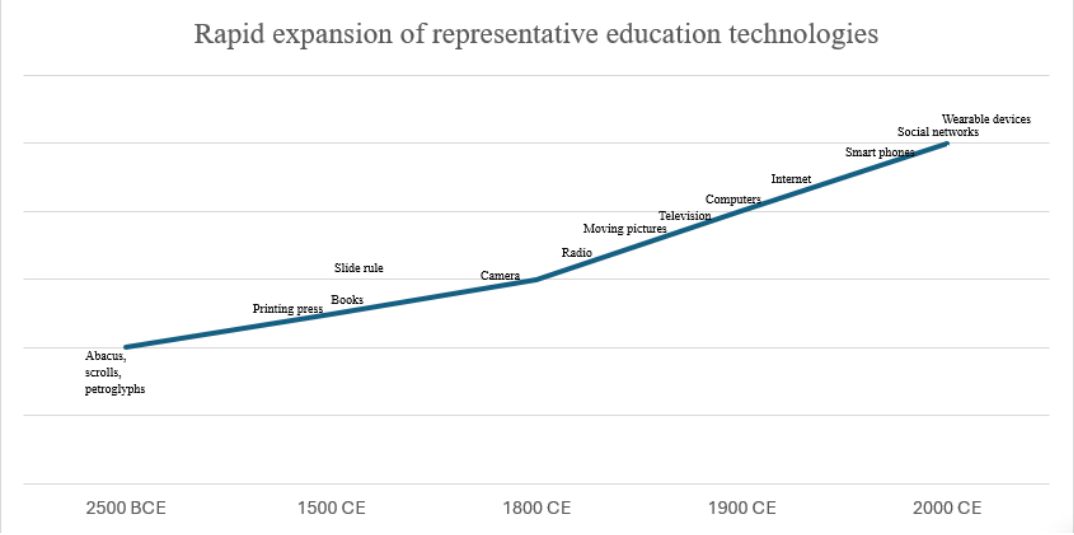



**Figure 2.** The changing in educational technology over years (Adapted from Huang et al., 2019)

The purpose of digital technology in education is to access information and resources, facilitate effective teaching and learning, and improve communication

between parents and children outside of school. Educational technology has been a topic of interest in educational sciences. According to Huang et al. (2019, pg.4), it is defined as the use of technology to support teaching and learning.

> "Educational technology refers to the use of tools, technologies, processes, procedures, resources, and strategies to improve learning experiences in a variety of settings, such as formal learning, informal learning, non-formal learning, lifelong learning, learning on demand, workplace learning, and just-in-time learning."

Mishra et al. (2009) and Huang et al. (2019) define educational technology as the creation, management, and use of technological practices and resources to enhance learning and improve learners' performance. Both definitions emphasize the importance of using educational technology with a clear purpose to enhance effective learning. Using technology in education involves more than just learning how to use hardware and software. It should also be integrated into pedagogical aspects, as suggested by Diaz and Bontembal (2000). Educators must improve their strategies to motivate children and maintain their focus on instruction by incorporating technology into education, as noted by Okojie et al. (2006). Educators can incorporate various digital technologies, such as the internet, tablets, digital cameras, office applications, interactive websites, multi-touch mobile tools, computers (Simon & Nemeth, 2012) as well as artificial intelligence, 3D printers, and virtual reality (Huawei, 2017).

Digital technology is used by educators in multiple ways such as communication, preparation for classroom activities, daily routines (Romero-Tena et al., 2020), play activities (Gjelaj et al., 2020), and evaluations (Danniels et al., 2020). However, the transformation of educational technology has not yet occurred as expected in preschools (Masoumi, 2021; Wartella et al., 2010; Weng & Li, 2018). Although digital technology has educational value in early childhood education (Clements & Sarama, 2003; Enochsson & Ribaeus, 2020; Ihmeideh & Al-Maadadi, 2018; Rahiem, 2021), its implementation has been limited.

As digital technologies continue to develop, their advantages also increase. This is particularly evident in the teaching curriculum, where traditional methods such as

drawing pictures on a blackboard with chalk have been replaced by digital tools. These tools are able to capture children's attention and help them concentrate on learning, thanks to their multiple and dynamic effects (Dong & Newman, 2018). Furthermore, the National Association for the Education of Young Children (NAEYC) promotes developmentally appropriate and intentional technology usage in early childhood education (2012). To enhance children's learning, NAEYC recommends the following to ECEs:

- digital technology tools should be interactive, and educators should consider the quality of their content.
- educators should use digital technology to support children's hands-on, active, creative, and authentic engagement.
- educators do not allow children to be passive technology consumers especially if they are younger than two years old and teachers should be careful about passive and non-interactive technology usage between two and five years old.

There are numerous studies demonstrating the positive impact of digital technologies in early childhood education settings. For example, Magnusson (2021) found that using digital technologies in Reggio Emilia ateliers enhances mathematics and literacy subjects by acquiring knowledge at the social level before the individual level. A recent study conducted by Larkin et al. (2022) found that a digital application can enhance the logical reasoning skills of 4-5 year old children, which is associated with improved mathematical achievement. The application provides a range of activities, including decoding, encoding, conditionals, and debugging. Fang et al. (2022) found that playing digital games has a positive impact on children's social competence and behavior. They suggest that digital learning tools, particularly video games, may be useful when working with young children. On the other hand, the disadvantages of digital technologies should be kept in mind, as the inappropriate use of digital technologies can distract the sleep routine and cause vision problems (Susilowati et al., 2021), as well as lack of attention and behavioral problems (Mustafaoğlu et al., 2018). These kinds of negative effects of digital technology should be considered when using digital technology in education.

Educators from early childhood education to others, have become a primary target for global education stakeholders seeking to improve their ability to integrate technology into educational settings (Brown et al., 2016). These transformations have placed new demands on educators, including changes in teaching methods, teacher-child relationships and the content of instruction (Edwards, 2016). When examining the roles of ECEs in using information and communication technologies (ICTs), research shows that educators are the primary users of these digital tools (Canaslan-Akyar, et al., 2024). Furthermore, their implementation of digital technology in school settings is not always appropriate (Yang & Hong, 2022). These situations can occur due to various reasons. For instance, ECEs often face challenges in maintaining discipline and managing children, especially when there is limited access to technology for a large group. This can result in a shift in their role from child-centered educators to controllers and trainers, and concerns about maintaining order during digital activities (Dong & Newman, 2018).

In order to effectively tackle these challenges and fulfil their evolving roles, educators must develop their digital competence. A lack of digital competence can lead to frustration when attempting to integrate digital technology into teaching practices (Dong, 2018). Lack of digital competence also may cause abandon their efforts to incorporate digital technology into education if they feel their digital competences are insufficient to create appropriate learning materials (Dong, 2018). Furthermore, research consistently indicates that the beliefs, digital skills, knowledge, and perceptions of ECEs regarding the application of digital technology in education are crucial too (Edwards, 2016; Magen-Nagar & Firstater, 2019; Mertala, 2019; Nikolopoulou & Gialamas, 2015). For instance, the confidence, attitudes towards technology, and practical use of an ECE are significantly influenced by her ability to integrate technology into specific subject areas in a developmentally appropriate way, deliver personalized learning experiences, and identify high-quality digital media content (Blackwell et al., 2014).

The adoption of digital technology in education is influenced by various factors. To understand educators' intentions to use technology, measuring user acceptance of technology is proving to be a valuable tool (Scherer et al., 2019). Some studies have

used the Technology Acceptance Model (TAM) to describe the underlying mechanisms and influencing factors of technology integration and user acceptance. However, to create a model that is more specific to education, it is important to consider how the TAM relates to the barriers that educators face when integrating technology. Although the TAM provides a strong theoretical foundation for explaining how people adopt and use technology (Blackwell et al., 2013), Ertmer (1999) identified two types of barriers that prevent the integration of digital technology into educational environments. These barriers are classified as first-order and second-order barriers. The first-order barriers, also known as extrinsic barriers, limit educators from integrating digital technology due to lack of access to technology, time to learn and use technology, technical support and training, and professional development (Ertmer, 1999; Hatzigianni & Kalaitzidis, 2018). The second-order barriers, also known as intrinsic barriers, prevent educators from integrating digital technology due to their perceived value in children's learning, use of technology, and pedagogical beliefs (Ertmer, 1999; Lawrence & Tar, 2018; Lucas et al., 2021; Mumtaz, 2000). The following sections will provide a detailed explanation of the technology acceptance model and its associated barriers.

## 2.2. Technology Acceptance Model

The Technology Acceptance Model (TAM) developed by Davis (1989) is an important model for describing the underlying mechanisms and influencing factors of technology integration and user acceptance. There has been a considerable amount of research since the theory first came into existence (Marangunić & Granić, 2015). This theory aimed to explain the determinants of computer acceptance in general (Davis et al., 1989) as well as why users reject or accept the use of technology (information systems) and how the design of the technology system affects users' acceptance behavior (Davis, 1987). This theoretical framework provided a basis for examining the external factors and their effects on users' internal beliefs, attitudes and intentions of acceptance of technology (Davis et al., 1989).

The proposed technology acceptance model is based on the Fishbein (1967) model, which was later refined by Fishbein and Ajzen (1975). The model comprises three

equations that explain the relationship between an individual's intention to perform a behavior, their attitude towards the behavior, and the perceived social influence from important individuals. The Theory of Planned Behavior (TPB) posits that an individual's behavioral intention is influenced by their attitude towards the behavior, subjective norm, and perceived behavioral control. The TPB has been widely used to explain technology use behavior (Rafique et al., 2018).

According to TAM, user motivation to adopt and use technology can be explained by two main factors: perceived usefulness and perceived ease of use. Perceived usefulness refers to the individual's belief that using the technology will improve their job performance (Davis, 1989; Davis & Granić, 2023). Perceived ease of use refers to the effort required to use the technology as perceived by the individual. Thus, a system can be perceived as easy to use if it is effortless to use. The TAM framework (see Figure 3) articulates the relationship between these factors, Davis (1989) proposed that an individual's attitude towards the system significantly determines whether they will ultimately accept or reject the technology in this framework.

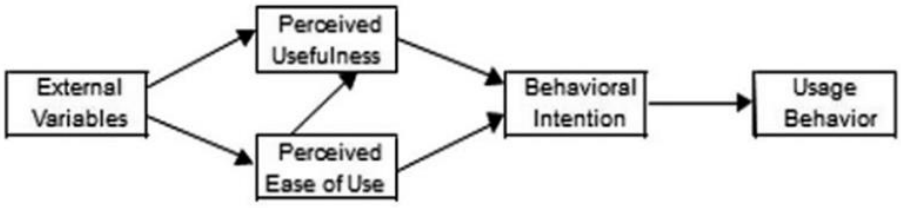



**Figure 3.** Technology Acceptance Model (TAM) (Davis et al., 1989)

Technology use is determined by behavioral intention. However, it differs in that behavioral intention is determined by attitudes towards using the system and perceived usefulness. Ease of use also influences attitude and behavior. Behavioral intention to use a technology is influenced by attitudes towards its use, as well as the direct and indirect effects of perceived usefulness and perceived ease of use (Teo, 2009).

Davis (1989) associated structure components of TAM with different factors. The TAM model only provides shallow information about technology usage and does not

contribute to system improvement unless external factors are included (Mathieson, 1991). Through specialized factors, the TAM model provides information on how the technology can be adapted beyond usage (Davis et al., 1989).

TAM's usefulness in understanding user behavior and acceptance in diverse contexts has been emphasized in numerous studies and from different backgrounds (Venkatesh & Bala, 2008). It is widely applicable across various technologies and user groups, including educators' intention to use technology (Scherer & Teo, 2019). Venkatesh et al. (2003) confirmed the broad applicability of TAM and its ability to provide insights into users' acceptance of various technologies. For instance, TAM's core predictors have been tested extensively in educational settings and have been supplemented with additional predictors, including validated self-efficacy, subjective norm, perceived enjoyment, perceived playfulness, anxiety, social influence, system quality, and facilitating conditions over time (Chipps et al., 2015; Farahat, 2012; Granić, 2023; Lin & Yeh, 2019; Yu, 2020). In the course of time, the TAM has gained prominence as a leading scientific paradigm for investigating the acceptance of learning technology by students, teachers, and other stakeholders. According to Davis (2011), TAM continues to be relevant and impactful in the field of technology acceptance, especially in the context of educational technology.

TAM has been used to explain educators' acceptance of digital technology in education. Educators are more willing to use technology in education when they perceive that it improves the learning process (Mac Callum et al., 2014). Perceived usefulness is one of the main triggers for educators to incorporate digital technology tools in education (Venkatesh & Davis, 2000). Furthermore, implementing new technology may appear to be an additional burden for educators (Thorsteinsson & Niculescu, 2013). If the technology becomes more complex or difficult to navigate, educators may be more likely to abandon its use (Sánchez-Prieto et al., 2019). Therefore, perceived ease of use and perceived usefulness can become internal barriers (Venkatesh & Bala, 2008). Educators face two main groups of barriers, referred to as first-order and second-order barriers, that prevent them from adopting digital technology (Ertmer, 1999). These barriers are associated with the technology acceptance process (Brown et al., 2016; Venkatesh et al., 2003).

To address this issue, Ertmer (1999) identified first-order and second-order factors that impede the acceptance and use of technology by educators. The external barriers, also known as first-order factors, are often linked to resource shortages, such as limited access to computers and software, insufficient time for instructional planning, and inadequate technical and administrative support (Hew & Bush, 2007; Ertmer et al., 2012). For instance, if educators feel that they lack adequate access to technology or support, they may view technology as less useful and more difficult to use, resulting in reduced acceptance and use of technology. On the other hand, second-order barriers, also known as internal barriers, can be explained as internal factors intrinsic to educators. These barriers include their beliefs about technology integration and their pedagogical practices (Wang, 2017). They involve fundamental beliefs about current practices and may require changes in goals, structures, or roles (Hew & Bush, 2007). For example, if educators strongly believe that technology is irrelevant to their curriculum or disrupts their established teaching practices, they may perceive technology as less useful and more difficult to use. This can lead to lower acceptance and use of technology (Ertmer et al., 2012).

In summary, the TAM can help to explain how both first-order and second-order barriers influence educators' acceptance and use of technology. Educators' perceptions of the usefulness and ease of use of technology can be impacted by first-order barriers, such as lack of resources and support, and second-order barriers, such as beliefs and pedagogical practices. Ultimately, these barriers can affect attitudes and intentions towards technology use. Strategies to address these barriers and promote effective technology integration in education can be informed by understanding their relationship with TAM.

### 2.3. Barriers to Technology Integration

The educational process is a complex and multifaceted system, involving not only teachers and students, but also complex systems and cultural influences. As a result, the implementation of technology in the classroom is subject to numerous factors such as school calendars, academic standards, local and national education policies (Mishra & Warr, 2021). These various elements in the educational ecosystem are

interconnected and constantly interacting. In such a dynamic environment, it is insufficient to explain technology integration with only one factor. Instead, it is crucial to recognize that technology is not directly influenced by these factors, but rather interacts with educators and leads to changes in their approach to technology integration (Ertmer, 1999). Although educators do not face all these factors, any one of these factors could suppress educators' meaningful technology usage in the classroom (Hativa & Lesgold, 1996).

As mentioned earlier, factors that hinder technology integration are referred to as "barriers" and can be categorized into two groups: first-order and second-order barriers (Blackwell et al., 2014; Ertmer et al., 2012). First-order barriers, also known as external barriers, hinder educators' ability to integrate digital technology due to external factors. These factors include limited access to technology, time constraints, lack of technical support and training, and inadequate professional development opportunities (Ertmer, 1999; Hatzigianni & Kalaitzidis, 2018). These barriers are often measurable and can be effectively addressed through resource allocation (Kelly, 2015).

On the other hand, second-order barriers, also referred to as intrinsic barriers, depend on educators' internal factors. These include their beliefs about the value of technology in education (Vongkulluksn et al., 2018) and their pedagogical beliefs (Ertmer, 1999; Lawrence & Tar, 2018; Lucas et al., 2021; Mumtaz, 2000). These barriers are intricately linked to educators' pedagogical beliefs and can sometimes remain hidden and unnoticed by educators themselves or others (Kerr, 1996).

### 2.3.1. First-Order Barriers

In the context of educational technology, first-order barriers are defined by Ertmer (1999) as institutional resources that exist outside of educators. These barriers encompass crucial elements, including the availability of hardware and software, the scope of training provided, and the level of support offered to educators. In addition, the availability of digital technology in the classroom, the accessibility of technical

support, as well as administrators' priorities and the school's overall approach to technology integration (Hew & Brush, 2007; Kopcha, 2012).

#### 2.3.1.1. Access

In order to apply technological tools in education, educators require access to sufficient technology tools and resources (Inan & Lowther, 2010). The term "*access to available technology*" is defined as the lack of sufficient and appropriate technology, including physical devices and free software, to serve both educators and children's usage (Hew & Brush, 2007). A study by Ertmer et al. (2012) indicates that schools have been expanding their capacity to provide accessible technology tools and resources. However, challenges persist, particularly in rural school districts (Makki et al., 2018).

In order for technology to be effectively integrated into education, it is of the utmost importance that it is accessible to all students, regardless of whether they reside in rural or urban areas. In addition, the availability of high-speed and reliable internet connections for educators is also an important requirement. It is essential that the necessary infrastructure is provided directly inside classrooms, rather than relying on separate computer rooms (European Commission, 2020).

In the Turkish context, the situation can be summarized as some kindergartens are equipped with technology through initiatives led by school districts, while in some early childhood classrooms, educators are tasked with using school funds or donations from parents to introduce technology (Ozel, 2019). Essentially, access is a fundamental step in the integration of digital technology, and a lack of access automatically limits the ability of teachers to effectively integrate technology into the classroom (Peeraer & Petegem, 2011).

#### 2.3.1.2. Support

In addition to access to technology, another significant obstacle to the effective integration of technology into the classroom is the necessity for support. Educators

require assistance and guidance in utilizing digital technologies in various capacities, and it is the responsibility of educational institutions to provide technical support (Hew & Brush, 2007). In the absence of adequate technical support, educators may encounter difficulties in resolving technical issues, particularly when they lack the requisite technical expertise. Consequently, numerous educators may develop apprehensions regarding their capacity to address technology-related concerns, which can impede the educational process.

Similarly, technology support services also play an important role in improving technology integration in education (Gürfidan & Koc, 2016). When educators are aware that they can rely on administrative support for guidance on using a particular technology in the classroom, their confidence and self-efficacy increase. As a result, they are more comfortable taking risks and adopting new technologies as educational tools (Gürfidan & Koc, 2016). Inan and Lowhter (2010) stated that although technical support does not have a direct effect on technology integration, it affects mediating variables, thereby indirectly contributing to technology integration.

#### 2.3.1.3. Gatekeepers

Despite the availability of technology and the provision of support, additional factors within the school, school district, or organizational culture can impede the use of technology in the educational setting (Tondeur et al., 2017). One of these critical factors is the attitude of school leaders, which has a significant impact on educators' adoption of digital technologies for teaching and learning. As influencers and decision makers, school leaders play a pivotal role in shaping the vision of technology use in education. They can either encourage the adoption of technology or impede its adoption (Chang, 2012; Christensen et al., 2018; Thannimalai & Raman, 2018).

Moreover, the attitudes of guardians towards the use of digital technology in education also have a significant impact on technology integration. When asked about their perspectives on children's use of digital technology, some guardians acknowledge that technology-based activities contribute positively to children's

learning (Hollingworth et al., 2011; Turow & Nir, 2000). In contrast, others expressed concerns about the potential negative effects of technology (Davies, 2011; Fleming et al., 2006). Given the ongoing debate about the negative effects of digital technology on children on social media, some guardians may question the inclusion of technology in the classroom by educators (Forsling, 2019, as cited in Lindeman et al., 2021). Such guardians may hold the belief that children need to be protected from technology, which may lead them to discourage the use of technology or to resist technology and see it as unnecessary (Hamutoğlu & Basarmak, 2020).

Given that educators must consider the attitudes of guardians, the integration of technology in education is contingent upon their attitudes towards technology. Consequently, guardians' reluctance to utilize technology in education can be perceived as a hindrance. These impediments, originating from both school leaders and guardians, are collectively designated as "gatekeepers" in the current study.

### 2.3.2. Second-Order Barriers

Second-order barriers, also referred to as intrinsic barriers, encompass factors specific to educators themselves. These include their confidence in using technology, their beliefs about the benefits of technology integration for children's learning (Hatzigianni & Kalaitzidis, 2018), and their attitudes towards the use of digital technology (Hew & Brush, 2007). For instance, educators' comfort with technology and their perceptions of its value in education have been demonstrated to significantly influence the use of digital technology in educational practices (Blackwell et al., 2014).

#### 2.3.2.1. Attitudes towards Digital Technology

One of the second-order barriers to technology integration is educators' attitudes towards the use of digital technology in education, and this factor is of great importance as it is a central determinant of technology usage (Backfisch et al., 2021). Attitudes towards digital technology can be defined as "general feeling of favorable or unfavorable for the use of ICT in teaching and learning process" (Lawrence &

Tar, 2018, p.93). As the definition suggests, educators' attitudes towards digital technology significantly influence their efforts to incorporate it into educational practices (Casillas Martín et al., 2020; Francom, 2020; Inan & Lowther, 2010; Vongkulluksn et al., 2018). When educators believe that the use of digital technology has a negative impact on children, they are less likely to integrate it into their teaching methods. For example, an early childhood educator (ECE) in Taiwan who is concerned about the potential negative effects of digital technology on children's eyesight may choose to prevent the use of digital tools in the classroom in order to protect children's eye health (Chen et al., 2018).

Positive attitudes towards using digital technology among ECEs are associated with greater incorporation of digital tools into their educational practice (Mertala, 2017). Conversely, educators who hold negative attitudes towards digital technology may avoid using it, even when they have access to excellent technology infrastructure (Lawrence & Tar, 2018). For instance, some ECEs believe that the use of digital technology by young children impedes the practice of authentic communication and play-based learning, which are fundamental to the field of early childhood education (Hernwall, 2016). Such perceptions may negatively affect educators' attitudes towards the use of digital technology in education. Consequently, ECEs may not endorse digital technology as an instructional strategy in young children's learning (Dong & Xu, 2021).

The relationship between first-order and second-order barriers is complex and it is not always straightforward to determine the direction of this relationship. One study (Hamutoğlu & Basarmak, 2020) suggests that first-order barriers directly and positively affect second-order barriers. In contrast, some studies have suggested that second-order barriers have a more significant impact on educators' technology use than first-order barriers (Ertmer, 2012; Inan & Lowther, 2010; Lawrence & Tar, 2018). Moreover, educators' internal barriers seem to be more closely linked to the level of technology integration in education than external barriers. It is hypothesized that the type of barriers may discourage the implementation of digital tools. For instance, second-order barriers may impede the meaningful use of technology, whereas first-order barriers may impede the application of more productive beliefs

(Ertmer, 1999). Another study indicates that the presence of fewer first-order barriers is associated with higher levels of technology integration among educators (Ertmer, 1999).

#### 2.3.2.2. Teacher Inhibitions

The second-order barriers were defined as teacher inhibitions including "teachers' self-efficacy and preparedness for integrating technology into the classroom" (Blackwell et al., 2013, pg.4). The self-efficacy of educators with regard to digital technology is related to their perception of their ability to use it for teaching and learning activities (Ottenbreit-Leftwich et al., 2018). In some studies, self-efficacy is related to educators' perceived ease of use (Holden & Rada, 2011; Scherer & Hatlevik, 2017). This perceived ease of use depends on how educators perceive a particular digital technology tool as easy to use. However, self-efficacy and perceived ease of use are two distinct concepts. Nevertheless, they could be considered under the same conceptual disposition factor (Ottenbreit-Leftwich et al., 2018). Conversely, the implementation of digital technology is a complex process due to the necessity of integrating various internal applications utilized in teaching and learning (Lawrence & Tar, 2018). This increases the level of complexity.

Educators' self-efficacy in using digital tools is a crucial factor in determining their choice to use these tools in education. Educators who lack confidence in using digital technology are more likely to avoid activities that require digital technology as their self-efficacy affects their choices (Pajares & Schunk, 2002). Although limited research has been conducted on this topic, mostly involving pre-service educators, the findings of one study suggest that educators' self-efficacy is an important factor affecting their participation in digital technology-based activities (Minshew & Anderson, 2015).

Another factor associated with teacher inhibitions is preparedness, sometimes educators have issues as they do not have enough time for preparation. Educators are required to follow a curriculum and accomplish specific objectives during the education semester. However, early childhood education may appear more flexible

than other levels, as it does not necessarily need to follow a structured curriculum. Nevertheless, there is a daily plan to conduct during the day. Therefore, time could potentially act as a barrier to implementing an effective technology-integrated education activity (Hew & Brush, 2007). Conversely, educators must invest time in exploring technological tools, a commitment that may not always be feasible (Tondeur et al., 2017). They often lack the opportunity to participate in professional training programs designed to enhance their technological skills. Moreover, educators perceive that it is challenging to find sufficient time to practice using digital tools within the constraints of the regular classroom schedule. In addition, the lack of time is considered a significant and pervasive obstacle to integrating digital tools into education (Lawrence & Tar, 2018).

Moreover, educators were inadequately prepared for the integration of digital technologies in education during their teacher training. Either professional or university training is insufficient and predominantly focuses on technical aspects, with a notable absence of attention to the pedagogical aspects of digital literacy (Fernández-Batanero et al., 2020). The teacher preparation program should provide an environment and experience of trial educational technology and facilitate an understanding of how to integrate educational technology in an appropriate manner. Nevertheless, the content of relevant courses in teacher preparation programs is predominantly focused on operationalizing digital devices, with a paucity of instruction on the creation of participatory learning environments through digital technology usage in educational settings (Luo et al., 2020).

### 2.4. Digital Competence of Educators

In 2006, the European Parliament and the Council identified digital competence as one of the eight key components of lifelong learning. By 2010, it had become the primary focus of European Commission policies, actions and communications aimed at preparing society for digitalization and ensuring that Europe did not lag in digital development. As defined by the European Commission, digital competence encompasses the confident, critical, and responsible use of digital technologies for learning, working and participating in society (2018, p.5).

Educators' digital competence is a multifaceted and complex concept because it encompasses various dimensions, including social, behavioral, ethical, pedagogical and attitudinal aspects of the educational environment (Krumsvik, 2014; Lund et al., 2014; Pettersson, 2018). Lund and Erikson (2016) describe educators' digital competence as a "double challenge" because it requires them to possess the basic ICT skills needed by professionals such as engineers, doctors, and nurses, as well as the knowledge to use digital technologies competently and effectively to enhance children's learning. Numerous frameworks and definitions have been created to clarify this complex concept (Hatlevik, 2017; Falloon, 2022; Johannesen et al., 2014; Krumsvik 2007; Krumsvik, 2011; Redecker, 2017; UNICEF, 2022).

Krumsvik's definition of digital competence emphasizes its complexity by defining it as "teachers'/prospective teachers' competence to use ICT in a professional context with good pedagogical-didactic reasoning and awareness of its implications for learning strategies and students' digital Bildung" (2011, p.45). This definition emphasizes the need for a comprehensive and holistic level of competence.

The complex structure of digital competence and the need to understand the changing pedagogical aspects of integrating digital technology and take advantage of its potential bring many models to explain educators' digital competence. Among these models, the DigCompEdu model has been chosen to explain how educators' digital competence refers to both technical and pedagogical aspects.

### 2.4.1. DigCompEdu Framework

Some frameworks and models have been developed to study digital competence in education (e.g., Janssen et al., 2013a; Kelentrić et al., 2017; Krumsvik, 2014; International Society for Technology in Education [ISTE], 2017). However, these frameworks often provide a general understanding of digital competence (Instefjord & Munthe, 2017), and have been deprived of explaining which competences are necessary for educators (Garcia-Martin & Garcia-Sanchez, 2017). Therefore, a more comprehensive framework was required to explain which knowledge should be acquired by educators to develop their digital competence, especially in educational

practices. To address this gap, the European Joint Research Centre conducted an extensive study and published the Digital Competence of Educators (DigCompEdu) framework which builds upon the existing DigComp framework developed by the Joint Research Center (Siddiq et al., 2016).

DigComEdu is a comprehensive framework that focuses on the competence areas educators require to efficiently run digital technologies in the school context (Redecker, 2017). The framework provides a consistent understanding of what forms digital competence for educators (Skantz-Åberg et al., 2022). It is also recognized for instructors at all levels from early childhood to adult education (Benali et al., 2018).

In the initial phase of developing DigCompEdu, 50 instruments were analyzed, and 32 instruments were selected to serve as the foundation for the preliminary draft (Caena & Redecker, 2019). Some of the instruments were excluded due to insufficient detail, lack of relevance, or being outside the scope of the purpose. The final draft was ultimately determined through online or face-to-face consultations with stakeholders. Following the completion of these processes, the DigCompEdu framework emerged as a unifying reference point for national and local initiatives (Caena & Redecker, 2019). Its objective was to establish digital competence specific to teachers' professions, enabling the tailoring of digital technologies for enhancing and innovating education (Redecker, 2017).

DigCompEdu encompasses the integration of digital technology for both with and about technology (Tondeur et al., 2018). This is the requisite pedagogical competence for empowering learners to apply differentiated and actively engaged learning by using digital technologies in educational settings (Runge et al., 2023). In other words, the DigCompEdu framework encompasses both the use of digital technology in the classroom and the instruction of digital technology to children. This approach aims to enhance children's appropriate use of digital technology (Cattaneo et al., 2022). Consequently, digital competence advocates for a comprehensive approach to pedagogical knowledge, learning methods, and techniques (Redecker, 2017).

DigCompEdu framework includes 22 total competences under six different areas (also known as subdimensions) (Redecker, 2017). These areas comprise the core competences namely educators' professional competence, educators' pedagogic competence and learners' competence. These competences, areas and core competences are illustrated in Figure 4, with an accompanying explanation provided in Table 1 and 2.

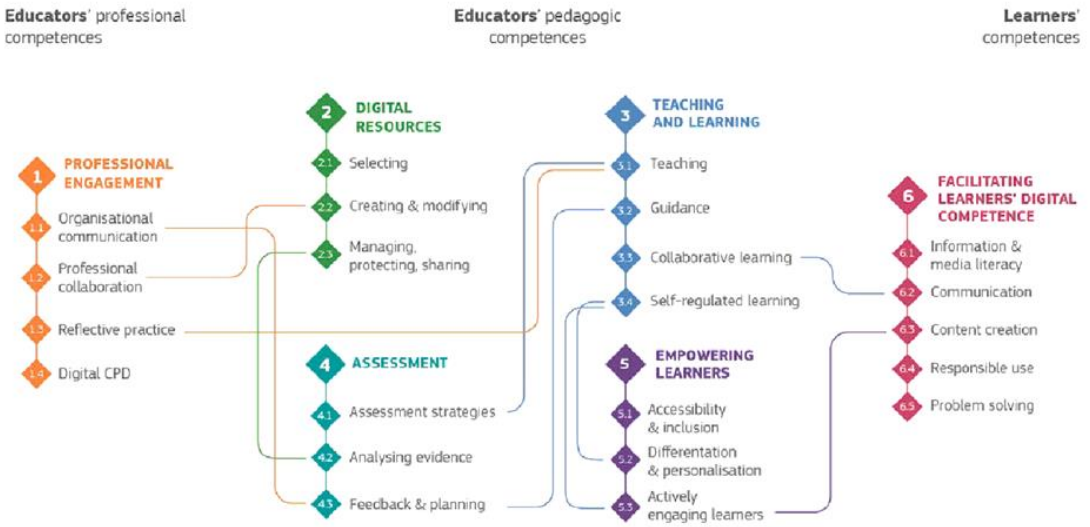



**Figure 4.** DigCompEdu Framework Competence Areas (Redecker, 2017)

Among the areas between 2 and 5 represent the core idea of DigCompEdu which focuses on the integrating digital technologies into educational practice in a pedagogically meaningful way (Caena & Redecker, 2019) so these areas are prerequisites for successful technology integration (Runge et al., 2023).

Competence areas 2 and 4 provide details on planning, implementation, and assessment, competence area 5 mentions the child-centered approach rather than the teacher-centered approach (Lucas et al., 2021). Furthermore, areas 1 and 6 are related to the working community of educators and the broader digital societal context, a situation that some scholars take into account to examine various social and cultural influences on the use of digital technology by educators (Engen, 2019).

**Table 1.** DigCompEdu areas and descriptions

| Areas | Description | Competences |
|---|---|---|
| **Area 1:**<br>**Professional Engagement** | This area refers to teachers' communication, collaboration, and professional development through digital technologies | ● Organizational communication<br>● Professional collaboration<br>● Reflective practice<br>● Digital Continuous Professional Development (CPD) |
| **Area 2:**<br>**Digital Resources** | This area includes the selection, creation, modification, and management process of digital educational resources. Personal data protection and copyright laws are considered when modifying and publishing digital content. | ● Selecting<br>● Creating & modifying<br>● Managing, protecting, sharing |
| **Area 3:**<br>**Teaching and Learning** | This area highlights how digital technologies are managing and orchestrating teaching and learning. In other words, the area focuses on incorporating digital resources and methods to promote learning. | ● Teaching<br>● Guidance<br>● Collaborative learning<br>● Self-regulated learning |
| **Area 4:**<br>**Assessment** | This area focuses on using digital technologies and strategies to support the assessment process. | ● Assessment strategies<br>● Analyzing evidence<br>● Feedback & planning |

Table 1. (continued)

| | | |
|---|---|---|
| **Area 5: Empowering Learners** | This area refers to the use of digital technology to empower learners' active participation and address their needs. Through digital technologies, teachers can foster individual learning, differentiation, and personalization. As well as teachers encourage children's active engagement by providing equal access to digital technologies. | • Accessibility & inclusion<br>• Differentiation and personalization<br>• Actively engaging learners |
| **Area 6: Facilitating Learners' Digital Competence** | This area focuses on children's creativity and responsibly use of digital technologies, so teachers' digital competence promotes learners' digital competence. | • Information & Media literacy<br>• Communication<br>• Content creation<br>• Responsible use<br>• Problem solving |

**Table 2.** DigCompEdu areas and explanation of competences of each areas

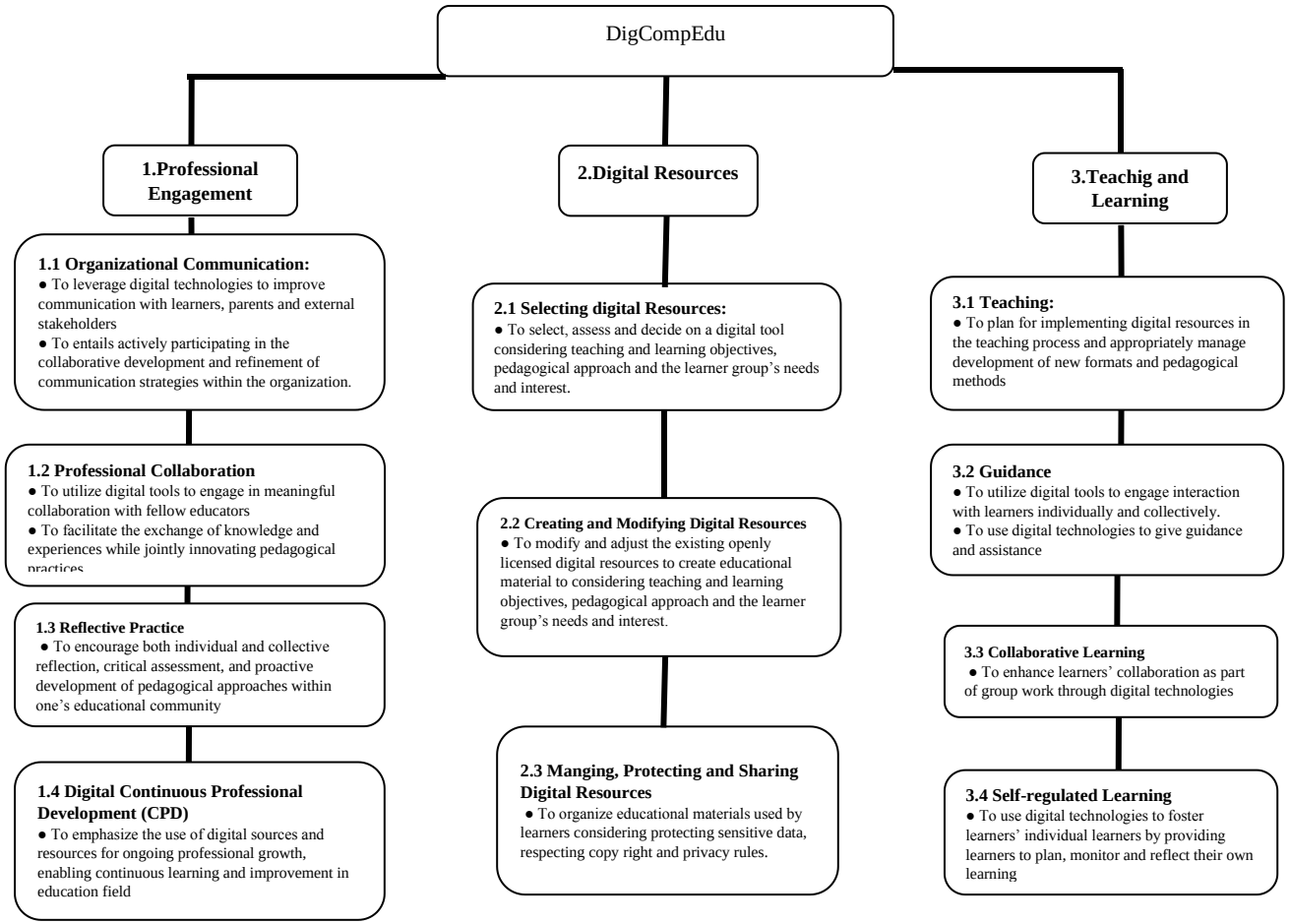
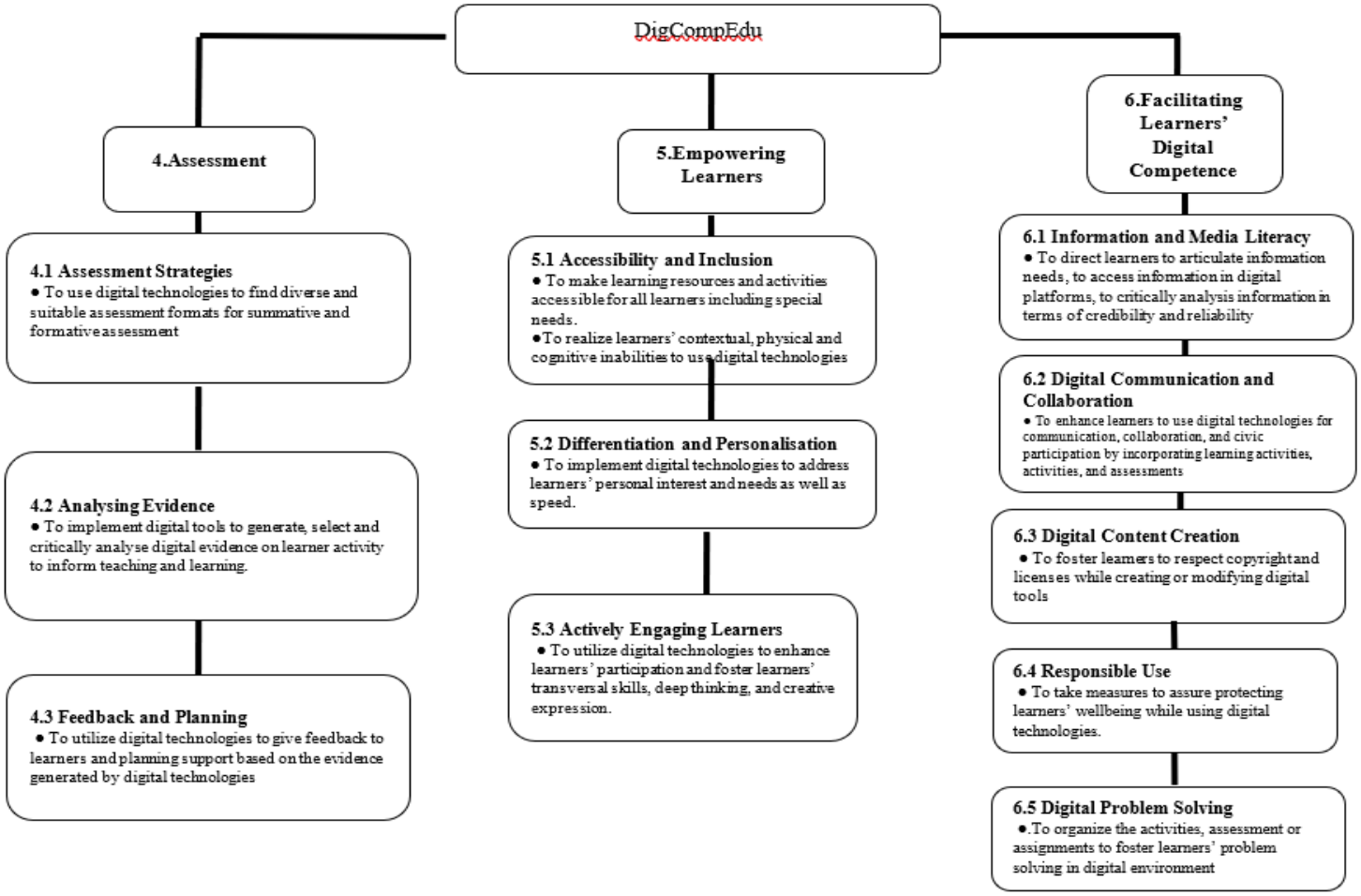


Table 2. (continued)



The link between these domains is illustrated in Figure 5 and shows that they are closely related to the broader concept of overall digital competence (Runge et al., 2023). For educators, digital competence goes beyond the use of digital technologies in teaching and learning. A digitally competent educator must also consider the broader context in which educational interactions take place. Educators' digital competence includes preparing learners to actively participate in life and work in a digital age. It is also an integral part of their competence to use digital technologies to improve instructional practices and organizational strategies (Redecker, 2017).

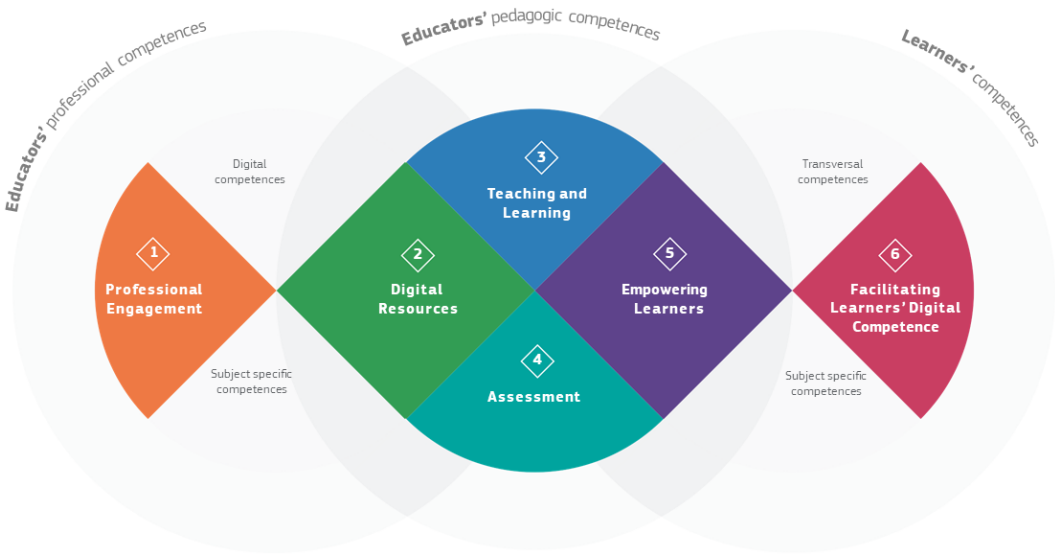



**Figure 5.**Synthesize of the DigCompEdu framework (Redecker, 2017)

DigCompEdu framework was designed based on the progression model which helps educators to define their weaknesses or strengths in different digital competence areas (Redecker, 2017). That is, educators can independently assess their competence level or stages in the areas of professional engagement, digital resources, teaching, and learning, assessment, empowering learners, and facilitating learners. Therefore, educators can identify their strengths and weaknesses in each competence area. Being aware of the weaknesses and strengths of digital competence helps educators to plan how to improve themselves in these areas and what is the next step to achieve digital fluency (Dias-Trindade & Ferreira, 2020).

Educators' levels of digital competence are categorized into a framework similar to the Common European Framework of Reference for Languages (CEFR) (Council of

Europe, 2001). These categories are often referred to as proficiency levels and are developed based on Bloom's taxonomy. The proficiency levels correspond to stages of learning progress in Bloom's taxonomy. For example, the first level is called "Newcomer" (A1) and "Explorer" (A2), which correspond to the cognitive stages of "remembering" and "understanding". At these levels, educators assimilate new knowledge and improve basic educational practices. The next two levels are "Integrator" (B1) and "Expert" (B2), which corresponds to the "Applying" and "Analyzing" stages of Bloom's taxonomy. During these stages, educators seek to expand on their practices and engage in reflection. Finally, in the last levels, educators are classified as "Leader" (C1) and "Pioneer" (C2), similar to the "Evaluating" and "Creating" stages in Bloom's taxonomy. At these levels, educators critically evaluate existing practices and have the potential to develop new and innovative approaches (Redecker, 2017).

The first two levels, A1 and A2, refer to educators who have begun to use technology in some areas and who are aware of the benefits of digital technology for advancing pedagogical and professional practice. Levels B1 or B2 mean that educators are already incorporating digital technologies into practice in a variety of ways and contexts. The highest levels, C1, and C2 refer to educators sharing their experiences with colleagues and creating new pedagogical approaches through digital technologies (Ghomi & Redecker, 2019). The DigCompEdu progression levels are shown in Figure 6.

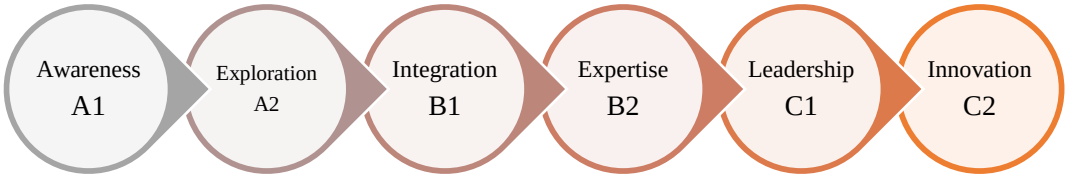



**Figure 6.** DigCompEdu progression model (Adapted from Redecker, 2017)

As a result, the DigCompEdu framework serves as a valuable guide for education policymakers at different levels, including local, national, European, and international contexts (Ghomi & Redecker, 2019). In addition to providing a

common understanding of educators' digital competence, the framework outlines the specific knowledge and skills that digitally competent educators should possess. Within the framework, educators have the opportunity to self-assess their digital competence and identify their level of competence, ranging from newcomer to pioneer. This self-assessment can then inform targeted educational interventions aimed at increasing educators' digital competence, ranging from micro-level initiatives to broader, systemic change. For this reason, this framework is currently used in the SELFIE project by the European Commission (SELFIE, n.d). This project aims to improve schools' technology use for teaching and learning. DigCompEdu is a framework for identifying educators' levels of digital competence. Based on the results of the framework, educators can design their learning paths. This SELFIE tool has been used by 41,249 schools, 6,428,472 users in 86 countries, and translated into 41 languages. The DigCompEdu framework was selected as the theoretical basis for this study due to its comprehensive coverage of digital competence domains and its ability to empower educators to self-assess and develop their digital competence in specific areas (Redecker, 2017; McDonagh et al., 2021). Additionally, it is accepted as a common framework by EU (EU Science Hub, n.d.-a).

#### 2.4.1.1. Studies on Educators' Digital Competence

The digital competence of educators has a direct and influential impact on the utilization of digital technologies in education since digital competence encompasses a range of knowledge, skills, and attitudes necessary for effectively incorporating digital technology into educational practices (Hatlevik, 2017; Instefjord & Munthe, 2017; Røkenes & Krumsvik, 2016). Consequently, numerous studies have been conducted with the objective of identifying the factors that influence educators' digital competence**.** These studies have explored both educators' personal characteristics, such as age, gender, attitudes, and beliefs, as well as background and school-related factors, including technical infrastructure and school development (Cattaneo et al., 2022).

A study conducted by Almerich and colleagues in 2016 aimed to investigate the impact of various personal and contextual factors on educators' digital competences.

The study involved 1,095 primary, secondary and university educators in eastern Spain, including both male and female participants. The researchers employed a survey methodology to collect data. The findings of the study revealed that various factors play an important role in shaping educators' digital competences. In particular, gender, frequency of computer use at home, educational background and access to computers were identified as key factors. In particular, frequency of computer use at home had a stronger impact on ICT competence compared to pedagogical competence. Moreover, both gender and computer access were found to be factors affecting both ICT and pedagogical competence dimensions.

Hatlevik et al. (2016) conducted a study to investigate the relationship between self-efficacy in basic ICT and digital competence. The study involved 312 primary and secondary school educators from Norway. The results indicated a positive correlation between self-efficacy in basic ICT and digital competence. The findings of the study demonstrated a positive correlation between basic ICT self-efficacy and digital competence. In other words, educators who demonstrate higher levels of self-efficacy in the use of basic ICT also tend to exhibit higher levels of digital competence. This suggests that educators' confidence and belief in their ability to use basic ICT tools play a role in predicting their overall digital competence.

In 2018, Tondeur and colleagues conducted a study with the objective of uncovering the perceived digital competence of pre-service educators in relation to their background characteristics and ICT profiles, including their attitudes towards digital technology. The study involved 931 pre-service educators in their final year of teacher education from 20 teacher training institutions in Flanders. Data for the study was collected through a questionnaire. The results of the study revealed several important findings. First, the study revealed that attitudes towards ICT in education significantly impact on pre-service educators' ability to encourage children's use of digital technology. However, the study also found that attitudes towards digital technology did not significantly affect pre-service educators' competence in designing learning environments using digital technologies. One of the particularly surprising results of the study is the discovery that the intensity of pre-service educators' use of digital technology is not related to their digital competence levels.

The study also revealed that factors such as age and gender did not significantly influence on pre-service educators' digital competence.

In 2019, Ghomi and Redecker conducted a study to assess the digital competence of STEM (Science, Technology, Engineering and Mathematics) educators and identify factors associated with it. The study included 335 STEM educators as participants. The findings of the study revealed several important findings. Those STEM educators with more years of experience in teaching with digital technologies exhibited higher levels of digital competence. This suggests that practical experience with digital tools over time contributes to greater digital competence among STEM educators. Furthermore, the study found a positive correlation between the use of a variety of digital technologies and higher levels of digital competence among STEM educators. The use of a wide range of digital tools seems to be associated with enhanced digital competence. One of the key discoveries was the impact of educators' attitudes towards the use of digital technologies in education. STEM educators with positive or neutral attitudes towards digital technology demonstrated higher levels of digital competence, whereas educators with negative attitudes towards digital tools exhibited lower digital competence scores. This highlights the pivotal role of educators' beliefs and attitudes towards digital technology in influencing their digital competence levels.

In 2021, Lucas and colleagues conducted a study with the objective of exploring the relationship between personal and contextual factors among in-service educators. For the research, they collaborated with 1,071 in-service educators from primary and secondary schools in Portugal. Data collection was conducted through the administration of questionnaires. The findings of the study revealed several notable insights. First, gender emerged as a significant determinant of digital competence in favor of male teachers. Moreover, the study revealed that younger teachers exhibited higher digital competence than their more senior colleagues. Additionally, the study identified several factors that play a significant role in predicting educators' digital competence. In particular, confidence in the use of digital technology, participation in social networks and the number of tools used for teaching and learning were found to be important predictors of educators' digital competence.

In 2021, Garzón-Artacho and colleagues conducted a study with the objective of identifying the factors influencing the digital competence of teachers engaged in lifelong learning. The study involved 140 teachers working in Andalusia, Spain, who were selected as participants. Data for the study was collected through the administration of a questionnaire. The study's findings indicated that certain socio-demographic factors, including age, teaching experience, and specific areas of communication, exert a significant influence on the advancement of lifelong learning teachers' digital competence.

In consideration of contextual factors, the research indicated that variables such as students' access to technology and curriculum facilitation were statistically significant predictors of educators' digital competence. An unexpected discovery was that school facilities were significant predictors only for the professional engagement dimension of DigCompEdu and this relationship was negatively correlated. Consequently, the study highlighted that personal factors have a more significant predictive power than contextual factors in determining educators' digital competence.

Guillén-Gámez and his team conducted a study in 2021 with 81 educators from Madrid, Spain. The study covered educators in early childhood, primary and secondary education. It employed a non-experimental ex post facto design and utilized a survey instrument to gather data. The study found that gender and age affected educators' digital competence levels. Interestingly, the specific level of education at which educators worked did not have a significant impact on their digital competence.

In 2021, Hämäläinen and his team conducted a study to investigate the relationship between educators' digital competence and various personal and contextual factors. Using data from the PIAAC and TALIS datasets, they recruited a sample of 2,590 educators from primary and secondary schools, including both lower and upper levels. These educators represent a variety of countries, including Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, the Netherlands, Norway, the Slovak Republic, Sweden, and the United Kingdom. The findings of the study

emphasized the importance of second-order barriers in relation to digital competence and the integration of digital tools into education. The researchers argued that these second-order barriers, which include factors such as educators' attitudes towards digital technologies in education and school strategies, play a more important role than first-order barriers. Furthermore, the study showed that the use of multiple strategies can effectively overcome these second-order barriers and ultimately contribute to educators' self-perceived efficacy in using digital tools for education.

Cattaneo et al. conducted a study in 2022 to investigate how digital competence is influenced among VET educators, including those teaching vocational baccalaureate, vocational courses and general education. They also sought to investigate the influence of personal and contextual factors on VET educators' digital competence. The study included 3,404 VET educators from Sweden. According to results of the study, gender is not a significant predictor of digital competence of educators. Regarding age, the study found that digital competence tends to decrease with age increases. The study results also show that workload is a significant predictor of digital competence, high workload percentage is associated with high digital competence. In terms of attitudes, the authors found that attitudes towards technology is one of the core determinants of digital competence. The positive attitudes towards technology positively impact digital competence of educators. Regarding the school context, it can be said that school infrastructural characteristics, and subjective perception of the school does not influence digital competence.

In 2023, Inamorato Dos Santos and their team conducted a large-scale study involving 30,407 participants in higher education from a variety of disciplines in seven countries: Argentina, Brazil, Colombia, Chile, Peru, Mexico, and Portugal. The objective of the study was to examine professional digital competence among educators. The study revealed that age, teaching experience and gender did not significantly affect educators' professional digital competences. However, the study identified some environmental factors that play an important role in shaping educators' professional digital competence. In particular, a working environment with a reliable internet connection and the availability of media tools have a positive impact on educators' digital competences in their professional roles. This underlines

the importance of supportive working environments and access to digital resources in developing educators' digital skills and competence.

In 2023, Madsen et al. conducted a comprehensive comparative study aimed at exploring the digital competence dynamics of pre-service early childhood educators in eight different countries: Norway, Slovenia, Portugal, Poland, Poland, Türkiye, Ukraine, the UK and Jordan. The study involved 772 prospective educators in their final year of education. The findings of the study revealed a significant difference in the level of digital competence of pre-service educators in the various countries studied. This suggests that educators' digital competence is influenced by national contexts and practices. Furthermore, the study emphasized the importance of building a common understanding of educators' digital competence dynamics at the national level.

In 2023, Masoumi and Noorozi conducted a systematic literature review study to explore the development of digital competence among early career primary, secondary and higher education teachers (ECTs) and identify the enabling factors influencing this development. They revised 25 scientific articles and identified five factors influencing this development: institutional culture, digital technology availability and access, governance and leadership, availability of technical and pedagogical support, and workload. The study found that early career teachers' digital competence development is largely influenced by their individual explorations and experiences in the classroom. When teachers lack motivation to use digital technology, it can hinder their ability to develop digital competence. Conversely, teachers who perceive digital technology as a valuable tool for integrating into education and possess self-efficacy are more likely to pursue the development of their digital competence. The researchers posited that as ECTs' digital competence development is contingent upon various factors, including institutional culture, accessibility of digital technologies, mentoring, and administrative support, a systematic approach can motivate ECTs to develop their digital competence on a continuous basis.

Studies conducted in the Turkish context have also provided valuable insights.

In a study conducted in 2021, Yilmaz and Toker examined 6,118 educators from different fields, including verbal, numerical and applied disciplines. The results of the study revealed a significant difference in digital competence among educators according to their fields of study. In particular, educators in verbal disciplines were found to have lower levels of digital competence than their colleagues in applied disciplines. This suggests that the nature of the teaching field may influence digital competence levels of educators with applied fields potentially having a more favorable digital competence profile.

Fidan and Yelegen (2022) conducted another study to investigate teachers' digital competence regarding its relevant factors. 158 teachers from North Blacksea part of Türkiye and working in a public primary school. According to the results of the study, gender, years of teaching experience, using internet duration, and usage of Web 2.0 tools significantly impact educators' digital competence. The results of the study revealed that several factors have a significant impact on educators' digital competence. These factors include gender, years of teaching experience, years of internet usage and use of Web 2.0 tools. In other words, while gender differences play a role in digital competence, teaching experience, internet usage habits and the incorporation of Web 2.0 tools into teaching practices also influence educators' digital competence levels. This study shown that the multifaceted nature of digital competence among educators and emphasized the importance of various factors in shaping their digital competence.

Gümüş and Kukul conducted a study in 2023 to investigate the predictors of digital competence among primary, secondary and high school educators in different disciplines. In the study, 695 teachers took part as participants. First, the study revealed that gender did not play a significant role in determining digital competence among educators. In other words, no significant difference was found between male and female teachers in terms of their digital competence levels.

In a study conducted by Kuş and Mert (2024), 212 educators from various areas and cities in Türkiye were surveyed. The quantitative data indicated that Turkish educators in various disciplines, including social studies, classroom teaching,

science, and mathematics, were found to possess expertise at the "expert" level. However, the qualitative data revealed that the researchers identified educators' digital competence at the "integrative" level. The researchers posited that Turkish educators possess technological knowledge but lack the ability to apply this knowledge in a pedagogically effective manner. They asserted that educators do not consider digital content development a priority, preferring to rely on existing materials. The study also demonstrated that teachers are unable to utilize digital technology for assessment purposes.

Research in education has found consistent relationships between educators' digital competence and various demographic, personal, and professional characteristics (Almerich et al., 2016; Krumsvik et al., 2016; Lucas et al., 2021; Tondeur et al., 2018). For example, the amount of time educators spend with digital screens positively affects both their personal digital competence and professional digital competence (Hatlevik, 2017; Krumsvik et al., 2016; Lucas et al., 2021; Tondeur et al., 2018). However, there are inconsistencies in the literature regarding the impact of these factors on educators' digital competence.

Indeed, it is noteworthy that most studies in the area of educators' digital competence have focused on primary and secondary school educators. Given the unique developmental characteristics of young children, different pedagogical practices, and curricular differences in early childhood education, there is a clear gap in research examining the factors that influence educators' digital competence, especially in the field of preschool or early childhood education.

It is important to conduct specific studies in this area. In this way, researchers and educators can gain a deeper understanding of the predictors that influence early childhood educators' digital competences. This understanding can help educators overcome potential barriers in their digital competence development and enhance their ability to use technology effectively in the context of early childhood education.

By addressing these factors, educators can both improve their own digital competences and benefit the children they work with by better integrating technology

into their teaching practices. Ultimately, research in this area can contribute to the overall quality of early childhood education and help prepare young children for the increasingly digital world in which they are growing up.

#### 2.4.1.2. Turkish Education System and Status for Digital Technology

The Turkish education system is a centralized system managed by the Ministry of National Education (MoNE). The ministry is responsible for implementing all policies in primary and secondary education. Additionally, as the system is centralized, the curriculum, textbooks, and assessment practices are uniform across all primary and secondary education institutions. The ministry also allocates human and financial resources to these institutions through its Provincial Directorates (OECD, 2019). The centralized system is particularly robust in Türkiye, to the extent that schools have limited autonomy to implement their curriculum or utilize financial resources to meet their requirements (OECD, 2019).

The digitalization of education studies in Türkiye commenced with the implementation of the "Computer Assisted Education" initiative in 1984, spearheaded by the MoNE. The primary objective of this project was to cultivate a computer-literate workforce (Usun, 2006). As part of this initiative, 1,111 computers were installed in 101 high schools. Furthermore, two educators from each school were trained for a period of five weeks. According to the project, these educators were to train their colleagues at their respective schools (Parlak-Yilmaz, 2011). In addition to these schools, 130 computers were purchased for 101 vocational schools specializing in tourism and hotel operations. Computer literacy courses were integrated into these schools' curricula as elective courses. The project concluded in 1997. During this period, the project was extended to include private schools and universities.

In 2000, another project, the "Project for Globalization in Education 2000," was supported by the World Bank. The primary objective of the project was to implement instructional technologies at each level of education in order to equip society with information and technology standards. Under this project, 2,451 technology

classrooms were established in primary and secondary schools in all cities of Türkiye. The classrooms were furnished with computers, scanners, office software, and courses in various subjects related to computer literacy (Akkoyunlu & Orhan, 2001). In the second stage of the project, an additional 3,000 schools were provided with technological devices. The project introduced Türkiye to some of the basic tenets of the 21st century, including the support of formal education through distance learning, the installation of computer labs, the provision of access to all children for computer-assisted education in primary education institutions, the implementation of measures to make teachers and children computer literate, and the equipping of schools with modern digital technologies (Usun, 2006).

In 2010, a major government-supported project was initiated in Türkiye, as the Movement of Enhancing Opportunities and Improving Technology project (Fırsatları Artırma ve Teknolojiyi İyileştirme Hareketi) which is also referred to as FATIH. The project was launched by Ministry of Education (MoNE) in 2010 with five main actions, these include;

- The provision of hardware and software infrastructure
- The delivery and management of instructional e-content
- In-service training for teachers
- Ensuring conscious, secure, manageable, and measurable use of ICT:
- The effective use of ICT in the curricula (http://fatihprojesi.meb.gov.tr/, as cited Demir, 2023).

The FATIH project, which was initiated in 2013, aimed to provide students and educators with tablets. By 2021, 2,148,607 tablets had been distributed (http://fatihprojesi.meb.gov.tr/). Additionally, the Ministry of National Education (MoNE) reported that approximately 90% of classrooms had been equipped with interactive whiteboards by 2022 (MoNE, 2022). However, the FATIH project has not been implemented as intended in early childhood classrooms. Some types of digital technology, such as televisions and computers, have been made available in classrooms (Konca & Tantekin-Erden, 2021). Moreover, the Education Informatics

Network (EBA) was established in 2012 with the objective of providing digital learning environments, including educational videos, e-content, and interactive materials, for educators and students (MoNE, 2013). The EBA platform plays a pivotal role in facilitating self-paced learning for students and offering professional development opportunities for educators (MoNE, 2020).

Even though significant investments were made to accelerate the use of educational technology, uncertainties have arisen. For example, there is ambiguity regarding the condition of the devices distributed in 2010. Another point of criticism is that, through EBA, educators can access e-contents; however, some educators complain about a lack of available e-content. Additionally, educators face challenges in producing e-content independently. Despite efforts to train educators in the creation their own e-contents and the enhancement of their digital skills, the professional training provided has not been adequate to meet educators' needs. This inadequacy is attributed to the training's short duration and its lack of specificity for their teaching areas (Demir, 2023).

In 2023, a current project entitled "Digital Citizenship Education in Türkiye" was initiated. The objective of this project is to enhance the understanding of digital citizenship concepts and empower students to navigate the digital landscape effectively. The project's focus is on three key areas: being online, online wellbeing, and aligning with the main clusters of digital citizenship education tools as outlined by the Council of Europe by 2025. The primary beneficiaries of the project are students, educators, school administrators, parents, and caregivers. The project will achieve this by means of capacity-building activities for educators and school leaders, initiating awareness activities about the 10 principles of digital citizenship education, empowering students' digital presence through games and guiding materials, and so on (Council of Europe, 2023).

Another current study to enhance the digital competence of educators is being conducted by the MoNE in collaboration with the UNICEF (MoNE, 2023). The project's objectives include the following:

1. Enhancing teacher training with digital tools.
2. Raising awareness about digital skills in higher education institutions.
3. Designing a training program for educators to develop their digital skills.
4. Enriching the classroom environment to address children with special needs through digital tools.
5. Integrating digital technology into educators' professional implementation.

#### 2.4.1.3. Turkish Early Childhood Education System and Educators' Technology Usage

Early childhood education typically serves to children between the ages of 36 and 68 months, and it is not mandatory in Türkiye. These educational institutions are known as kindergartens and are overseen by the Ministry of National Education (MoNE), General Directorate of Basic Education. In addition, some primary schools offer early childhood education classes for children aged 45-68 months.

Nursery and Day Care Centers provide services for children aged 0-36 months as part of its early childhood education offerings. Furthermore, there are compulsory special education kindergartens specifically designed for children with special needs which serve children aged 0-36 months. These special education kindergartens fall under the mandate of the General Directorate of Child Services within the Ministry of Family, Labour and Social Services.

To become an early childhood educator in Türkiye, candidates are required to complete a four-year undergraduate program in early childhood education or graduate from child development in health science departments of universities, but they can become an early childhood educator if they complete their pedagogical training. This comprehensive program includes coursework in child development, educational theories, pedagogy, and applied teaching experiences. The program emphasizes child-centered methodologies and play-based learning, with curricula and methodologies designed to support children's development holistically. The Ministry of Education also actively promotes the continuous professional

development of early childhood teachers by offering in-service training at the beginning and end of each semester (Madsen et al., 2023).

All early childhood education activities are centralized and controlled by the Ministry of National Education (MoNE), resulting in the use of a single, standardized curriculum for all early childhood educators. The most recent curriculum in Türkiye was introduced by MoNE for children aged 36-72 months in 2024. This curriculum aims to promote children's development, create an enriched learning environment and ensure a smooth transition to formal education (MoNE, 2024). The curriculum is based on acquisition and indicators that span five development domains: (1) Cognitive, (2) Language, (3) Social and Emotional, (4) Motor, and (5) Self-care development. Educators organize daily and monthly plans according to the curriculum and align objectives with children's developmental skills. Educators also have the flexibility to set new objectives as needed. However, a notable omission in the curriculum is the absence of any reference to digital media and technologies (MoNE, 2024).

Research indicates that the majority of Early Childhood Educators (ECEs) incorporate digital technologies into their daily lives, predominantly through the use of smartphones (Bay, 2022; Öner 2020). They frequently engage with social platforms such as Facebook and Instagram (Öner, 2020). Despite the absence of technology integration in the current early childhood education curriculum and a lack of guidelines for its implementation, Turkish ECEs exhibit positive attitudes towards integrating technology into education (Koç, 2014; Konca & Tantekin-Erden, 2021; Ozel, 2019). In fact, many educators are already utilizing digital technologies in their classrooms (Simsar & Kadim, 2017).

Turkish educators have reported numerous benefits of digital technologies, including simplifying their work, enhancing learning, facilitating knowledge transfer, and improving communication with families (Bay, 2022). Preferred devices include computers and televisions (Konca & Tantekin-Erden, 2021), smart boards, smartphones, and cameras (Gülen, 2021). These technologies are often used for

passive activities such as watching cartoons, reading digital stories, and listening to music (Aksoy, 2021; Konca & Tantekin-Erden, 2021).

Educators encounter several challenges when integrating digital technologies into their teaching. A significant factor contributing to these difficulties is the variance in educators' perceptions, beliefs, and practices. Despite recognizing the potential of digital technology to enhance children's learning, they often underutilize it in their classrooms (Alberola-Mulet et al., 2021). Additionally, educators frequently lack knowledge on how to incorporate digital technologies pedagogically, such as blending them with play-based pedagogy. This gap in understanding often leads to concerns about digital technology infringing on children's free-play time. Although they have technological infrastructure, their attitudes are a more influential factor in the use of digital technology (Bay, 2022).

# CHAPTER 3

# METHOD

The study was conducted to examine the relationship among perceived first-order barriers (access and support; gatekeepers), second-order barriers (teachers' inhibitions and attitudes towards digital technology) and early childhood educators' digital competence and also examine whether the second-order barriers mediated the relationship among first-order barriers and digital competence. Additionally, Turkish early childhood educators' (ECEs) digital competence level were identified. For the specific purpose of the study, the following research questions were formulated:

RQ1: What is the relationship between first-order barriers and the digital competence of early childhood educators?

RQ1.1: What is the relationship between access and support and the digital competence of early childhood educators?

RQ1.2: What is the relationship between gatekeepers and the digital competence of early childhood educators?

RQ2: What is the relationship between second-order barriers and the digital competence of early childhood educators?

RQ.2.1: What is the relationship between educators' attitudes towards digital technology and digital competence of early childhood educators?

RQ.2.2: What is the relationship between teacher inhibitions and digital competence of early childhood educators?

RQ3: To what extent do second-order barriers mediate the relationship between first-order barriers and digital competence of early childhood educators?

### 3.1. Design of the Study

In accordance with the research purpose, a correlational research design was selected. Correlational designs are well suited to measure and describe the degree of relationship between two or more variables without establishing causality (Fraenkel et al., 2012). This design enables the exploration of complex relationships between predictor and outcome variables.

The main aim of this study is to examine the relationships between first-order, second-order and digital competence of early childhood educators. These relationships were explored in the context of mediated effects through attitudes and teacher inhibitions, specifically focusing on second-order barriers. Additionally, the study examined the status of Turkish early childhood educators' digital competence level. Structural equation modeling (SEM) was used to investigate the complex interaction between first and second-order barriers and digital competence in ECEs.

Researchers use SEM to test the accuracy of a theoretical model to realize that researcher identifies a model that supports a particular theory and identify possible constructs, measured with appropriate observable variables, to test the predictions of that model (Kline, 2016). In addition, this is a robust method of analysis used to test the hypothesis about the impact of simultaneous latent and observed variables on the other variables in the established model (Lee, 2007). Hence, this method provides good evidence to validate for testing and extending the theoretical model (Thakkar, 2020).

SEM was used in the study in order to comprehensively understand the relationships between multifaceted variables (such as teacher inhibition, gatekeepers, attitudes, access and support and DigCompEdu), each of which contributes to the overall phenomenon within the scope of the research in different dimensions, and also due to the complexity of the research questions, to answer all the questions and explain the complex relationship between the variables. These could not be possible to address by traditional statistical methods such as simple regression or correlation analyses as these methods are not powerful enough to investigate the interconnected nature of

the relationships within the current conceptual model. In addition, SEM provides more accurate and valid results by account for measurement error.

A researcher attempting to examine the relationships among a set of defined constructs aims to determine the extent to which the hypothesized theoretical model is consistent and adequate for the sample data. In the end, a researcher has two options to follow. Firstly, if the sample data supports the hypothesis, the researcher can extend it by investigating more complex structures. Secondly, if the theoretical model fails with the sample data, the researcher should either modify it or develop an alternative model for testing (Thakkar, 2020).

In order to test the hypothesized model as shown in Figure 1, an instrument (see section 3.5.1) was created to examine all the variables included in the current research. The sample group (see 3.3) was selected, and data was collected from them. The statistical analysis was carried out to test the hypothesized model. The results were listed, and based on these results, a final interpretation was made to decide whether to accept or reject the model.

### 3.2. Description of the variables

*Digital competence* (DC) of educators is the primary outcome variable of the current study. This competence is related to the use of digital technologies in educational settings to promote professional development, enhance children's learning experiences and inspire children to become proficient with digital tools through their pedagogical integration. To assess educators' digital competence, the study used the DigCompEdu framework, which consists of six different competence areas.

Within the DigCompEdu framework, there are six competence areas that have been explored in this study:

*Professional Engagement* (PE) involves the use of digital technologies to enhance educators' professional skills and development.

*Digital Resources* (DR) refers to the application of digital technologies to enrich educational materials, while adhering to ethical guidelines and considerations.

*Teaching and Learning* (TL) encompasses the integration of digital tools within educational contexts to facilitate and enhance the learning process.

*Assessment* (ASS) involves the use of digital resources to support the assessment and evaluation of children's progress and performance.

*Empowering Learners* (EL) focuses on leveraging digital technologies to encourage active participation among students, empowering them to take charge of their own learning.

*Facilitating Learners' Digital Competence* (FL) entails using digital technologies to enable and promote responsible and creative use of technology among children.

In this study, each of these components and the overall digital competence of educators were examined in relation to first-order and second-order barriers. A higher score on these variables indicates a higher level of digital competence across the competence areas, namely professional engagement, digital resources, assessment, teaching and learning, empowering learners, and facilitating learners' digital competence.

*Access and support variable* (AS) is one of the exogenous variables in the hypothesized model. This variable also falls within the category of first-order barriers. It pertains to the capacity and resources within schools concerning digital technology and how easily educators can access these tools. Furthermore, it encompasses the presence of a technical support team within the school. A higher score on this variable indicates a greater level of barriers related to access and support for digital technology.

*Gatekeepers* (GT) variable is another exogenous variable in the hypothesized model. This variable concerns the attitude and approach of school leaders and guardians toward the utilization of digital technologies within educational settings. A higher score on this variable signifies a higher level of barriers stemming from the attitudes and decisions of these key individuals in the school community.

Another exogenous variable in the study is *Teacher inhibitions* (TI), which is also categorized as one of the second-order barriers. Teacher inhibition encompasses educators' internal barriers, such as their self-efficacy and preparedness to effectively integrate technology into educational settings in a pedagogical manner, as well as their perceived lack of time for preparation. A higher score on this variable indicates a greater level of barriers stemming from educators' own inhibitions.

*Attitudes towards using digital technology* (ATT) is another exogenous variable in the study. It pertains to educators' perceptions and feelings about using digital tools to facilitate their work and enhance children's learning through these tools. This variable is also examined within the context of second-order barriers. A higher score on this variable reflects a more positive attitude towards the use of digital technology in education.

Furthermore, both the "Teacher inhibitions" and "Attitudes towards using digital technology " variables serve as mediator variables, as they are proposed to mediate the relationship between the first-order barriers (Access and Support and Gatekeepers) and the overall outcome or dependent variable. These mediator variables help to explain how the first-order barriers may influence the outcome variable through their impact on teacher inhibitions and attitudes towards digital technology usage.

### 3.3. Sampling Procedure and Participants

The participants of the study were selected through convenient sampling method. The criteria of the sample are teaching currently in an early childhood education institution, graduated from early childhood education or child development program of universities, associated program or high school, so the sample of this study consisted of 713 early childhood educators from all over Türkiye. The sample size is one of the critical aspects of SEM method, because if sample size is too small the analysis might be inaccurate and cannot estimate the reasonable precious between parameters. When conducting SEM analysis, these two points should be considered regarding the sample size (1) to provide number of cases to have adequate statistical

precision, (2) to have the minimum sample size so that the significance test in SEM has adequate power (Kline, 2016). There are different approaches that have been suggested to have reasonable results in SEM, which minimum sample size could be considered regarding the ratio of the number of cases ($N$) to the number of parameters that require statistical estimates ($q$). A recommended ratio is $N{:}q$ would be 20:1; 10:1 (Kline, 2016) or 5:1 is acceptable (Bentler & Chou, 1987).

The sample selection covers all regions of Türkiye. An online Google forms was used for data collection. After approval from the ethics committee, the online form was distributed throughout the country. The researcher effectively used social media platforms to communicate with early childhood educators and encourage their participation. For example, Telegram groups such as "Okul Öncesi Öğretmenleri, Okul Öncesi, okul öncesi", and Facebook groups such as "Tüm Anaokulu ve Okul Öncesi Öğretmenleri Topluluğu, Okul Öncesi Anasınıfı Öğretmenleri, Okul Öncesi Öğretmenleri, Okul Öncesi Öğretmenleri Etkinlik Havuzu, Okul Öncesi Etkinlik ve Çocuk Dünyası" are available. The researcher either sent a general announcement or reached out to the members of these groups in person.

Early childhood educators on Instagram were found, and the questionnaire link was sent through this social media channel. In addition, the phone number of school administrators at early childhood centers was found and a WhatsApp message was sent to inform them about the study and share the study link. In this process, a systematic approach was employed, and the link to the study was disseminated to school administrators in all provinces of Türkiye, whose contact information was accessible on school websites.

The online Google forms was designed to take approximately 20-30 minutes to complete. Participants were assured of anonymity and their participation in the study was completely voluntary. The data collection process spanned the 2022-2023 academic semester and lasted approximately 6 months.

The study's sample consisted of a total of 713 early childhood educators. Within this sample, 616 were female, and 97 were male educators. The age of the educators

varied across a range of 20 to 69 years, with a mean age of 34.8±7.6 years. For a more detailed overview of the demographic information of the study participants, please refer to Table 3, which provides frequencies and additional relevant data.

**Table 3.** Demographic characteristics of the participants (*N*=713)

| Variable | | *f* | % |
|---|---|---|---|
| Gender | Female | 616 | 86,4% |
| | Male | 97 | 13,6% |
| Age | 20-29 | 196 | 27,5% |
| | 30-39 | 324 | 45,4% |
| | 40-49 | 165 | 23,1% |
| | 50-59 | 26 | 3,6% |
| | 60-69 | 2 | 0,3% |
| Highest education level | High school | 8 | 1,1% |
| | Associated degree | 27 | 3,8% |
| | Open Education Faculty (Associated) | 10 | 1,4% |
| | Open Education Faculty (Bachelor) | 65 | 9,1% |
| | Bachelor | 507 | 71,1% |
| | Master's degree without thesis | 49 | 6,9% |
| | Master's degree | 45 | 6,3% |
| | PhD | 2 | 0,3% |

Educators' professional life information is given in Table 3. According to Table 4, 72 educators are currently working in the 36-48 months range, 285 educators are in the 48-60 months range, and 356 educators are in the 60-72 months range.

In terms of educators' years of overall teaching experience, 205 educators have 0-5 years of teaching experience, 150 educators have 6-10 years of experience, 290 educators have 11-20 years of experience, 54 educators have 21-30 years of experience, and 14 educators have more than 31 years of teaching experience.

**Table 4.**Professional profile of the participants

| Variable | | *f* | % |
|---|---|---|---|
| Working age group | 36-48 month | 72 | 10,1% |
| | 48-60 month | 285 | 40,0% |
| | 60-72 month | 356 | 49,9% |
| Years of teaching experience | 0-5 year | 205 | 28,8% |
| | 6-10 years | 150 | 21,0% |
| | 11-20 years | 290 | 40,7% |
| | 21-30 years | 54 | 7,6% |
| | 31 + | 14 | 2,0% |

### 3.4. Instruments

#### 3.4.1. Self-Assessment Instrument

The online survey includes three main sections, which are barriers to technology usage, educators' attitudes toward digital technology usage, and digital competence items. The whole questionnaire could be referred as a "Self-assessment instrument". These sections are described here (see Appendix A).

##### 3.4.1.1. Barriers to Technology Usage

As mentioned earlier, barriers to technology usage could predict educators' digital competence. In the current study to measure the relationship between barriers and ECEs' digital competence, Using Technology in Early Childhood Education Scales Barriers to Technology Usage survey instrument (Blackwell et al., 2013) was used. The original survey includes 46 items to address their access and use of multiple technologies, attitudes and beliefs professional development, and also extrinsic and intrinsic barriers. Blackwell et al., (2013) developed questions to investigate the characteristics of the first-order and second-order barriers' characteristics. This part of the instrument was used in the current study. In the barrier index, the researchers were found three dimensions the first factor was called "teacher inhibitions" and was loaded with five items; the second factor was called "access and support" was formed by three items and the final factor was called "gatekeeper" and was loaded with two items. A total of ten items were included in the first and second-order barriers as 5-Point Likert scale, ranging from (1) totally disagree to (5) totally agree part of the instrument.

Although the scale was originally developed in 2013, the instrument was adopted in Turkish by Ömrüuzun (2019), all the validity and reliability requirements of the scale were checked in 2019. The Cronbach alpha was calculated at .87 for the scale. In the current study, the Cronbach alpha was calculated .84 for the overall barriers to technology usage, .88 teacher inhibitions, .75 for the access and support and .74 for the gatekeeper. The scale was selected for the study because this scale is directly

related to the barriers of technology integration, so that it can be used in early childhood education.

#### 3.4.1.2. Attitude Scale Devoted to The Usage of Technology in Pre-School Education

The educators' attitudes towards digital technology usage assessed with "Attitude Scale Devoted to The Usage of Technology in Pre-School Education" which is developed by Kol (2012). The scale contains 20 items, 14 items are positive, and 6 items are negative statements with one factor. The Cronbach alpha was calculated to be .92 for the scale and .93 for the current study. The scale is a 5-Point Likert scale. The response scale ranges from (1) totally disagree to (5) totally agree. The positive items are calculated (1) totally disagree and (5) totally agree; the negative statements are calculated (1) totally agree and (5) totally disagree. The whole scale items were used in the current study. The minimum scale score is 1.00 and the maximum scale score is 5.00. If educators get a high score, they have a positive attitude towards technology.

As the scale was developed in 2012, the scale has been actively used in Turkish studies currently, for example, Konca and Tantekin-Erden (2021), and Gülen and Kaya (2023) have used this scale in their studies. Therefore, we could say that the scale is still valid and meets the current needs. This scale was used because it directly measures the attitudes of early childhood educators toward the use of digital technology in the Turkish language. In addition, it has good internal consistency.

#### 3.4.1.3. Digital Competence for Educators Self-assessment Scale

The "Digital Competence for Educators" self-assessment scale was developed based on the European Framework for the Digital Competence of Educators, as outlined by Redecker in 2017. This self-assessment tool consists of six dimensions and includes a total of 22 statements. Respondents are asked to select one statement from five available options that best reflects their own practice. Each statement is assigned a value between 0 and 4, resulting in a total score for the instrument ranging from 0 to 88.

The framework provides a structured progression model for assessing educators' digital competence. The first two levels are designated as "Newcomer" (A1) and "Explorer" (A2). The subsequent levels are "Integrator" (B1) and "Expert" (B2). The highest levels are "Leader" (C1) and "Pioneer" (C2). It's important to note that educators' digital competence levels may vary across different digital competence areas. For example, an educator might be categorized as an explorer in professional engagement but as an integrator in digital resources, and so on.

To provide clear proficiency benchmarks, cut-off scores have been established within the scale. These cut-off scores are as follows: 0-19 points correspond to the "Newcomer" (A1) level, 20-33 points indicate the "Explorer" (A2) level, 34-49 points signify the "Integrator" (B1) level, 50-65 points represent the "Expert" (B2) level, 66-80 points denote the "Leader" (C1) level, and 81-88 points indicate the "Pioneer" (C2) level (Çebi & Reisoglu, 2022). You can see the scores and the corresponding level in Table 5 below.

**Table 5.** DigCompEdu framework scores and corresponding level according to the digcompedu framework

| Score | Level |
|---|---|
| 0-19 | A1- Newcomer |
| 20-33 | A2-Explorer |
| 34-49 | B1-Integrator |
| 50-65 | B2- Expert |
| 66-80 | C1-Leader |
| 81-88 | C2-Pioneer |

For a visual representation of the proficiency levels within each competence area, please refer to Table 6. This framework and scoring system enable a comprehensive assessment of educators' digital competence across various dimensions and proficiency levels. This framework and scoring system provides a comprehensive assessment of educators' digital competences across a range of competence areas. The table will be used to determine the digital competence levels of educators according to competence areas. To do so, the score collected from each area will be mapped to these levels from A1 to C2.

**Table 6.** Digital competence areas and corresponding scores (Adapted by Santos et al., 2021)

| | Digital Competence Area | | | | | |
|---|---|---|---|---|---|---|
| Proficiency Level | Professional Engagement | Digital Resources | Teaching and Learning | Assessment | Empowering Learners | Facilitating Learners' Digital Competence |
| A1 | 0-4 | 0-3 | 0-4 | 0-3 | 0-3 | 5-6 |
| A2 | 5-7 | 4-5 | 5-7 | 4-5 | 4-5 | 7-8 |
| B1 | 8-10 | 6-7 | 8-10 | 6-7 | 6-7 | 9-12 |
| B2 | 11-13 | 8-9 | 11-13 | 8-9 | 8-9 | 13-16 |
| C1 | 14-15 | 10-11 | 14-15 | 10-11 | 10-11 | 17-19 |
| C2 | 16 | 12 | 16 | 12 | 12 | 20 |

The Turkish adaptation of the "Digital Competence for Educators" self-assessment instrument, conducted by Çebi and Reisoğlu in 2022, closely reflects the structure of the original instrument. It maintains a six-dimensional structure with a total of 22 statements. The validation and reliability analyses conducted on the Turkish version of the instrument yielded favorable results. Specifically, the Average Variance Extracted (AVE) values ranged from .43 to .63, and the Composite Reliability (CR) values ranged from .69 to .89. These values indicate good construct validity and reliability. Additionally, the Cronbach's alpha coefficient, which assesses the internal consistency of the instrument, was calculated to be .95 and the value was calculated to be .93 for the current study. This high Cronbach's alpha value further underscores the reliability of the Turkish version of the self-assessment instrument. Overall, the Turkish adaptation of the instrument has demonstrated strong psychometric properties, making it a reliable and valid tool for assessing digital competence among educators in the Turkish context.

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### 3.5. Data Analysis

In the research, the survey responses of 713 participants were analyzed using SPSS 25.0 and AMOS version 24.0. Descriptive information regarding demographic characteristics (i.e. age, gender) and work-related information (i.e. years of teaching experience) was presented in Tables 3 and 4 along with percentages. The Skewness and Kurtosis results were controlled for normality, the results were found between -2 and +2 boundaries (Byrne, 2010). According to the result, each scale in the current study indicates univariate normality. As part of the process, a missing value analysis was conducted to detect any missing values. In descriptive analysis, educators' digital competence levels and their distributions were also calculated.

Confirmatory factor analyses were conducted for the Barriers to Technology Usage (BTU) Scale, Attitude (ATT) Scale, and Digital Competence (DC) Scale. The validity and reliability of the scales in the sample were assessed using Cronbach's alpha, composite reliability, and Average Variance Extracted (AVE). Discriminant validity analysis was performed to examine whether there was sufficient differentiation between variables for structural equation modeling.

Structural equation modeling (SEM) was conducted to test the hypothesized structural model and evaluate relationship among study variables as well as direct and indirect effects on early childhood educators' digital competence using AMOS 24.0 program. The effects of the Access and Support (AS) and Gatekeeper (GT) dimensions of the Barriers to Technology Usage (BTU) scale on the Digital Competence (DC) variable, and the mediating role of Attitude (ATT) variable and the Teacher Inhibition (TI) dimension were examined using path analysis with

observed variables. The bootstrap method (n=5000) was preferred to test the mediation hypotheses. Multiple regression path analysis model was run as well in order to further analyze the relationship between first-order, second-order barriers and the six digital competence areas.

# CHAPTER 4

# RESULTS

This chapter presents the results of the study. In order to provide a summary of the statistical procedures employed, it is first necessary to describe the descriptive statistics conducted for the purpose of explaining the demographic characteristics of the sample, describing the professional profile of the sample, checking the normality of the data, and calculating the digital competence level of early childhood educators using SPSS 25.0 software. Secondly, the psychological characteristics of the scale were evaluated using AMOS 24.0 software. The construct validity and reliability were then assessed. Subsequently, the structural model was tested.

## 4.1. Descriptive Statistics

To enhance one of the assumptions of structural equation modelling, normality was checked using skewness and kurtosis values. The results were shown in Table 7. According to the results the skewness and kurtosis values were found between +2 and -2, indicating the data roughly distributed normally (Byrne, 2010). The descriptive analysis results also showed that there is no missing value in any variable.

**Table 7.** Normality results of model constructs

| | *n* | *Min.* | *Max.* | *SD* | *Skewness* | *Kurtosis* |
|---|---|---|---|---|---|---|
| Access and Support (AS) | 713 | 1.00 | 5.00 | 3.01 | -.269 | -.765 |
| Gatekeeper (GT) | 713 | 1.00 | 5.00 | 1.95 | 1.085 | .603 |
| Teacher Inhibition (TI) | 713 | 1.00 | 5.00 | 1.92 | .925 | .439 |
| Attitude (ATT) | 713 | 1.47 | 5.00 | 0.33 | -.974 | .787 |
| Digital Competence (DC) | 713 | .20 | 3.95 | 17.80 | .506 | -.560 |
| Valid N (listwise) | 713 | | | | | |

### 4.2. The Digital Competence Level of Early Childhood Educators

The educators' DigCompEdu mean was calculated as *M*=39.8 with *SD*=17.8. According to the Çebi and Reisoğlu (2022), the educators' DigCompEdu profiency level is B1, meaning that *integrator*. Their proficiency level by areas also found as professional engagement is *M*=8.1 with *SD*=3.5 corresponding B1 level; digital resources *M*=5.5 with *SD*=2.5 corresponding A2; teaching and learning *M*=7.4 with *SD*=4.3 corresponding A2 level; assessment *M*=5.6 with *SD*=2.8 corresponding B1 level; empowering learners *M*=5.6 with *SD*=3.1 corresponding B1 level; and finally facilitating learners' digital competence *M*=7.2 with *SD*=5.9 corresponding A2 level. (see Table 8).

**Table 8.**Mean and standard deviation for DigCompEdu

| | *N* | *M* | *SD* |
|---|---|---|---|
| DigcompEdu | 713 | 39.8 | 17.8 |
| PE | 713 | 8.1 | 3.5 |
| DR | 713 | 5.5 | 2.6 |
| TL | 713 | 7.4 | 4.3 |
| ASS | 713 | 5.9 | 2.8 |
| EL | 713 | 5.6 | 3.1 |
| FL | 713 | 7.2 | 5.9 |

The general scenario presented in Table 9 shows that most of the educators are clustered between A2 and B1 levels. In area 1, 2 and 4 most of the educators are clustered between A2-B1; in areas 3,5 and 6 educators are usually placed between A1 and A2.

**Table 9.**The percentage of educators by area according to the DigCompEdu model

| Competence Levels | Overall DigCompEdu | Area1: Professional Engagement (PE) % | Area2: Digital Resources (DR) % | Area3: Teaching and Learning (TL) % | Area4: Assessment (Ass) % | Area5: Empowering Learners (EL) % | Area6: Facilitating Learners Digital Competence % |
|---|---|---|---|---|---|---|---|
| A1. Beginner | 11.6 | 15.8 | 24.0 | 32.1 | 17.0 | 30.3 | 51.5 |
| A2. Exploratory | 30.3 | 27.1 | 25.7 | 23.0 | 34.9 | 23.4 | 9.4 |

Table 9. (continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B1. Integrator | 31.7 | 32.3 | 31.7 | 17.3 | 19.4 | 18.1 | 18.3 |
| B2. Expert | 16.0 | 17.8 | 11.5 | 16.6 | 12.4 | 14.2 | 11.9 |
| C1. Leader | 8.2 | 5.7 | 4.9 | 7.4 | 15.7 | 7.8 | 4.9 |
| C2. Pioneer | 2.2 | 1.3 | 2.2 | 3.5 | 0.7 | 6.0 | 4.1 |

### 4.3. Psychometric Characteristics of the Scales

Confirmatory Factor Analysis (CFA) was performed using AMOS 24.0 to verify the factor structure of the scales used in the current study. In CFA, as the sample size increases, especially in samples larger than 200, the Chi-Square ($x^2$) value tends to be high, and the statistical significance level of the Chi-Square ($x^2$) test is relatively low (Bollen, 1989). Therefore, to determine the adequacy of the used instruments for the overall tested models, Chi-square ($x^2$) value adjusted by degree of freedom (Chi-Square value/degree of freedom), other goodness of fit indices (Goodness of Fit Index GFI, Comparative Fit Index CFI, Standardized Root Mean Square Residual SRMSR and Root Mean Square Error of Approximation RMSEA) and the values in the standardized residual covariance matrix were analyzed (Bayram, 2013). According to Meydan (2011), The Goodness of Fit Indices and cut-off values are given in Table 10.

**Table 10.** Goodness of fit indices and cut-off values

| Goodness of fit criteria | Good fit | Acceptable Fit |
|---|---|---|
| $x^2$ / df | $0 \leq \chi 2/df \leq 2$ | $2 < \chi 2/df \leq 3$ |
| GFI | $\geq 0,90$ | 0,85-0,89 |
| CFI | $\geq 0,97$ | $\geq 0,95$ |
| SRMR | $\leq 0,05$ | $,06 \leq SRMR \leq ,08$ |
| RMSEA | $\leq 0,05$ | $,06 \leq RMSEA \leq ,08$ |

df: degree of freedom, GFI:goodness of fit index, CFI: comparative fit index, SRMR: standardized root mean square residual, RMSEA: root mean square error of approximation.

Additionally, according to Marsh and Hocevar (1985), for $x^2$/df if the value is $\leq$ 5 it indicates a reasonable fit.

### 4.3.1 Barriers to Technology Usage (BTU) Scale

The Barriers to Technology Usage Scale (BTU), 10 items and 3 dimensions were used in the current study (Blackwell et al., 2013). The analysis started with 10 items, but the 1st item was eliminated because its factor loading was low (FL<0.50). The CFA analysis resulted in three-dimensional structure with 9 items, as described in the literature. In the analysis, it was observed that the factor loadings ranged from 0.52 and 0.90 (see Figure 7).

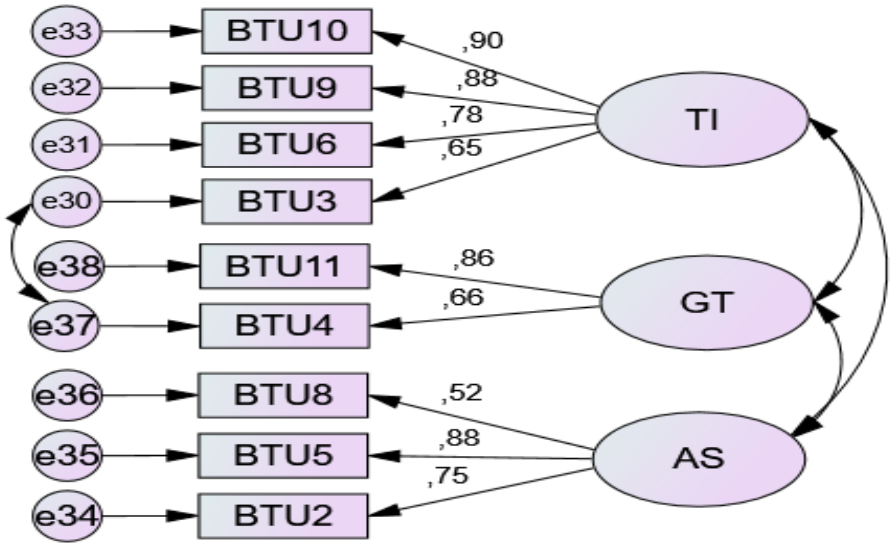


**Figure 7.** Barriers to technology usage scale's CFA dimension's structure

To improve the model fit, errors e30-e37 were covaried. The structural model demonstrated good model fit with chi-square, $\chi 2$=56.979, $\chi 2$/df =2.999, GFI=.983, CFI=.988, SRMR=.032, and RMSEA=.053 and found to be significant $p$<0.05. The standardized factor loadings and significance values are presented in Table 11.

**Table 11.**Confirmatory factor analysis parameter table for the BTU scale with a 3-dimensional structure

| Construct | | Item | Estimate | Std. estimate. | *Z* | *P* |
|---|---|---|---|---|---|---|
| TI | → | BTU3 | .747 | .653 | 19.925 | *** |
| TI | → | BTU6 | .880 | .775 | 25.931 | *** |
| TI | → | BTU9 | .982 | .881 | 32.104 | *** |
| TI | → | BTU10 | 1.000 | .901 | | |

Table 11. (continued)

| | | | | | | |
|---|---|---|---|---|---|---|
| AS | → | BTU2 | .797 | .746 | 15.291 | *** |
| AS | → | BTU5 | 1.000 | .876 | | |
| AS | → | BTU8 | .510 | .521 | 12.255 | *** |
| GT | → | BTU4 | 1.000 | .657 | | |
| GT | → | BTU11 | 1.198 | .856 | 13.772 | *** |

****p<0,001 **p<0,01 Estimate: estimated factor loading; Std. Estimate: standardized factor loading; Z:test table value*

The analysis result shows that all items' standardized factor loadings are higher than .50 and significant ($p$<0.05). According to the results, BTU scale is valid within the research sample.

### 4.3.2. Attitudes Scale Devoted to the Usage of Technology in Pre-schoool Education (ATT)

In the confirmatory factor analysis of the ATT Scale, which is described in the literature as consisting of 20 items and a single dimension, items 2, 6, and 10 were removed from the analysis as their factor loading is low (FL<0.50). The remaining 17 items factor loadings are between .50 and .84 (see Figure 8).

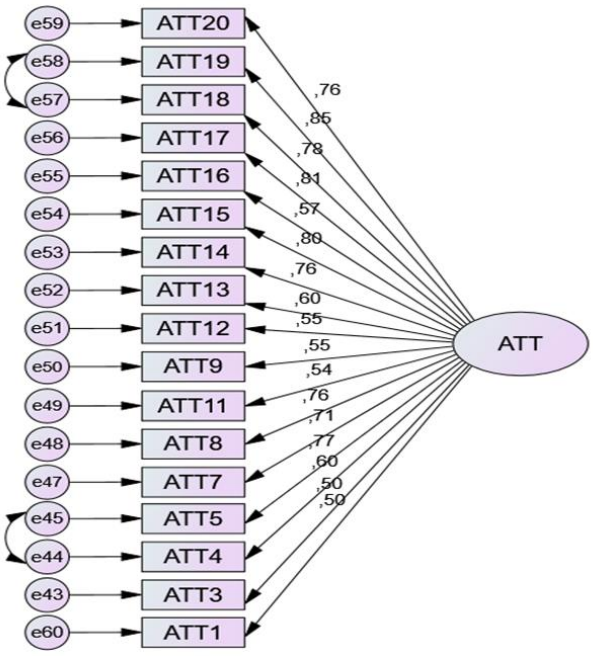


**Figure 8.** ATT scale's CFA structure

To improve the model fit, errors e57- e58 were covaried. The measurement model demonstrated an acceptable model fit with chi-square $\chi 2$=551.937, $\chi 2$/df =4.972, GFI=.911, CFI =.937, SRMR =.043, RMSEA =.075 and found to be significant $p$<0.05. The standardized factor loadings and significance values are presented in Table 12.

**Table 12.**Parameter table for confirmatory factor analysis of the ATT scale

| Construct | | Item | Estimate | Std. estimate. | *Z* | *P* |
|---|---|---|---|---|---|---|
| ATT | → | ATT7 | .988 | .712 | 20.986 | *** |
| ATT | → | ATT8 | .826 | .764 | 23.077 | *** |
| ATT | → | ATT11 | .681 | .545 | 15.163 | *** |
| ATT | → | ATT9 | .811 | .548 | 15.259 | *** |
| ATT | → | ATT12 | .687 | .553 | 15.444 | *** |
| ATT | → | ATT19 | .968 | .845 | 26.668 | *** |
| ATT | → | ATT18 | .998 | .784 | 26.151 | *** |
| ATT | → | ATT15 | .985 | .802 | 24.670 | *** |
| ATT | → | ATT20 | .824 | .763 | 23.060 | *** |
| ATT | → | ATT17 | 1.000 | .813 | | |
| ATT | → | ATT14 | .810 | .761 | 22.938 | *** |
| ATT | → | ATT13 | .821 | .596 | 16.866 | *** |
| ATT | → | ATT16 | .833 | .571 | 16.020 | *** |
| ATT | → | ATT5 | .850 | .772 | 23.431 | *** |
| ATT | → | ATT4 | .704 | .598 | 16.872 | *** |
| ATT | → | ATT3 | .510 | .501 | 13.788 | *** |
| ATT | → | ATT1 | .799 | .505 | 13.898 | *** |

****p<0,001 **p<0,01 Estimate: estimated factor loading; Std. Estimate: standardized factor loading; Z:test table value*

The analysis result shows that all items' standardized factor loadings are higher than .50 and significant ($p$<0.05). According to the results, ATT scale is valid within the research sample.

### 4.3.3. Digital Competence of Educators Self-assessment Scale (DC)

In the confirmatory factor analysis of the Digital Competence (DC) Scale, which is described in the literature as consisting of 22 items and 6 dimensions, items 3 and 5 were removed from the analysis as the item 3 and 5 standardized factor loadings are (FL<0.5). The remaining items' standardized factor loadings are between .52 and .82, it is shown in Figure 9.

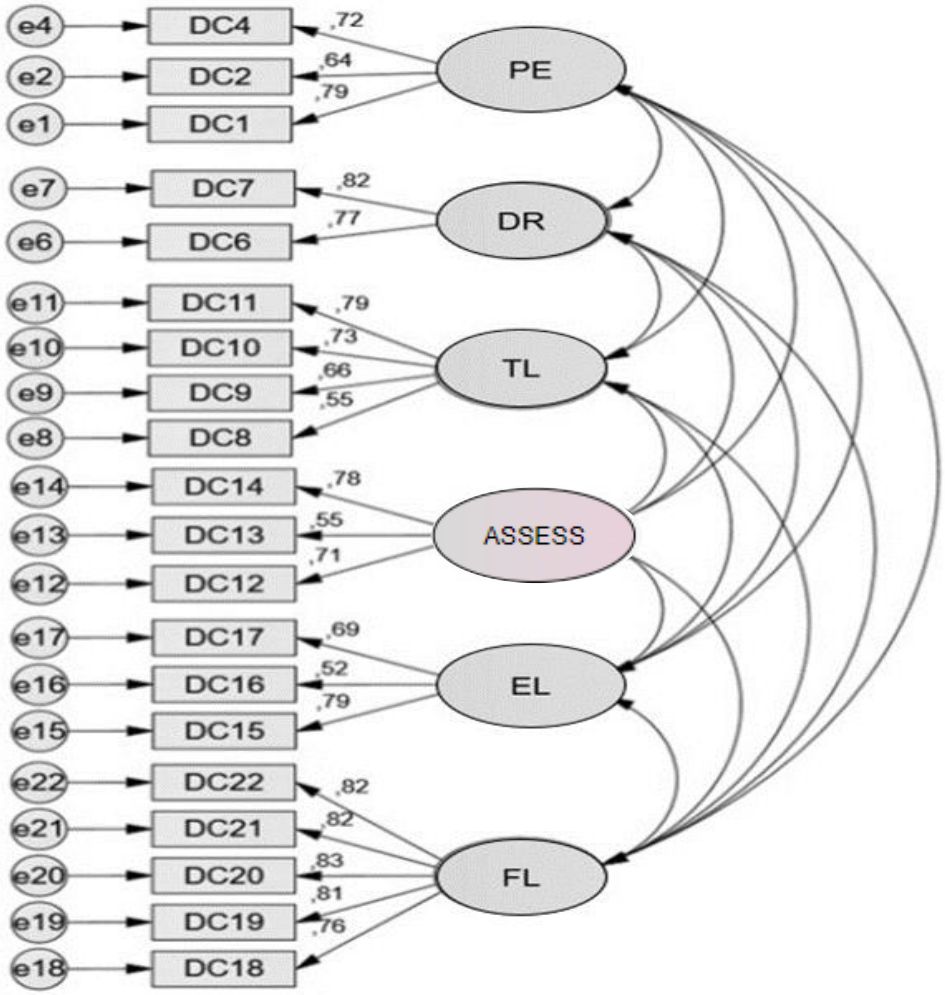


**Figure 9.** DC scale's CFA structure

The structural model demonstrated an acceptable model fit with $\chi 2$=366.796, $\chi 2$/df=2.366, GFI =.950, CFI=.970, SRMR=.032, RMSEA =.05 and found to be significant $p$<0.05. The standardized factor loadings and significance values are shown in Table 13.

**Table 13.** Confirmatory factor analysis parameter table for the 6-dimensional DC scale

| Construct | | Item | Estimate | Std. estimate. | *Z* | *P* |
|---|---|---|---|---|---|---|
| PE | → | DC1 | 1.000 | .818 | | |
| PE | → | DC2 | .744 | .549 | 14.853 | *** |
| PE | → | DC4 | .931 | .655 | 16.167 | *** |
| DR | → | DC6 | .845 | .733 | 16.824 | *** |
| DR | → | DC7 | 1.000 | .788 | | |
| TL | → | DC8 | 1.000 | .708 | | |
| TL | → | DC9 | 1.683 | .552 | 13.165 | *** |
| TL | → | DC10 | 1.687 | .776 | 14.081 | *** |
| TL | → | DC11 | 1.868 | .788 | 14.651 | *** |
| ASSESS | → | DC12 | 1.000 | .518 | | |
| ASSESS | → | DC13 | .684 | .695 | 13.720 | *** |
| ASSESS | → | DC14 | .971 | .764 | 19.017 | *** |
| EL | → | DC15 | 1.000 | .808 | | |
| EL | → | DC16 | .530 | .834 | 13.602 | *** |
| EL | → | DC17 | .499 | .824 | 18.914 | *** |
| FL | → | DC18 | 1.000 | .817 | | |
| FL | → | DC19 | 1.185 | .052 | 22.710 | *** |
| FL | → | DC20 | 1.085 | .046 | 23.592 | *** |
| FL | → | DC21 | 1.144 | .049 | 23.253 | *** |
| FL | → | DC22 | 1.070 | .047 | 22.993 | *** |

****p<0,001 **p<0,01 Estimate: estimated factor loading; Std. Estimate: standardized factor loading; Z:test table value*

The analysis result shows that all items' standardized factor loadings are higher than .50 and significant ($p$<0.05). Based on the results obtained, it can be said that the 6-dimensional structure of the Digital Competence (DC) Scale is valid for the sample.

The 6-dimensional structure of the DC Scale was reduced to a single dimension in the second-level CFA following the procedure suggested by Byrne (2010), which

reduced the six dimensions of the scale to a single factor structure. In the second-level confirmatory factor analysis, it was observed that the standardized factor loading values ranged from .52 to .85 (see Figure 10).

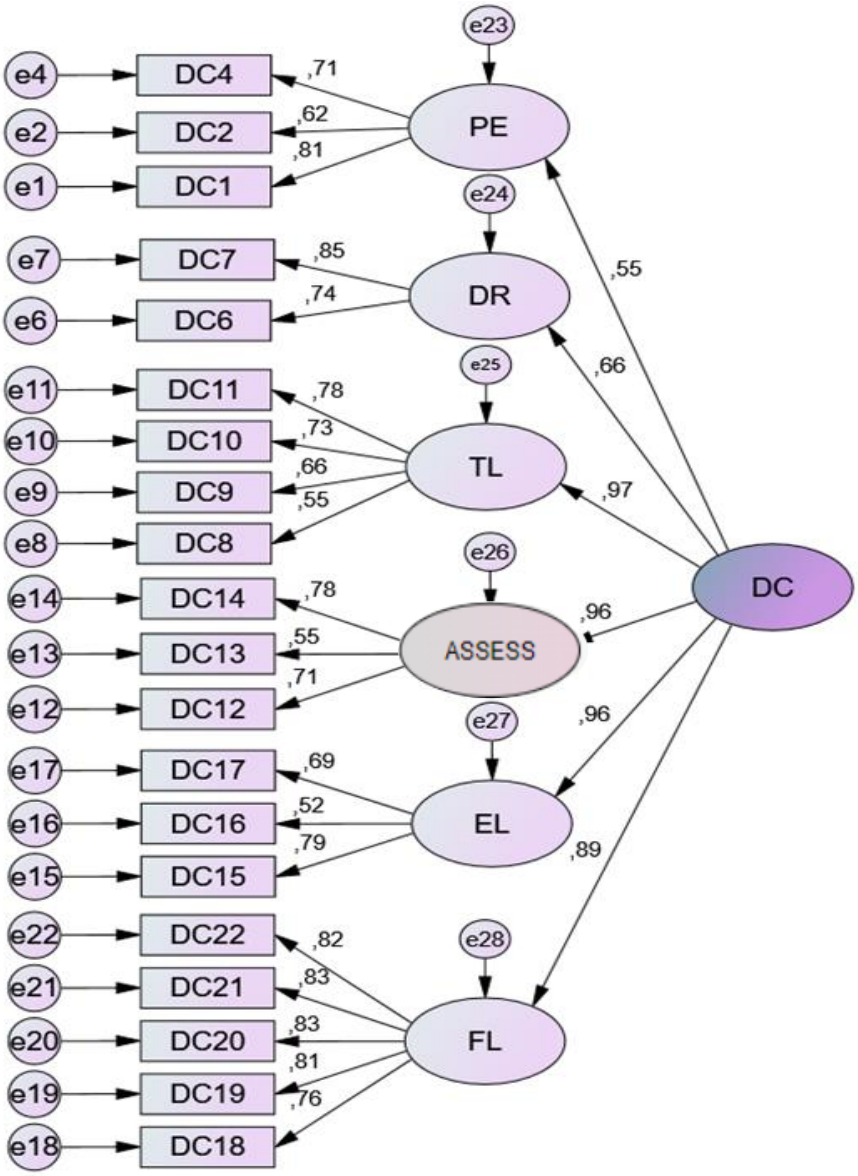


**Figure 10.** Digital Competence (DC) second-order CFA single factor structure

In the second-level confirmatory factor analysis, the model fit indices were found to be significant $p < 0.05$ and the results demonstrated acceptable model fit with $\chi 2$= =447.488, $\chi 2/df$ =2.73 GFI=.940, CFI =.96, SRMR=.043, and RMSEA=.05. The standard factor loadings were shown in Table 14.

**Table 14.** DC single factor structure scale factor loading parameters

| Construct | | Item | Estimate | Std. estimate. | *Z* | *P* |
|---|---|---|---|---|---|---|
| DC | → | PE | .582 | .553 | 11.820 | *** |
| DC | → | DR | .790 | .661 | 14.201 | *** |
| DC | → | TL | .642 | .966 | 13.614 | *** |
| DC | → | ASS | .926 | .956 | 17.015 | *** |
| DC | → | EL | 1.322 | .957 | 18.990 | *** |
| DC | → | FL | 1.000 | .895 | | |
| PE | → | DC1 | 1.000 | .812 | | |
| PE | → | DC2 | .704 | .625 | 14.362 | *** |
| PE | → | DC4 | .887 | .710 | 15.594 | *** |
| DR | → | DC6 | .787 | .744 | 15.383 | *** |
| DR | → | DC7 | 1.000 | .848 | | |
| TL | → | DC8 | 1.000 | .551 | | |
| TL | → | DC9 | 1.699 | .663 | 13.291 | *** |
| TL | → | DC10 | 1.681 | .733 | 14.108 | *** |
| TL | → | DC11 | 1.844 | .781 | 14.609 | *** |
| ASSESS | → | DC12 | 1.000 | .706 | | |
| ASSESS | → | DC13 | .686 | .552 | 13.654 | *** |
| ASSESS | → | DC14 | .979 | .780 | 18.941 | *** |
| EL | → | DC15 | 1.000 | .790 | | |
| EL | → | DC16 | .536 | .525 | 13.740 | *** |
| EL | → | DC17 | .494 | .689 | 18.643 | *** |
| FL | → | DC18 | 1.000 | .764 | | |
| FL | → | DC19 | 1.180 | .805 | 22.577 | *** |
| FL | → | DC20 | 1.082 | .833 | 23.492 | *** |
| FL | → | DC21 | 1.146 | .826 | 23.281 | *** |
| FL | → | DC22 | 1,074 | ,820 | 23,068 | *** |

****p<0,001 **p<0,01 Estimate:estimated factor loading std. Estimate:factor loading standart Z: table value*

The analysis result shows that all items' standardized factor loadings are higher than .50 and significant ($p$<0.05). Therefore, the single factor structure scale (second-order CFA) is valid in the research sample.

### 4.4. Evaluation of the Measurement Scale

The reliability and validity of the constructs in the proposed model were checked. Construct validity was assessed using Composite Reliability (CR). A CR of 0.60 or more indicates good reliability (Hair et al., 2014). The internal consistency of all constructs was measured by Cronbach alpha coefficient. The cut off coefficient value is .70 (Fornell & Larcker, 1981). The convergent validity of the constructs within the measurement model was checked using CFA and Average Variance Extracted (AVE). In order to confirm convergent validity, it is sufficient for the AVE to be greater than or equal to 0.50. If the Composite Reliability (CR) is greater than or equal to 0.70 and the AVE is greater than or equal to 0.40, it is also considered sufficient. In order to ensure discriminant validity, the square root of the AVE (√AVE) must be higher than the correlation values in the same row and column (Fornell, & Larcker, 1981).

Given that all CRs met the requirement of CR≥0.70, the convergent validity of the constructs given in the model is deemed adequate. Regarding convergent reliability, the AVEs of all constructs were AVE≥0.40, indicating an acceptable convergent validity. The internal consistency of constructs was found; Barriers to Technology Usage (BTU) .835, and its sub dimensions; Access and Support (AS) .749, Gatekeeper (GT) .741, Teacher Inhibition (TI) .878; Attitude (ATT) .931, and Digital Competence (DC) .930. The results were shown in Table 15.Results of the check for discriminant validity, the square roots of AVE were greater than the correlation between each construct and all others, it can be concluded that discriminant validity was achieved.

**Table 15.** Results of the measurement model

| Construct | *AO* | *SS* | *AS* | *GT* | *TI* | *ATT* | *DC* |
|---|---|---|---|---|---|---|---|
| Access and Support (AS) | 3.02 | 1.03 | (.793) | | | | |
| Gatekeeper (GT) | 1.95 | .98 | .283** | (.770) | | | |
| *Teacher İnhibition (TI)* | 1.92 | .86 | .318** | .607** | (.809) | | |
| Attitude (ATT) | 4.33 | .57 | .010 | -.273** | -.327** | (.688) | |
| Digital Competence (DC) | 1.84 | .86 | -.127** | .120** | -.054 | .144** | (728) |
| Cronbach's Alpha (CA) | | | .749 | .741 | .878 | .931 | .930 |
| Composite reliability (CR) | | | .765 | .742 | .882 | .937 | .958 |
| Average Variance Extracted (AVE) | | | .630 | .593 | .656 | .474 | .530 |

****p<0.001 **p<0.01 *p<0.05 BTU: Barriers to technology usage DC: Digital Competence ATT:Attitude AS:Access & Support GT:Gatekeeper TI:Teacher Inhibition*

In sum, the items in the proposed measurement model demonstrated acceptable reliability and validity.

### 4.5. The Relationship between First-order, Second-order barriers and Digital Competence of Early Childhood Educators; Structural Equation Modeling

A structural equation model was shown in Figure 11 was tested using path analysis with variables calculated through the AMOS program version 24.0. To examine indirect effects, bootstrap resampling method allowed for the assessment of whether the indirect effects in the model were statistically significant, with a 95% confidence interval (Preacher & Hayes 2008) was used.

The research model examined the mediating effect of the ATT variable and the TI dimension on the impact of the AS and GT dimensions of the BTU scale on the DC variable using path analysis.

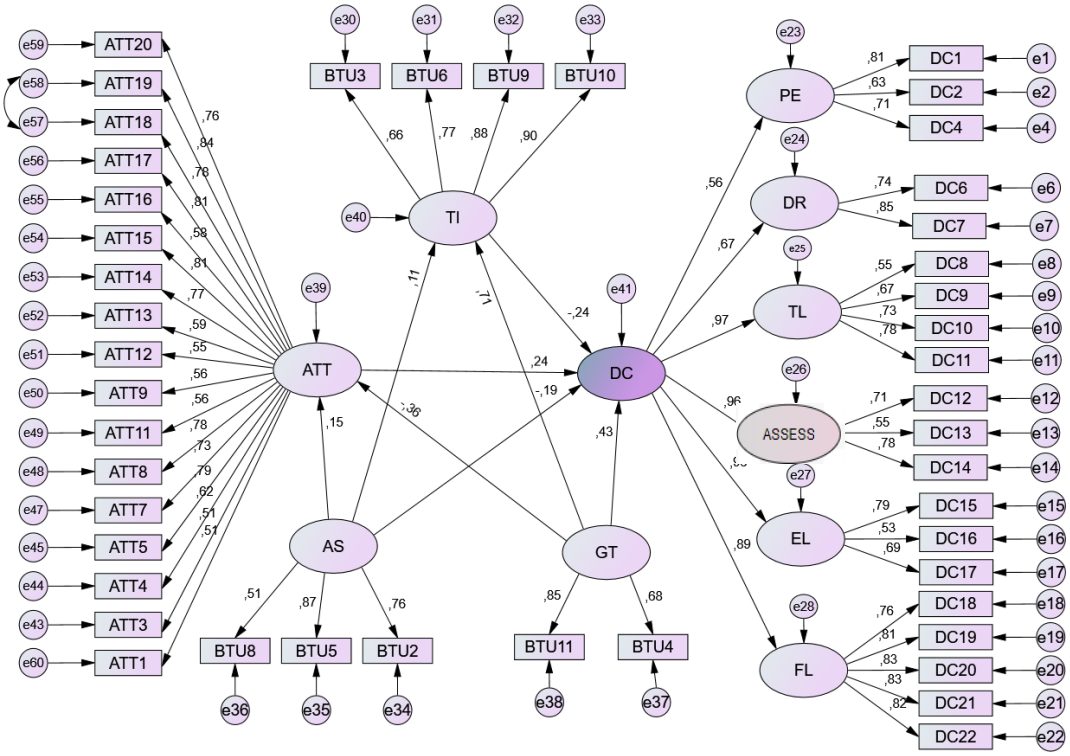


**Figure 11.** Mediator model path analysis (bootsrap n=5000)

In the path analysis model with observed variables, the model test values were found to be significant ($p < 0.05$) with $\chi2$=2523.237, $\chi2$ /df= 2.61, GFI=.854, CFI =.912,

SRMR=.068, RMSEA=.048 and also the structural model demonstrated an acceptable model fit.

The regression parameters of the model are presented in Table 16, and detailed values regarding the path analysis were given in the Appendix D.

**Table 16.** The significance test of the regression coefficients in the model

| Exogenous | | Endogenous | Estimate | St. Estimate | *Z* | *P* | Hypothesis |
|---|---|---|---|---|---|---|---|
| AS | → | ATT | .082 | .023 | 3.623 | *** | Accept |
| GT | → | TI | .808 | .055 | 14.770 | *** | Accept |
| GT | → | ATT | -.302 | .037 | -8.117 | *** | Accept |
| AS | → | TI | .083 | .026 | 3.198 | ** | Accept |
| ATT | → | DC | .336 | .063 | 5.370 | *** | Accept |
| AS | → | DC | -.150 | .035 | -4.327 | *** | Accept |
| GT | → | DC | .518 | .096 | 5.405 | *** | Accept |
| TI | → | DC | -.255 | .075 | -3.419 | *** | Accept |

****p<0,001 **p<0,01 BTU: Barriers to technology usage DC: Digital Competence ATT:Attitude AS:Access & Support GT:Gatekeeper TI:Teacher Inhibition*

The study assessed the impact of first-order barriers on the early childhood educators' (ECEs) digital competence. The impact of the access and support on ECEs' digital competence was negative and significant ($\beta$ = -0.150, $p < 0.05$), hence H1 was accepted. The impact of gatekeepers on ECEs' digital competence was positive and significant ($\beta$ = 0.518, $p < 0.05$), therefore, H2 was accepted.

Additionally, the study assessed the impact of second-order barriers on the early childhood educators' digital competence. The impact of the attitudes towards digital technology on ECEs' digital competence was positive and significant ($\beta$ = 0.336, $p < 0.05$) hence H3 was accepted. The impact of teacher inhibitions on ECEs' digital

competence was negative and significant ($\beta$ = -0.255, $p$ < 0.05), therefore H4 was accepted.

The impact of the factors on early childhood educators' digital competence can be ranked in order from greatest to least, as follows; gatekeepers, attitudes towards digital technology, teacher inhibitions, and access and support.

### 4.6. The Mediation Role of Second-Order Barriers on the Relationship Between First-Order Barriers and Digital Competence of Early Childhood Educators

In the model examining the mediating effects of the attitudes towards digital technology (ATT) variable and the teacher inhibitions (TI) on the impact of the access and support (AS) and gatekeepers (GT) on the digital competence (DC) variable, the test results obtained using the bootstrap method (n=5000) for the hypotheses regarding the mediation effects are presented in Table 17.

**Table 17.** The mediator hypothesis significant results

| | Estimate | Min | Max | P | Hypothesis |
|---|---|---|---|---|---|
| AS→ATT→DC | .028 | .013 | .047 | .000** | Accept |
| AS→TI→DC | -.021 | -.040 | -.010 | .000** | Accept |
| GT→ATT→DC | -.102 | -.153 | -.065 | .000** | Accept |
| GT→TI→DC | -.206 | -.352 | -.099 | .000** | Accept |

*BTU: Barriers to technology usage DC: Digital Competence ATT:Attitude AS:Acces & Support GT:Gatekeeper TI:Teacher Inhibition*

The direct regression effects in the path analysis model with observed variables, examining the mediating effect of the ATT variable and the TI dimension on the impact of the AS and GT on the DC variable, are shown in Table 14. The direct effects formed by AS and GT, as well as the direct effects formed by the ATT and TI variables, were found to be significant ($p$ < 0.05).

The study assessed the mediating role of attitudes towards digital technology (ATT) on the relationship between first-order barriers (access and support (AS) and

gatekeepers (GT)) and digital competence (DC) of early childhood educators' digital competence. The results revealed a significant indirect effect of AS on DC through ATT ($\beta$ = 0.028, $p$ < 0.05), supporting H9 as well as revealed a significant indirect effect of GT on DC through ATT (β = -0.102, p < 0.05), supporting H10. Furthermore, the direct effect of AS on DC and GT and DC was significant ($\beta$ = -0.150, $p$ < 0.05); ($\beta$ = 0.518, $p$ < 0.05), respectively, hence ATT partially mediated the relationship among AS, GT and DC of early childhood educators.

The study also assessed the mediating role teacher inhibitions (TI) on the relationship between first-order barriers (access and support (AS) and gatekeepers (GT)) and digital competence (DC) of early childhood educators' digital competence. The found a significant mediating role of TI on the AS and DC (β = -0.021, $p$ < 0.05), support H11 and a significant mediating role of TI on GT and DC (β = -0.206, $p$ < 0.05), support H12. Furthermore, the direct effect of AS on DC and GT and DC was significant ($\beta$ = -0.150, $p$ < 0.05); ($\beta$ = 0.518, $p$ < 0.05), respectively, hence TI partially mediated the relationship among AS, GT and DC of early childhood educators.

### 4.6. The Effect of the First-order and Second-order Barriers on the Digital Competence Areas: A Multiple Structural Regression Model

In this research model, the impact of the first-order and second-order barriers, namely access and support (AS), gatekeeper (GT), teacher inhibitions (TI), and attitude (ATT) on areas of DigCompEdu (Professional Engagement (PE); Digital Resources (DR); Teaching and Learning (TL); Assessment (ASS); Empowering of Learners (EL); and Facilitating Learners' Digital Competence (FL) was examined using a multiple regression path analysis model. Since observed variables were used in the model, latent variables have become the variables under investigation for the effects in the model (Figure 12).

In the path analysis model with observed variables, the model fit indices indicate the significance of the model, with model test values ($p$ < 0.05), namely $\chi^2$ (2738.724) and $\chi^2/df$ (2.841), suggesting that the model is significant. The model's fit index

values, GFI (.882), CFI (.925), SRMR (.0790), and RMSEA (.0560), fall within acceptable limits, indicating that the model is valid.

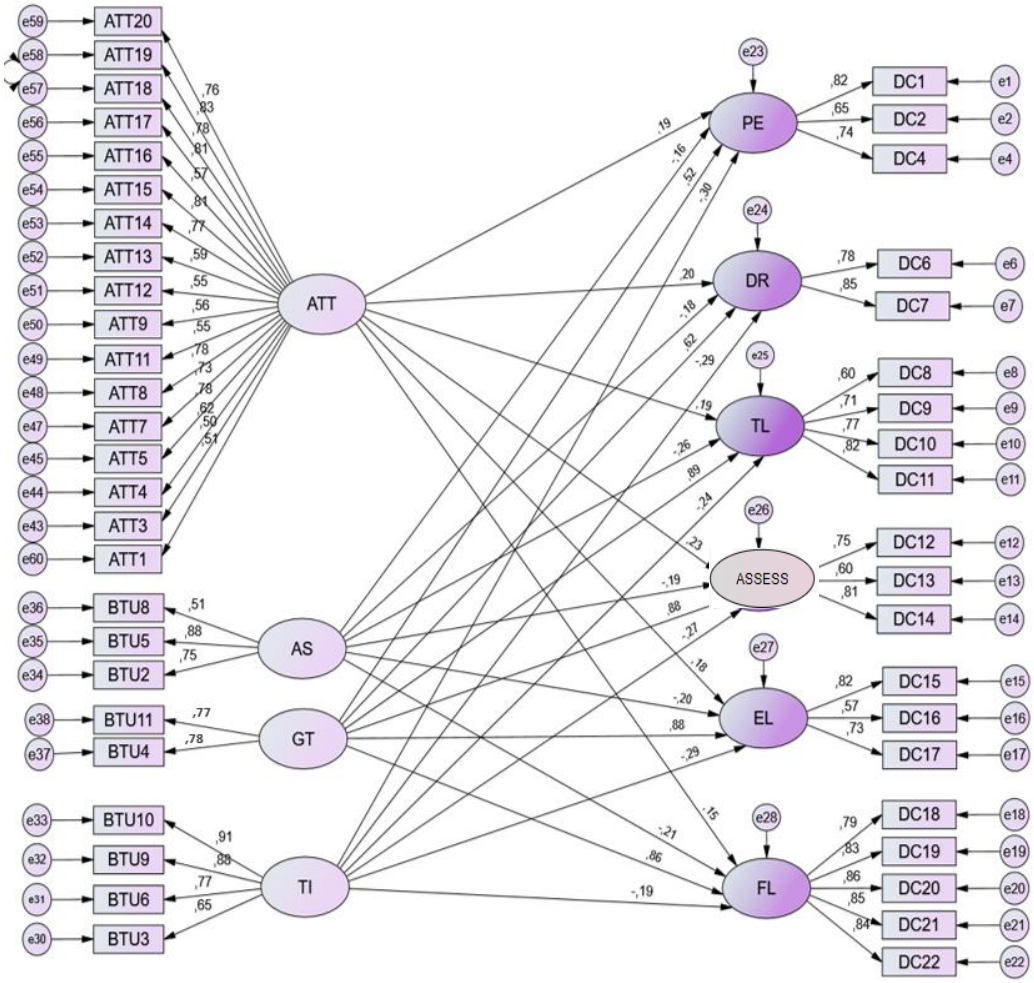


**Figure 12.** Model of multiple regression path analysis with observed variables

"The regression parameters of the model are presented in Table 18."

**Table 18.**Significance testing of the multiple regression coefficients present in the model

| End. | | Ex. | Estimate | Std.estimate | Z | P | Hypothesis |
|---|---|---|---|---|---|---|---|
| ATT | → | DR | .358 | .200 | 5.107 | *** | Accepted |
| ATT | → | TL | .203 | .193 | 5.162 | *** | Accepted |
| ATT | → | ASS | .354 | .228 | 5.981 | *** | Accepted |

Table 18. (continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ATT | → | EL | .406 | .184 | 4.891 | *** | Accepted |
| ATT | → | PE | .302 | .194 | 4.861 | *** | Accepted |
| ATT | → | FL | .256 | .148 | 4.216 | *** | Accepted |
| AS | → | DR | -.180 | -.183 | -4.351 | *** | Accepted |
| AS | → | ASS | -.160 | -.187 | -4.589 | *** | Accepted |
| AS | → | EL | -.246 | -.203 | -4.972 | *** | Accepted |
| AS | → | PE | -.136 | -.160 | -3.736 | *** | Accepted |
| AS | → | TL | -.153 | -.264 | -6.289 | *** | Accepted |
| AS | → | FL | -.204 | -.215 | -5.551 | *** | Accepted |
| TI | → | PE | -.343 | -.304 | -7.417 | *** | Accepted |
| TI | → | ASS | -.307 | -.273 | -7.043 | *** | Accepted |
| TI | → | DR | -.372 | -.286 | -7.178 | *** | Accepted |
| TI | → | TL | -.182 | -.238 | -6.208 | *** | Accepted |
| TI | → | EL | -.455 | -.285 | -7.406 | *** | Accepted |
| TI | → | FL | -.236 | -.188 | -5.264 | *** | Accepted |
| GT | → | TL | 1.510 | .889 | 9.077 | *** | Accepted |
| GT | → | PE | 1.316 | .524 | 8.327 | *** | Accepted |
| GT | → | DR | 1.807 | .624 | 9.017 | *** | Accepted |
| GT | → | ASS | 2.205 | .879 | 9.706 | *** | Accepted |
| GT | → | FL | 2.391 | .858 | 9.783 | *** | Accepted |
| GT | → | EL | 3.120 | .878 | 9.919 | *** | Accepted |

In the multiple regression path analysis investigating the effects of the first-order and second-order barriers, namely access and support (AS), gatekeeper (GT), and teacher inhibition (TI), and attitude (ATT) variables and their impact on the areas of the DigCompEdu, all effects are statistically significant ($p < 0.05$).

The effect of the ATT on the Digital Resources (DR) area of the DigCompEdu is positive and significant ($\beta = .358$; $p < 0.05$). This implies that an increase in the

value of the ATT variable directly leads to an increase in the value of the DR area. The ATT has a significantly positive impact on the Teaching and Learning (TL) area of DigCompEdu with (β = .203; $p < 0.05$). This means that when there is an increase in the ATT value, there will be an increase in TL area as well. The ATT was found to have a positive and significant effect on the Assessment (ASSESS) area (β=.354; $p<0.05$). Here, an increase in the value of the ATT increases the value of the ASSESS area. The effect of ATT on the Empowering Learning (EL) is positive and significant (β = .406; $p < 0.05$). This implies that an increase in the value of the ATT directly leads to an increase in the value of the EL area. The ATT variable has a significantly positive impact on the Professional Engagement (PE) area with (β = .302; $p < 0.05$). This means that when there is an increase in the ATT value, there will be an increase in PE area as well. The ATT was found to have a positive and significant effect on the facilitating Learners Digital Competence (FL) area (β=.256; $p<0.05$). Here, an increase in the value of the ATT variable increases the value of the FL area.

The effect of the AS variable on the DR area is negative and significant (β = -.180; $p < 0.05$). This implies that an increase in the value of the ATT variable leads to a decrease in the value of the DR area. The AS has a significantly negative impact on the ASSESS area with (β = -.160; $p < 0.05$). This means that when there is an increase in the AS value, there will be a decrease in ASSESS area. The effect of AS on the EL is negative and significant (β = -.246; $p < 0.05$). This implies that an increase in the value of the AS directly leads to a decrease in the value of the EL area. The AS has a significantly negative impact on the PE area with (β = -.136; $p < 0.05$). This means that when there is an increase in the AS value, there will be a decrease in PE area. The AS was found to have a negative and significant effect on the TL area (β=-.153; $p<0.05$). Here, an increase in the value of the AS variable decreases the value of the TL area. The effect of the AS on the FL area is negative and significant (β = -.240; $p < 0.05$). This implies that an increase in the value of the AS leads to a decrease in the value of the FL area.

In terms of the effect of TI on the PE is negative and significant (β = -.343; $p < 0.05$). This implies that an increase in the value of the TI directly leads to a decrease in the

value of the PE area. The TI variable has a significantly negative impact on the ASSESS with (β = -.307; $p < 0.05$). This means that when there is an increase in the TI value, there will be a decrease in ASS area. The effect of the TI on the DR area is negative and significant (β = -.372; $p < 0.05$). This implies that an increase in the value of the TI leads to a decrease in the value of the DR area. The effect of the TI on the TL area is negative and significant (β = -.182; $p < 0.05$). This implies that an increase in the value of the TI variable leads to a decrease in the value of the FL area. The TI was found to have a negative and significant effect on the EL area (β=-.455; $p<0.05$). Here, an increase in the value of the TI decreases the value of the EL area. The TI has a significantly negative impact on the FL area with (β = -.236; $p < 0.05$). This means that when there is an increase in the TI value, there will be a decrease in FL area.

The effect of the GT on the TL area is positive and significant (β = 1.510; $p < 0.05$). This implies that an increase in the value of the GT leads to an increase in the value of the TL area. The effect of the GT on the PE area is negative and significant (β = 1.316; $p < 0.05$). This implies that an increase in the value of the GT leads to an increase in the value of the PE area. The GT was found to have a positive and significant effect on the DR area (β=1.807; $p<0.05$). Here, an increase in the value of the GT increases the value of the DR area. The GT has a significantly positive impact on the ASSESS area with (β = 2.205; $p < 0.05$). This means that when there is an increase in the GT value, there will be an increase in ASSESS area. The GT was found to have a positive and significant effect on the FL area (β=2.391; $p<0.05$). Here, an increase in the value of the GT increases the value of the FL area. The GT was found to have a positive and significant effect on the EL area (β=3.120; $p<0.05$). Here, an increase in the value of the GT variable increases the value of the EL area.

### 4.7. The Summary of Results

To test the hypothesized model, Barriers to Technology Usage Scales' sub-scale with three dimensions developed by Blackwell et al., 2013 and adopted by Ömrüuzun, 2019; Attitude Scale Devoted to the Usage of Technology in Pre-School Education with one factor (Kol, 2012) and DigCompEdu Self-assessment Scale with six

competence areas (Redecker, 2017) were used. CFA and the reliability and validity measurement of the constructs applied in the hypothesized model. The scales used in this study have good psychometric characteristics and are valid for the study sample.

As for the sample, the descriptive statistics indicated that the early childhood educators are at the B1 (integrator) level in terms of their digital competence. However, they showed different variations in the areas of competence. They are at B1 level in the area of professional engagement, at A2 level in the area of digital resources, at A2 level in teaching and learning, at B1 level in assessment, at B1 level in empowering learners, and at A2 level in facilitating learners' digital competence.

The result of the structural equation modeling indicated a model with a good fit. All predictor variables in the model significantly influenced the outcome variable. Furthermore, the mediator variables, attitudes towards digital technology and teacher inhibitions, significantly mediated the relationship between first-order barriers and digital competence of early childhood educators.

Finally, there was a similar finding for the digital competence areas. The access and support negatively impact the competence areas of early childhood educators, although the gatekeepers have a positive impact on all the competence areas. In addition, attitudes positively impact the competence areas and teacher inhibitions negatively impact these competence areas.

# CHAPTER 5

# DISCUSSION

The study examined the nature of the relationship between first-order, second-order barriers, and digital competence among early childhood educators. It also investigated whether second-order barriers mediate the relationship between first-order and digital competence. Additionally, the digital competence level of Turkish early childhood educators was measured using the DigCompEdu scale. This chapter presents the major findings of the study and discusses their implications for educational practice and further research.

The current study examined the digital competence of early childhood educators (ECEs), addressing a crucial gap in early childhood education research. To address this gap in the literature, the study conducted a comprehensive analysis of data collected from early childhood educators (ECEs) working in different regions of Türkiye. The digital competence levels of these educators were evaluated using the DigCompEdu scale. The findings of the study indicated that Turkish early childhood educators exhibited a proficiency level equivalent to B1 in digital competence, indicating an "integrative" level (Çebi & Reisoğlu, 2022). Nevertheless, it is evident that in order to critically assess the existing digital sources and produce their own, educators should ideally reach C1/C2 level (Redecker, 2017). The characteristics of the various levels were described in the DigCompEdu framework;

> "Integrators experiment with digital technologies in a variety of contexts and for a range of purposes, integrating them into many of their practices. They creatively use them to enhance diverse aspects of their professional engagement. They are eager to expand their repertoire of practices. They are, however, still working on understanding which tools work best in which situations and on fitting digital technologies to pedagogic strategies and methods. Integrators just need some more time for experimentation and reflection, complemented by collaborative encouragement and knowledge exchange to become Experts." (Redecker, 2017 pg. 30).

The results reflect that the educators still have a long way to go until they reach the C2 level which is pioneer described as the highest level by DigCompEdu.

In a study conducted by Yılmaz and Toker (2022), educators from different fields (verbal, numerical, applied field) in the Turkish context were found to have a digital competence level at the B1-integrative level. Similarly, Kuş and Mert (2024) found that educators from different fields such as classroom teachers, Turkish teachers, English teachers in the same context had a digital competence level at the B2-expert level. Öztürk (2022) also found that the digital competence of early childhood educators was at an average level. These findings underscore the necessity for targeted interventions and professional development programs designed to enhance the educators' digital competence and according to the current study result it can be noted that particularly on the pedagogical digital competence areas. It is of paramount importance to enhance educators' capacity to employ digital technologies for the purposes of teaching, learning, assessment, and learner empowerment and this can be a pivotal step in the advancement of digital competence in early childhood education.

The findings of the current study indicate that the ECEs were placed in the B1 level, integrator, within the professional engagement competence area. This area is generally associated with the willingness to use digital technology, not only in education but also in educators' professional development. In accordance with the DigCompEdu framework, educators at the B1 level are able to utilise digital technologies for effective and responsible communication, sharing and exchanging practice with their peers and/or colleagues, and for peer learning, identifying opportunities for professional development (Redecker, 2017). It can be stated that educators tend to develop their digital competence through technology-based learning or an active search for different educational resources to engage the learning process by using digital tools (Ghomi & Redecker, 2019).

Using digital technologies for professional development is also stated by Göksoy (2022), which revealed that early childhood educators utilize the Internet and social media to enhance their professional knowledge. This evidence is significant for

ECEs in terms of their training on digital competence by employing digital technologies. It is likely that ECEs can use digital technologies to enhance their professional development in certain areas. Digital tools or online training can be employed to enhance their digital competence.

The educators demonstrated proficiency at the A2 level in the digital resource competence area. This suggests that early childhood educators (ECEs) in the present context are capable of identifying and assessing suitable digital resources, taking into account fundamental criteria, and modifying resources through the use of some advanced features (Redecker, 2017). However, they may require further development of their digital competence to utilize these tools in diverse ways and contexts. This aligns with the Luo et al. (2021) study, which found that preservice ECEs stated that they felt comfortable while using interactive whiteboards, laptops, mobile digital devices, cameras, projectors, or tablets. However, they lacked confidence in using 3D printers, digital audio recorders, robotics, or virtual reality headsets. The researchers posited that preservice educators tend to adopt a passive implementation approach that aligns with the conventional education style. For instance, they typically opt to utilize digital tools, such as video, PowerPoint, or music, to engage with children. Consequently, in order for educators to utilize digital tools in an interactive manner, it is essential that they feel more comfortable and possess enhanced skills to develop their tools in accordance with their educational objectives.

Turkish early childhood educators have been placed at the A2 level in the "teaching and learning" area. This indicates that they are able to basically implement available digital technologies into the teaching process, enhance basic interaction methods of digital technologies, and encourage the use of digital technologies to design collaborative and self-regulated activities (Redecker, 2017). In order to integrate digital tools into early childhood settings in a manner that encourages children's learning and enriches teaching, educators must be aware of the pedagogical integration of these tools, as highlighted in the Vidal-Hall et al. (2020) study. The researchers posited that until the early childhood educator who participated in the intervention, she had not fully appreciated the capacity of digital tools to support valuable learning aligned with the curriculum in an early childhood education

context. As demonstrated by the study, educators must recognize the capacity of digital tools to support learning in alignment with the curriculum, fostering collaborative learning and self-regulated learning and to achieve this, the early childhood educators must enhance their teaching and learning competence to a higher level.

Another area is "assessment" where Turkish ECEs are placed at the B1 level. The digital technologies can support educators to conduct systematic observation and monitoring of children's progress (Lyons & Tredwell, 2015) through a variety of digital tools such as cameras, audio devices, scanners, and electronic portfolios (Hooker, 2015). Our findings indicate that educators can employ and modify digital technologies for assessment purposes, evaluate a range of data to enhance their teaching practices, and utilize digital tools to provide feedback to students (Redecker, 2017). The findings indicate that ECEs require enhanced assessment skills to effectively utilize digital tools for more systematic monitoring and recording of children's developmental progress.

In addition, "empowering learners" area, Turkish ECEs needs to level up as they are in B1 level. According to their competence, they can be aware of the issues of accessibility and inclusion, the potential of digital technologies for differentiation and personalization, and also use digital technologies to engage learners (Redecker, 2017). There are many digital resources websites, educational tools, and videos that can be used by educators for effective instruction (Trust, 2018). These available resources should be used by educators to bridge the digital divide and empower all students as learners. Furthermore, they should use digital technology to reduce the social and educational inequalities that affect the use of technology at home and in school (Warschauer, 2007). As supported in the related literature, educators' digital competence in the empowering learners need to be improved to leverage digital technologies advantage to ensure the accessibility including children with special needs and use digital technologies to address the individual needs of children.

Finally, educators are placed in the A2 level in the facilitation of learners' digital competence. This implies that educators can encourage learners to utilize digital

technologies to learn new information, for communication and collaboration, and to create content. Furthermore, educators must ensure that these tools are used in a safe and responsible manner (Redecker, 2017). Despite the fact that the early childhood educators can implement some activities to facilitate children's digital competence, they might improve their competence to the level required to integrate pedagogic strategies in it. In this manner, educators can facilitate children's positive use of digital technology and contribute to society (Trust, 2018).

### 5.1. The Relationship between the First-Order Barriers and ECEs' Digital Competence

In order to address the initial research question, the relationship between first-order barriers and digital competence was investigated. With regard to the first-order barriers, the model demonstrated that access and support, as well as gatekeepers, exert a significant influence on the ECEs' digital competence.

Firstly, it was established that access and support barriers have a negative impact on the digital competence of early childhood educators (ECEs). However, the impact of the barrier on the digital competence of ECEs was found to be less significant than that on other barriers. These insights contribute to our understanding of the factors that influence educators' digital competence and highlight the importance of addressing access and support barriers in the educational context. Institutions can facilitate educators' acquisition of digital competence and effective integration of technology into their pedagogical practice by fostering an environment that provides adequate access to technology resources and support mechanisms (Inamorato dos Santos et al., 2023).

This situation can be attributed to a number of factors. Primarily, educators may become frustrated when they lack the requisite technological tools and resources to implement their planned activities. As a result, they tend to become less confident in integrating technology. Consequently, this sense of uncertainty can impede educators' motivation to actively engage with digital tools and acquire the basic skills needed for effective implementation (Lucas, 2020). Secondly, in the absence of

digital technology tools, educators may encounter difficulties in implementing technology-oriented teaching strategies. This creates a cyclical pattern: educators' capacity to develop their digital competence is intrinsically linked to their children' access to technology (Almerich, 2016; Lucas et al., 2021). However, it is equally important to recognize that educators' competence serves as a prerequisite for enabling children to make effective use of technology to enrich their learning experiences. This complex relationship underscores the reciprocal dependence between educators' and children's digital experiences in the educational environment. Consequently, future studies may benefit from examining access and support from both educators' and children's perspectives in ECE settings. By adopting a dual perspective, it is possible to gain a more comprehensive understanding of the multifaceted nature of digital competence development in educational settings can be achieved.

In addition, a lack of accessible technology resources and inadequate support for the integration of digital technologies into various educational contexts has a detrimental impact on the professional development, digital resources, teaching and learning, assessment, empowering learners, and facilitation of learners' digital competence of ECEs as presented in this current study. This result gives a significant evidence because certain regions within Türkiye encounter limitations in the availability of digital technology equipment in early childhood education settings (Ozel, 2019). This limitation underscores the necessity for targeted interventions and investments in these regions to bridge the digital divide and ensure early childhood education settings have access to the requisite technological tools and resources. Such actions can play an important role in enhancing educators' digital competence across all competence areas and contribute to a more equalized digital learning environment for young learners in these regions. The constraints presented by the lack of accessible technology and resources in early childhood education are often so evident that, as noted in Ozel (2019)'s study, educators may find themselves resorting to asking parents for donations to mitigate these constraints. A similar conclusion was reached in the study by Madsen et al. (2023), which found that Turkish pre-service ECEs perceived a lack of digital tools and resources in their field. The economic situation in early childhood education was identified as a significant barrier to accessing

digital tools. Additionally, they revealed that Turkish pre-service ECEs considered digital tools to be an essential component of effective pedagogical programs and frequently planned to integrate digital tools into their future careers. Nevertheless, it is evident that in order to achieve this, the technical infrastructure may be enhanced within the early childhood education environment.

When considered collectively, these parallel findings underscore the pressing need to expand technological access for ECEs to encompass not only the quantity and appropriate types of digital tools, but also the requisite technological support. Ertmer and Hruskocy (1999) proposed solutions to overcome the access and support issues such as hiring a technical troubleshooter or information technology expert, which could potentially eliminate the barrier. The current study can suggest that policymakers must recognize and address the issue by strengthening efforts to equip schools and classrooms with the necessary and appropriate technological tools and support teams. Ultimately, this concerted action will play a crucial role in fostering ECEs' digital competence.

Among the barriers to digital competence of educators, gatekeepers have a positive impact on the digital competence of early childhood educators (ECEs) and have been identified as the most salient factor. This may occurs because early childhood education involves family, school leaders, and educators as stakeholders. The relationship between these stakeholders is an important factor in enhancing children's development (Erkan, 2013). However, there are instances where guardians may impede the educators' work during the educational process. Furthermore, in some instances, the opinions of educators may be disregarded, or the interests of guardians may become a primary concern for school leaders (Can & Kılıç, 2019). Due to compromised relationships, early childhood educators may seriously consider the gatekeepers' opinion and desires.

Additionally, the impact of gatekeepers on the digital competence of ECEs was a surprising result. It was unexpectedly revealed that the gatekeeper barrier had a positive impact on ECEs' digital competence and extending to all digital competence areas. The finding argues that factors such as negative attitudes towards digital

technology usage on the part of school leaders and guardians may contribute to improvements in early childhood educators' digital competence. Although this result is surprising, it is also consistent with the findings of Lucas et al. (2021), who observed a similar result. They argued that a reduction in the level of school facilitation is linked to an enhancement in the professional engagement competence of educators. It is, however, important to note that the findings of our study appear to differ from Masoumi and Noorozi (2023), who reported that a school's approach to technology integration in education had a significant impact on educators' digital competence. When schools did not provide educators with the necessary resources to integrate digital technology into their classrooms, educators perceived a constraint on their digital competence. This was due to the limited opportunities for technology integration.

Furthermore, at times, educators' use of technology in education is subject to criticism by guardians who are influenced by media debates on the adverse effects of digital technologies on children (Blum-Ross & Livingstone, 2018). Nevertheless, the study by Lindeman et al. (2021) revealed that guardians tend to exhibit less concern regarding the use of digital technology in early childhood education settings. This is due to the fact that educators are always transparent about the purpose of utilizing digital technology in the classroom as an educational tool and not for gaming.

A reasonable explanation for the discrepancy in findings between our study and literature is that, until a certain level of gatekeepers' provision of support, educators' digital competence can be improved. However, after a certain threshold, ECEs can perceive that support is not sufficient or even sometimes contrary to their needs when their digital competence is high. For instance, when educators express a desire to purchase digital tools to enhance teaching and learning, school leaders may be perceived as unsupportive of the use of digital technology in education. Therefore, depending on educators' digital competence, their expectations from school leaders or guardians may differ and their perceptions of gatekeepers' attitudes towards digital technology use may become negative. For example, Huang et al. (2016) demonstrated that school leaders and parents expressed concerns about the potential adverse effects of augmented reality in early childhood education. As demonstrated

by this study, educators who possess a higher level of digital competence and who wish to integrate a variety of digital tools or novice strategies may encounter resistance from gatekeepers. However, it should be noted that further investigations need to be conducted to gain a deeper understanding of this result. This factor should be investigated in subsequent studies as it is the first study to consider the role of gatekeepers in the digital competence of educators.

In this context, ECEs may consider enhancing collaboration with guardians and school leaders to ensure that the use of digital technology in education does not harm children's development. For instance, ECEs may choose to adopt a transparent approach with parents, whereby they explain how digital technology is used in the classroom. It is recommended that regular newsletters be sent to parents to emphasize how digital tools enhance creativity in education. It may also be beneficial to extend an invitation to guardians and potentially, school leaders to participate in classroom activities involving digital technology. Consequently, ECEs can proactively engage with gatekeepers, address their concerns, and potentially influence their perceptions of the role of digital technology in early childhood education.

### 5.2. The Relationship Between Second-Order Barriers and ECE's Digital Competence

Secondly, the current study addressed the exploration of second-order barriers to answer the second research question. The model illuminates the important role that attitudes towards digital technology and teacher inhibitions play in shaping the digital competence of early childhood educators (ECEs). The results of our study indicate that attitudes towards digital technology are a positive and significant factor. Conversely teacher inhibitions have a negative and significant impact on all dimensions of digital competence,

In addition to the aforementioned studies, it has been demonstrated that the attitudes of ECEs towards the use of digital technology have a significant and positive impact on their educational digital competence (Bariu & Chun, 2022; Ursavaş et al., 2019;

Runge et al., 2023; Verma et al., 2018). This factor was found to be the second most important factor of the digital competence of ECEs according to our model. This implies that educators who hold positive attitudes towards the integration of digital technology in early childhood education settings demonstrate corresponding increases in their digital competence, as evidenced by the study findings. Moreover, the impact of attitudes towards the use of technology in ECE settings has a positive effect on all educators' digital competence, including professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence.

These findings highlight the pervasive influence of attitudes on educators' capacity to utilize digital technology for the enhancement of early childhood education practices. This finding reinforces previous research indicating that educators from diverse fields, including English teachers (Benali et al., 2018), secondary school educators (Demissie et al., 2022), and pre-service teachers (Tondeur et al., 2018), exhibited comparable results when compared to different levels of educators' digital competence, given the limited number of studies in the literature focusing on ECEs.

One strategy for enhancing educators' attitudes toward digital technology may be through the provision of digital pedagogy training (Pongsakdi et al., 2021). As educators' attitudes towards digital technology are a critical factor in improving digital competence and technology integration (Tondeur et al., 2018), efforts to support attitudes may contribute to more effective integration of technology in education. Nevertheless, it is crucial to acknowledge that addressing low levels of attitudes necessitates a sustained commitment of time and resources at the school leadership level (Skantz-Åberg et al., 2022). Such endeavors are essential to engender a favorable shift in educators' attitudes and, in turn, enhance their digital competence.

The study revealed that teacher inhibitions have a significant and negative effect on digital competence, and this barrier was found to be the second most important factor of the digital competence of ECEs according to our model. It can be argued that educators' lack of self-efficacy, inadequate education or training in digital

competence, and time constraints act as barriers to their digital competence. This result is consistent with the educators who exhibit high self-efficacy in the use of digital technology tend to exhibit high digital competence (Yada et al., 2022). The self-efficacy of educators in the use of technology may be closely related to the professional training they receive in initial education or through in-service training (Birisci & Kul, 2019). In the absence of knowledge and practice regarding the integration of technology, educators are likely to exhibit low self-efficacy. Indeed, García-Vandewalle García et al. (2023) highlights the interesting issue that teacher candidates in early childhood education programs tend to exhibit significantly lower digital competence compared to their elementary school counterparts. This discrepancy can be attributed to the fact that the initial education program for early childhood education does not provide as extensive training in digital competence as the elementary school program. In conclusion, the absence of knowledge and practice in the use of digital technology can impede the advancement of educators' digital competence. This interconnection implies that the enhancement of educators' self-efficacy in the utilization of technology can be facilitated by the provision of extensive training opportunities, both during their initial training and through ongoing professional development initiatives.

The existing literature also indicates that educators' weekly workload has a significant impact on the integration of technology into teaching practices (Cattaneo et al., 2022). The OECD report on "Working conditions and well-being of early childhood education and care staff" indicates that Türkiye is among the countries with the longest weekly working hours for staff (2020). Therefore, our study is in line with these findings and shows that time shortage, defined as an inhibition for teachers, negatively affects the development of digital competence among ECEs. To promote the optimal use of digital technology in education and increase educators' digital competence, it becomes imperative for governments to consider changing educators' workload and making it more flexible (Alexander et al., 2019). By introducing flexibility into educators' schedules, authorities can provide them with the time and space to more effectively engage with skills technology integration and develop their digital competence.

### 5.3. Mediator Effect of Second-Order Barriers on the Relationship between First-Order Barriers and ECEs' Digital Competence

Finally, we sought to address the final research question, which pertained to the mediating role of second-order barriers on the relationship between first-order barriers and digital competence among early childhood educators. Our model demonstrated that second-order barriers did, in fact, mediate the relationship between first-order barriers and digital competence among ECEs.

The analysis demonstrated that attitudes towards digital technology usage served as a mediator in the relationship between access and support and digital competence. The negative attitudes towards using digital technology, which was revealed to act as a mediator, suggests that educators' digital competence cannot be enhanced regardless of proper access and support. This result is consistent with the findings of Forsling (2022), which indicate that even when preschools have adequate digital technology resources, educators may not utilize them due to various factors. Accordingly, it is imperative that policymakers, school leaders, and other stakeholders recognize the necessity of fostering a positive attitude towards digital technology usage among ECEs. This is crucial for enhancing their digital competence and promoting the integration of pedagogically digital technology in the education context. Attitudes towards digital technology usage also mediated the relationship between gatekeepers and digital competence of ECEs. Therefore, when educators have negative attitudes towards using digital technology, gatekeepers' negative attitudes may be perceived as detrimental effect on digital competence development of educators.

The relationship between access to digital resources and support and digital competence was found to be mediated by teacher inhibitions. When teacher inhibitions are high the lack of access and support can be perceived as more significant. As a result, educators may choose to withdraw in order to enhance their digital competence. Furthermore, teacher inhibitions were identified as mediating variables in the relationship between gatekeepers and digital competence. This study indicates that when teacher inhibitions are present, gatekeepers' negative attitudes

towards digital technology usage may impede educators' development of digital competence.

These results are consistent with previous research indicating the significance of second-order barriers, such as attitudes towards using digital technology and teacher inhibitions, in mitigating first-order barriers, including lack of access and support, or gatekeepers (Inan & Lowther, 2010; Miranda & Russell, 2012; Lucas et al., 2021).

In conclusion, the study contributes to the existing literature by enriching the DigCompEdu framework that explains the mediator role of second-order barriers on the relationship between first-order barriers and the digital competence of educators. It is crucial to comprehend the mediator roles of second-order barriers in order to develop effective support mechanisms for enhancing the digital competence of early childhood educators. This is because addressing solely the environmental or external barriers may not guarantee the anticipated level of digital competence among educators.

### 5.4. Conclusion

The digital competence level of Turkish early childhood educators was determined to be moderate level, at the B1-integrator level. Educators at the B1 level are capable of integrating various educational technologies into their teaching, although they may still encounter difficulties in identifying the most suitable tools for specific conditions (Redecker, 2017). In addition, the results of this study present that educators fall within the A2 and B1 levels in terms of didactic and pedagogic-related competence areas, based on the comprehensive analysis provided by DigCompEdu. It is thus essential to provide appropriate training to enhance the digital competence of Turkish early childhood educators, with a particular focus on pedagogical and didactic areas. This will facilitate the integration of digital technologies into education in a pedagogically appropriate manner and assist in the development of children's digital competence.

This study aimed to investigate the relationship among first-order, second-order barriers and the digital competence of early childhood educators. The DigCompEdu

framework was employed to develop a model for examining the relationship through structural equation modeling analysis. These factors were selected since previous literature has primarily focused on demographic predictors such as age, gender, years of teaching experience, and teaching branches, while the impact of external and internal barriers, known to affect technology acceptance, has remained underexplored.

The findings indicate that first and second-order barriers significantly impact educators' digital competence. This study emphasizes that first-order barriers play a more prominent role in terms of direct impact on the digital competence of early childhood educators in the Turkish context with only a minor discrepancy between these barriers. Upon model validation through SEM analysis, the results could enrich the DigCompEdu framework by elucidating factors to consider when assessing educators' digital competence within this framework. As the DigCompEdu framework is predominantly employed for practice-oriented purposes and concrete actions involving the use of technology in education, the identification of external and internal factors within the framework provides insights for policymakers, school leaders, and other stakeholders to facilitate pedagogically and developmentally appropriate technology integration and digitalization of education.

The results of the study show us difficulties in accessing digital technology and receiving support negatively impact educators' ability to improve their digital competence. Therefore, the results suggest that possessing the necessary digital tools and being aware of technical support options are crucial for educators to enhance their digital competence. This, in turn, enables them to effectively utilize digital technologies for professional development, integrate technology in a pedagogically appropriate manner, and enhance learners' digital competence. Conversely, a positive relationship was found between gatekeepers and educators' digital competence. This unexpected result can be explained by the fact that educators with high digital competence tend to perceive gatekeepers' attitudes negatively. This is because educators with high digital competence tend to have more expectations of gatekeepers.

Educators' attitudes towards digital technology significantly influence their digital competence. If educators perceive digital technology as challenging to use or not beneficial for children's learning and development, they are less likely to improve their digital competence or integrate technology into education. Moreover, teacher inhibitions, such as lack of self-efficacy and preparedness barriers to technology integration, also negatively impact educators' digital competence. Therefore, if educators feel inadequately prepared to utilize digital technology due to a lack of training, experience, or time constraints, their capacity to enhance their digital competence may be constrained. Consequently, these educators may be less likely to utilize digital technology in an educational context, such as for professional development, assessment, or fostering learners' digital competence.

The results of the mediation analysis indicate that second-order barriers act as mediators in the relationship between first-order barriers and educators' digital competence. This finding has significant practical implications, as it provides evidence that when second-order barriers are mitigated, first-order barriers may also be mitigated to some extent.

### 5.5. Limitations

It is important to acknowledge several limitations of this study. Firstly, the study employed a convenience sampling procedure. While the sample selection was aligned with the study's objectives, it is crucial to highlight that random sampling was not employed. Hence, the generalizability of the study's findings is constrained. Furthermore, the living city information of the participants is absent from the current study. Consequently, the study is unable to provide a representative account of the digital competence of Turkish educators, which is acknowledged as a limitation. Moreover, the participants were not divided into private and public-school categories. The characteristics of the school may influence the digital competence of early childhood educators or the existence of barriers. This situation should be considered when interpreting the study results.

Secondly, educators were recruited for the study via technological means, including WhatsApp, Facebook, and Instagram. It is possible that educators who participated in

the online survey have an affinity for digital technologies and are interested in the development of digital competence in teaching. It is important to consider the limitations of the study when evaluating the results.

Thirdly, the data collection in this study is based the on participants' self-reports. This approach introduces the potential for participants to overestimate or underestimate their own digital competence. It is, however, important to note that valid studies in literature have successfully assessed educators' digital competence using self-reported measures (Scherer et al., 2017). In addition, the "Attitude Scale Devoted to the Usage of Technology in Pre-School Education" was developed in 2012. Despite the scale demonstrating good inconsistent validity, this may be considered a limitation of the current study.

Another notable limitation of the current study arises from the use of correlational research methodology. This approach is inherently limited in its ability to establish cause-and-effect relationships. Consequently, the study's findings do not permit the drawing of causal conclusions, and any potential causality between variables cannot be inferred from the results.

Finally, while the current study incorporated specific variables such as teacher inhibitions, attitude, gatekeepers, access and support based on the literature, it is important to recognize that there are numerous other individual, school-related, policy-related and environmental variables that may be relevant to understanding educators' digital competence. The incorporation of these additional variables can provide a more comprehensive and nuanced understanding of the factors that influence digital competence among ECEs. Therefore, the study's focus on a specific set of variables may represent a limitation in capturing the full scope of influences on educators' digital competence.

### 5.6. Implications

The study offers valuable insights into the digital competence development of early childhood educators in Türkiye. The findings indicate that these educators currently

exhibit proficiency at the moderate, B1 level, which is defined as "Integrative" in terms of digital competence. However, to reach the advanced level (C2), they will need to further develop their digital competence.

Given the level of expertise of the educators in question, it is of vital importance to consider professional development strategies that can facilitate their competence development. Professional development activities may be organized by school leaders, policymakers, or other stakeholders. As previously stated in the literature review chapter, there are several current projects underway to enhance educators' and teacher candidates' digital competence. One such project is the "Öğretmen Eğitimi Dijital Ekosistemi Projesi" The current study's results offer valuable insights into the needs of early childhood educators, indicating the specific areas in which they require digital competence training. Additionally, it is essential to comprehend the elements that affect educators' digital competence development, both at the school level (first-order barriers) and at the personal level (second-order barriers). This understanding should inform the initiation of efforts to remove these barriers, thereby facilitating educators' digital competence development.

This study makes several valuable contributions to the existing literature. Firstly, this study addresses a significant gap in the field by focusing on the digital competence of ECEs, an area that has received limited attention in previous research (Hatlevik, 2017; Lucas et al., 2021). Secondly, it is of significant importance to investigate educators' digital competence in order to facilitate the mainstream adaptation of digital technology in early childhood education settings. Research has demonstrated that educators with higher levels of digital competence tend to utilize technology more frequently in their teaching practices (Peng et al., 2023; Ghomi & Redecker, 2019). It can be argued that educators who possess a high level of digital competence are more likely to accept technology and utilize it effectively in their teaching endeavors. Furthermore, the current study offers a valuable model for identifying and understanding the factors that influence educators' digital competence development. The research distinguishes between first-order barriers related to the external and second-order barriers which are internal, thereby acknowledging the multifaceted

nature of educators' digital competence (Aesaert et al., 2015; Engen, 2019; Lucas et al., 2021).

In practical terms, technical support was identified as a significant factor influencing educators' digital competence development. For example, the provision of ongoing technical support and mentorship to enable experimentation with different technologies (Masoumi & Noorozi, 2023) may positively influence the digital competence of Turkish early childhood educators. Another crucial recommendation, derived from the findings of this study, is the need to emphasize the significance of access to digital technologies. Even the most enthusiastic educators without sufficient technological infrastructure are unable to rotate students in educators' personal computers (Agyei & Voogt, 2011). This limitation in access to technologies can prevent educators' digital competence and limit their digital technology use in education (Masoumi & Noorozi, 2023). This may also be associated with limitations in access to digital technology, preventing educators from engaging in exercises and exploring technology. Consequently, educational institutions and policymakers may prioritize the provision of accessible and appropriate technological infrastructure for early childhood education institutions.

In addition to the aforementioned first-order barriers, the attitudes of school leaders and parents towards the use of digital technologies may also impact educators' digital competence. When educators possess a high level of digital competence, they are likely to perceive gatekeepers' attitudes negatively. However, based on the literature, it can be argued that school leaders play a pivotal role in educators' digital competence by creating a technology-rich environment and supporting technology-enhanced learning environments (Tondeur et al., 2017). Consequently, school leaders and guardians may demonstrate a favorable disposition toward the integration of technology in education and provide educators with the necessary support to facilitate its implementation. Additionally, it can be suggested that school leaders need to develop their digital competence to support educators' digital competence (Masoumi & Noorozi, 2023; Pettersson, 2018).

The second-order barriers to digital competence can be overcome by highlighting the practical applications of the resulting can be used in a practical manner. Firstly, it can

be observed that teacher inhibitions, such as lack of self-efficacy and preparedness, have a negative impact on their digital competence. To effectively remove these barriers, it is essential that educators are continuously updated on developments in new digital technologies (Redecker, 2017). It is of critical importance to recognize digital competence development as a lifelong learning journey in this context. It is of vital importance to provide educators with training opportunities that are tailored to their specific needs. In order to implement this result in practice, this study suggests that educators should be relieved of duties such as administration, planning, and evaluation. These additional responsibilities can be a significant burden for educators, discouraging them from investing time in developing their digital competence (Masoumi & Noorozi, 2023; Sipilä, 2014). Consequently, it is recommended that school leaders and other stakeholders consider reducing the educators' workload and creating time for them to develop their digital competence.

School leaders can allocate time in educators' schedules and adjust course loads to ensure participation in training, workshops, and self-directed learning. Furthermore, ongoing training and support can be provided through mentoring programs, interaction with technology experts, or access to online resources (Ertmer, 1999). These strategies collectively contribute to the enhancement of educators' digital competence and the creation of a technologically enriched educational environment. To address the lack of digital technology issue, schools can optimize the use of available digital tools by centralizing equipment and potentially creating a dedicated technology lab (Means & Olson, 1997). This can be facilitated and encouraged by educators' self-experience and experimentation. Consequently, educators would also gain self-efficacy by using digital technologies in education.

In the current study, attitudes towards digital technologies among the second-order factors of ECEs' digital competence were addressed as well. The significance of positive attitudes has been underscored in previous studies for example, despite the availability of advanced technological resources and expertise in digital technologies, educators often exhibit negative attitudes that impede the integration of technology and digital competence (Aldhafeeri et al., 2016). It is therefore evident that the attitudes of early childhood educators towards the use of digital technology cannot be

overlooked during the teacher education program (Merjovaara et al., 2024; Yerdelen-Damar et al., 2017). Consequently, both universities, which are responsible for developing teacher education curricula, and the Ministry of National education, which is responsible for developing teachers' professional training programs, may consider providing training to develop positive attitudes in early childhood educators regarding the integration of technology in education. Such training could address both the technical management of digital technology and the pedagogically appropriate ways of integrating it into education. Furthermore, different types of learning delivery methods can be considered. As proposed by Perry and Jan (2017), online training represents a flexible and accessible approach for educators to develop their digital competence.

The mediation analysis results indicate the significance of addressing attitudes towards digital technology and teacher inhibitions to develop educators' digital competence. To effectively support educators in developing their digital competence, it becomes essential to remove these second-order barriers and foster positive attitudes towards digital technology. This responsibility falls to various stakeholders, including school leaders, policy makers and other relevant authorities. The findings of this study indicate that, while first-order barriers play a significant role in explaining educators' digital competence at the macro and meso levels, the primary responsibility for digital competence development ultimately rests with the educators themselves (Skantz-Åberg et al., 2022). This insight underscores the significance of equipping educators with the requisite resources, training, and assistance to overcome personal obstacles and develop a positive attitude towards digital technology.

It is crucial to interpret the results of this study within the specific context in which it was conducted and to be aware of its scope when attempting to generalize the findings.

The study demonstrated its contribution to existing literature, for future studies, it would be beneficial to suggest that a qualitative study be designed to explore the classroom practices of early childhood educators in terms of the DigCompEdu

framework areas. Systematic observations would be conducted in order to investigate how ECEs incorporate digital technologies into education and which DigCompEdu areas are most effectively implemented in practice. In addition, during the observation, some additional barriers or factors would be diagnosed. Although the current study elucidates the interrelationship between DigCompEdu and barriers to technology integration, based on the extant literature and previous studies, the specific circumstances may differ. In particular, the cultural variables, governmental policies, approaches to early childhood education ECE in different countries, and ECE curricula in different contexts represent significant factors that influence ECEs' digital competence. The aforementioned factors, which may act as either enablers or disablers of educators' digital competence, may be beneficial to conduct a further study on the subject as an ecosystem in its own right. Moreover, the data collection method employed in the study, namely self-reporting, is subject to the potential influence of individual and cultural biases. Consequently, observational studies may offer a valuable additional perspective when assessing the digital competence of educators and the factors influencing their digital competence development.

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# APPENDICIES

## A. APPROVAL OF THE METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
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MIDDLE EAST TECHNICAL UNIVERSITY

13 EYLÜL 2022

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

**Sayın Serap Sevimli ÇELİK**

Danışmanlığını yürüttüğünüz Begüm Canaslan Akyar'ın **"Okul Öncesi Öğretmenlerinin Dijital Yetkinliklerinin İncelenmesi"** başlıklı araştırmanız İnsan Araştırmaları Etik Kurulu tarafından uygun görülerek gerekli onay **0458-ODTUİAEK-2022** protokol numarası ile onaylanmıştır.

Bilgilerinize saygılarımla sunarım.

[redacted]
Prof. Dr. Mine MİSİRLİSOY
Başkan

[redacted]
Doç. Dr. İ.Semih AKÇOMAK
Üye

Dr. Öğretim Üyesi Müge GÜNDÜZ
Üye

[redacted]
Dr. Öğretim Üyesi Şerife SEVİNÇ
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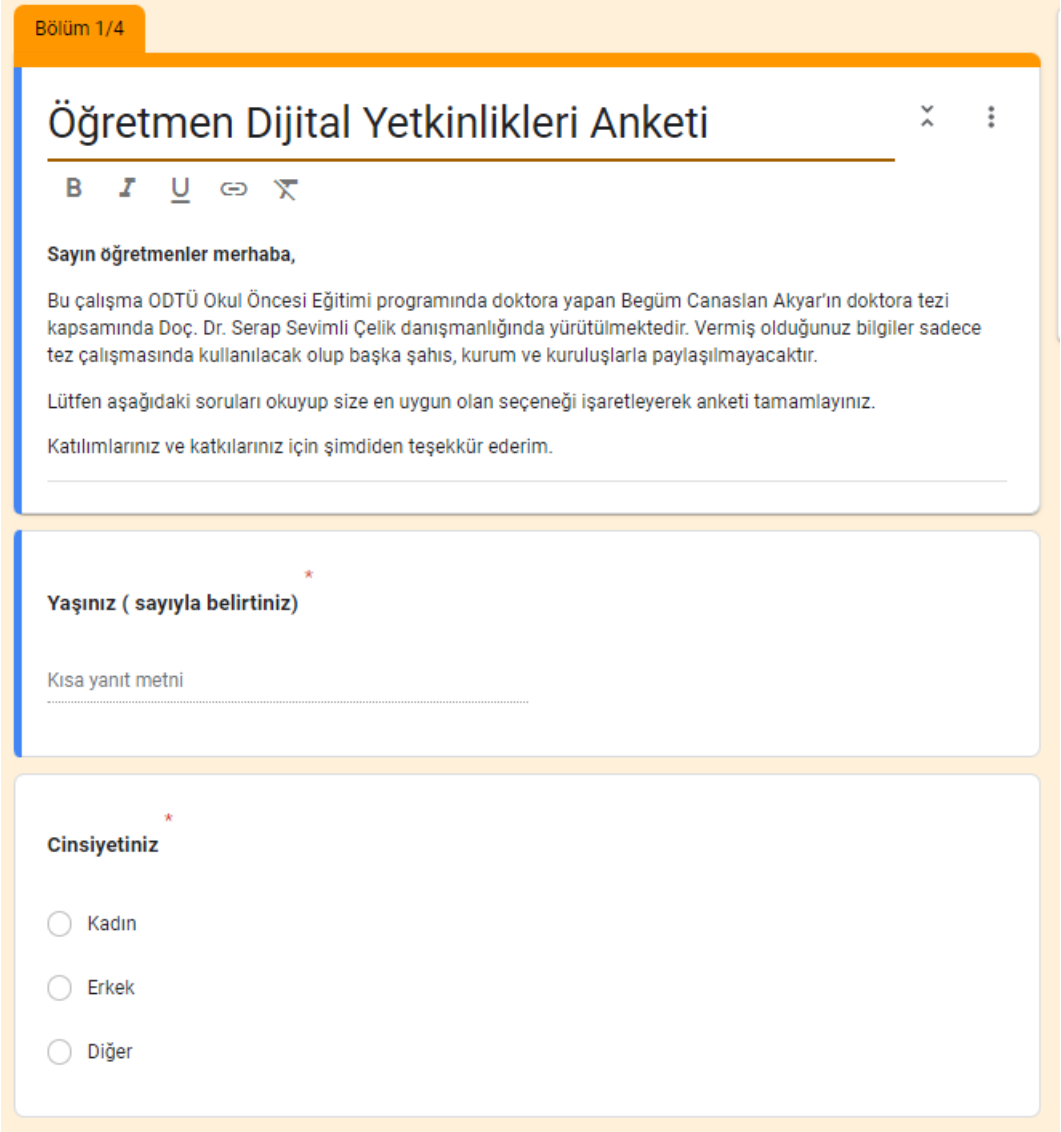
Dr. Öğretim Üyesi Süreyya ÖZCAN KABASAKAL
Üye

Dr. Öğretim Üyesi A. Emre TURGUT
Üye

## B. SELF-ASSESSMENT INSTRUMENT



**En son mezun olduğunuz program türü**

- ○ Lise
- ○ Önlisans
- ○ Açık öğretim fakültesi (Önlisans)
- ○ Açık öğretim fakültesi (Lisans)
- ○ Lisans
- ○ Tezsiz Yükseklisans
- ○ Yüksek Lisans
- ○ Doktora

**En son bitirdiğiniz programın mezuniyet yılı yazınız (sayıyla belirtiniz)** *

Kısa yanıt metni

**Mesleki Tecrübe Yılınız (sayıyla belirtiniz)** *

Kısa yanıt metni

**Şuan/En son çalıştığınız yaş grubu** *

- ○ 36-48 ay
- ○ 48-60 ay
- ○ 60-72 ay

1. bölümden sonraki kısım Sonraki bölüme geç

Bölüm 2/4

Eğitimde dijital teknoloji kullanımındaki bariyerler

Aşağıdaki sorulara sınıftaki dijital teknoloji kullanım durumunuzu düşünerek size en uygun cevabı veriniz.
1-Kesinlikle katılmıyorum; 2-Katılmıyorum; 3-Kararsızım; 4-Katılıyorum; 5-Kesinlikle Katılıyorum

**1-Teknoloji kullanımı hakkında yetersiz eğitim verildiği ya da hiç verilmediği için sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**2-Teknoloji kullanımı, donanım yetersizliği ve eksikliğinden dolayı sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

**3-Teknoloji kullanımı, sınıfta kullanacak zamanım olmadığından dolayı sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**4-Teknoloji kullanımı, okulumun teknolojinin sınıfta kullanımını engelleyen politikasından dolayı sınırlıdır**. *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**5-Teknoloji kullanımı, teknik destek yetersiz olduğu ya da hiç olmadığı için sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**6-Teknoloji kullanımı sınırlıdır, çünkü ilgili konuyla teknolojiyi nasıl ilişkilendireceğimi bilmiyorum.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**8-Teknoloji kullanımı, yazılım yetersizliği ve eksikliğinden dolayı sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**9-Teknoloji kullanımı, teknolojiyi öğrenmek için zamanım olmadığından dolayı sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**10-Teknoloji kullanımı, benim teknolojiyi rahat kullanamamdan dolayı sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**11-Teknoloji kullanımı, ebeveyn onayının olmamasından dolayı sınırlıdır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

Bölüm 3/4

**Okul Öncesi Eğitimde Teknolojik Araç-Gereç Kullanımına Yönelik Tutum Ölçeği**

Aşağıdaki sorulara sınıftaki dijital teknoloji kullanım durumunuzu düşünerek en doğru cevabı veriniz.
1-Kesinlikle katılmıyorum; 2-Katılmıyorum; 3-Kararsızım; 4-Katılıyorum; 5-Kesinlikle Katılıyorum

**1- Teknolojik araç gereçler benim için vazgeçilmez araçlardır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**2- Teknolojik araç-gereçlerin kullanımı okul öncesi eğitime katkı sağlar.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**3- Etkinliklerde teknolojik araç gereçler kullanmak zaman kaybıdır.** *

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

**4- Teknolojik araç gereçler okul öncesi öğretmeninin işini bir hayli kolaylaştırır.**

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**5- Teknolojik araç gereç kullanımı okul öncesi eğitimin kalitesini yükseltir.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**6- Teknolojik araç gereçler sınıfta öğretmenin rolünü azaltır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**7- Teknolojik araç-gereçler okul öncesi dönem çocuklarını üst düzeyde güdüler.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**8- Teknolojik araç-gereçler okul öncesi etkinliklerini daha zevkli hale getirir.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**9- Teknolojik araç-gereçler okul öncesi dönem çocuğunun dikkatini dağıtır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**10- Teknolojik araç gereçleri kullanabilmek için teknik bilgilerim yeterlidir.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**11- Okul öncesi eğitimde teknolojik araç-gereç kullanımı gereksizdir.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**12- Teknolojik araç-gereçler okul öncesi eğitimde kullanılan öğretim yöntemlerine uygundur.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**13- Deneyimli öğretmenlerin nitelikli bir eğitim verebilmeleri için teknolojik araç-gereçlere ihtiyaçları yoktur.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**14- Görsellik açısından okul öncesi etkinliklerde teknolojik araç-gereçleri kullanmak önemlidir.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

**15- Teknolojik araç-gereçler eğitimde okul öncesi öğretmenini daha etkili kılar.** *

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

**16- Teknolojik araç-gereçler öğretmen-öğrenci etkileşimini azaltır.**

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**17- Teknolojik araç-gereçler bilginin daha kalıcı olmasını sağlar.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**18- Teknolojik araç-gereçler ile yapılan etkinlikler okul öncesi dönem çocuğunun gelişim düzeyini arttırmaktadır.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**19- Teknolojik araç-gereçler çocuğun gelişimine olumlu katkı sağlar.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ◯ | ◯ | ◯ | ◯ | ◯ | Kesinlikle katılıyorum |

**20- Teknolojik araç-gereçler etkinlikler sürecinde soyut kavramların somutlaştırılmasında oldukça etkilidir.** *

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Kesinlikle katılmıyorum | ○ | ○ | ○ | ○ | ○ | Kesinlikle katılıyorum |

3. bölümden sonraki kısım Sonraki bölüme geç

Bölüm 4/4

**Eğitimcilerin Dijital Yeterliklerine Yönelik Öz-Değerlendirme Aracı**

Aşağıdaki sorulara sizi en iyi yansıttığını düşündüğünüz cevabı veriniz.

**1- Öğrencilerle, velilerle ve meslektaşlarımla iletişimimi geliştirmek için farklı dijital kanalları sistematik olarak kullanırım. *Örneğin; e-postalar, bloglar, web sitesi, uygulamalar*** *

- ○ Dijital iletişim kanallarını nadiren kullanırım
- ○ Temel dijital iletişim kanallarını kullanırım. Örneğin; e-posta
- ○ Farklı iletişim kanallarını birleştiririm. Örneğin; e-posta, sınıf blogu veya okul web sitesi
- ○ Etkili iletişim kurmak için farklı dijital çözümleri sistematik olarak seçer, uyarlar ve birleştiririm
- ○ İletişim stratejilerim üzerine düşünür, tartışır ve onları temkinli olarak geliştirim

**2- Eğitim kurumumun içindeki ve dışındaki meslektaşlarımla birlikte çalışmak için dijital teknolojileri kullanırım.** *

- Diğer öğretmenlerle nadiren işbirliği yapma fırsatım olur
- Meslektaşlarımla bazen materyal alışverişi yaparım
- İşbirlikçi ortamlarda meslektaşlarımla beraber çalışırız ya da paylaşımlı bulut ortamlarını (drive, yandexdi...
- Kurumum dışındaki öğretmenlerle de fikir ve materyal alışverişinde bulunurum. Örneğin; çevrimiçi öğretm...
- Çevrimiçi bir ağda diğer öğretmenlerle ortaklaşa materyaller oluştururum.

**3- Dijital öğretim becerilerimi aktif olarak geliştiririm.** *

- Dijital öğretim becerilerim üzerinde çalışmak için nadiren zamanım olur
- Yeteneklerimi yansıtma ve deneme yoluyla geliştiririm
- Dijital öğretim becerilerimi geliştirmek için çok çeşitli kaynaklar kullanırım
- Eğitim uygulamalarını geliştirmek ve yenilik getirmek için dijital teknolojilerin nasıl kullanılacağını meslekt...
- Meslektaşlarımın dijital öğretim stratejilerini geliştirmelerine yardımcı olurum

**4- Çevrimiçi eğitim fırsatlarına katılırım.** ***Örneğin, çevrimiçi kurslar, kitlesel çevrimiçi açık dersler, web seminerleri, sanal konferanslar***

- Bu henüz dikkate almadığım yeni bir alan
- Henüz katılmadım fakat kesinlikle ilgileniyorum
- Bir veya iki defa çevrimiçi eğitime katıldım
- Çeşitli çevrimiçi eğitim fırsatlarını denedim
- Çevrimiçi eğitimin her türüne sık sık katılırım

**5- Çok çeşitli dijital kaynaklar bulmak ve seçmek için farklı internet siteleri ve arama stratejileri kullanırım.**

- Kaynakları bulmak için nadiren interneti kullanırım
- İlgili kaynakları bulmak için arama motorlarını ve kaynak platformları kullanırım
- Kaynakların öğrenen grubuma uygunluğunu gözeterek değerlendirir ve seçerim
- Kaynakları bir dizi kriter kullanarak karşılaştırırım, örneğin: güvenilirlik, kalite, uygunluk, tasarım, etkileşim,...
- Uygun kaynaklar ve arama stratejileri hakkında meslektaşlarıma önerilerde bulunurum

**6- Kendi dijital kaynaklarımı oluşturur ve var olanları kendi ihtiyaçlarıma uyarlamak için değişiklik yaparım.** *

- ( ) Kendi dijital kaynaklarımı oluşturmam
- ( ) Çalışma kağıtlarını bilgisayarda hazırlarım fakat sonra onları yazdırırım
- ( ) Dijital sunumlar oluştururum ama çok fazla değil
- ( ) Farklı türden kaynaklar oluştururum ve üzerinde düzenlemeler yaparım
- ( ) Karmaşık ve etkileşimli kaynaklar hazırlarım ve bunları uyarlarım

**7- Hassas içeriği etkin bir şekilde korurum. *Örneğin; sınavlar, öğrenci notları, kişisel veriler*** *

- ( ) Bunu yapmama gerek yok çünkü kurumum bununla ilgilenir
- ( ) Kişisel verileri elektronik olarak saklamaktan kaçınırım
- ( ) Bazı kişisel verileri korurum
- ( ) Kişisel veriler içeren dosyaları şifreleyerek korurum
- ( ) Kişisel verileri kapsamlı bir şekilde korurum. Örneğin; tahmin edilmesi zor şifreler ile şifreleme ve sık yazıl...

**8- Dijital teknolojilerin sınıfta daha verimli şekilde kullanılmasını sağlamak için nasıl, ne zaman ve niçin kullandığımı dikkatlice düşünürüm.** *

- ○ Sınıfta teknolojiyi nadiren kullanırım veya kullanmam
- ○ Mevcut ekipmanı temel olarak kullanırım. Örneğin; dijital beyaz tahta veya projektörler
- ○ Öğretimimde çeşitli dijital stratejiler kullanırım
- ○ Öğretimi sistematik olarak geliştirmek için dijital araçlar kullanırım
- ○ Yenilikçi pedagojik stratejileri uygulamak için dijital araçlar kullanırım

**9- Öğrencilerimin kullandığımız işbirlikli çevrimiçi ortamlardaki etkinliklerini ve etkileşimlerini takip ederim.** *

- ○ Öğrencilerimle birlikte dijital ortamları kullanmam
- ○ Kullandığımız çevrimiçi ortamlarda öğrenci etkinliğini takip etmem
- ○ Onları ve tartışmalarını bazen kontrol ederim
- ○ Öğrencilerimin çevrimiçi etkinliklerini düzenli olarak takip eder ve analiz ederim
- ○ Motive edici veya düzeltici yorumlarla düzenli olarak müdahale ederim

**10- Öğrencilerim gruplar veya takımlar halinde çalışırken, bulgu elde etmek ve belgelemek için dijital teknolojileri kullanırlar.** *

- Öğrencilerim gruplar halinde çalışmaz
- Dijital teknolojileri grup çalışmasına entegre etmem mümkün değil
- Grup halinde çalışan öğrencileri çevrimiçi bilgi aramaya veya sonuçlarını dijital formatta sunmaya teşvik ...
- Takım halinde çalışan öğrencilerin bilgi bulmak ve sonuçlarını dijital formatta sunmak için interneti kullan...
- Öğrencilerim bulguları birbirleriyle paylaşır ve işbirlikli çevrimiçi alanda ortaklaşa bilgi oluştururlar

**11- Öğrencilerin kendi öğrenmelerini planlamalarını, belgelemelerini ve izlemelerini sağlamak için dijital teknolojileri kullanırım.** ***Örneğin, öz değerlendirme için sınavlar, belgelendirme ve sergileme için e-portfolyolar, çevrimiçi günlükler / yansıma blogları*** *

- Çalışma ortamımda mümkün değil
- Öğrencilerim öğrenmeleri üzerinde yansıtma yapabilirler; ancak dijital teknolojilerle değil
- Bazen kullanırım. Örneğin; öz değerlendirme sınavları için
- Öğrencilerin öğrenmelerini planlamalarını, belgelemelerini veya yansıtmalarını sağlamak için çeşitli dijital ...
- Öğrencilerin gelişimlerini planlamalarını, izlemelerini ve yansıtmalarını sağlamak için farklı dijital araçları ...

**12- Öğrencinin gelişimini takip etmek için dijital ölçme biçimleri (formatları) kullanırım.** *

- Öğrencilerin gelişimlerini takip etmem
- Öğrencilerin gelişimlerini düzenli olarak takip ederim ancak dijital araçlarla değil
- Bazen dijital bir araç kullanırım. Örneğin öğrencilerin gelişimini kontrol etmek için bir sınav
- Öğrencinin gelişimlerini takip etmek için çeşitli dijital araçlar kullanırım
- Öğrencinin gelişimlerini takip etmek için çeşitli dijital araçları sistematik olarak kullanırım

*

**13- Ek desteğe ihtiyaç duyan öğrencileri zamanında belirlemek için elimdeki tüm verileri analiz ederim.** ***"Ek desteğe ihtiyaç duyan öğrenciler" ile ifade edilmek istenen: okulu bırakma veya düşük performans gösterme riski taşıyan öğrenciler; öğrenme bozukluğu olan veya özel öğrenme ihtiyacı olan öğrenciler, genel becerilere sahip olmayan öğrenciler; sosyal, sözlü veya çalışma becerileri. "Veri" ile ifade edilmek istenen: öğrencilerin katılımı, performansı, notları, devamları; (çevrimiçi) ortamlarda etkinlikler ve sosyal etkileşimler***

- Bu veriler mevcut değildir ve / veya bunları analiz etmek benim sorumluluğum değil
- Sadece akademik verileri analiz ederim. Örneğin; performans ve notlar
- Ek desteğe ihtiyacı olan öğrencileri belirlemek için öğrencilerin etkinlikleriyle ve davranışlarıyla ilgili veriler...
- Ek desteğe ihtiyacı olan öğrencileri belirlemek için mevcut tüm bulguları düzenli olarak takip ederim
- Verileri sistematik olarak analiz ederim ve zamanında müdahale ederim.

**14- Etkili geri bildirim sağlamak için dijital teknolojileri kullanırım.** *

- ○ Çalışma ortamımda geri bildirim gerekli değil
- ○ Öğrencilere geri bildirim veririm ama dijital formatta değil
- ○ Bazen geri bildirim sağlamak için dijital yöntemler kullanırım. Örneğin; çevrimiçi sınavlardaki otomatik pu...
- ○ Geri bildirim sağlamak için çeşitli dijital yöntemler kullanırım
- ○ Geri bildirim sağlamak için dijital yaklaşımları sistematik olarak kullanırım

**15- Öğrenciler için dijital ödevler oluştururken potansiyel dijital problemlere dikkat çekerim ve onları göz önünde bulundururum.** ***Örneğin, dijital cihazlara ve kaynaklara eşit erişim; birlikte çalışabilirlik ve dönüşüm sorunları; dijital becerilerin eksikliği*** *

- ○ Dijital ödevler oluşturmam
- ○ Öğrencilerimin dijital teknolojiyi kullanmada problemleri yok
- ○ Zorlukları en aza indirmek için dijital ödevleri uyarlarım
- ○ Öğrencilerle olası engelleri tartışırım ve çözümlerin ana hatlarını belirtirim
- ○ Çeşitliliğe izin veririm. Örneğin; görevi uyarlarım, çözümleri tartışırım ve görevi tamamlamak için alternati...

**16- Öğrencilere kişiselleştirilmiş öğrenme fırsatları sunmak için dijital teknolojileri kullanırım. *Örneğin; öğrencilerin bireysel öğrenme ihtiyaçlarına, tercihlerine ve ilgi alanlarına hitap edecek farklı dijital görevler veririm***

- Çalışma ortamımda, seviyelerine bakılmaksızın, tüm öğrencilerin aynı etkinlikleri yapmaları gerekir.
- Öğrencilere ek kaynaklar için önerilerde bulunurum.
- Gelişmiş veya geride kalanlar için isteğe bağlı dijital etkinlikler yaparım
- Mümkün olduğunda, farklılaştırılmış öğrenme fırsatları sunmak için dijital teknolojileri kullanırım
- Öğretimimi öğrencilerin bireysel öğrenme ihtiyaçlarıyla, tercihleriyle ve ilgi alanlarıyla ilişkilendirmek için s...

**17- Öğrencilerin derslere aktif olarak katılmaları için dijital teknolojiler kullanırım.**

- Çalışma ortamımda sınıftaki öğrencileri aktif bir şekilde derse dâhil etmek mümkün değil
- Öğrencileri aktif olarak derse dâhil ederim ama dijital teknolojilerle değil
- Öğretim yaparken, motive edici uyaranları kullanırım. Örneğin; videolar, animasyonlar, çizgi filmler
- Öğrencilerim sınıfta dijital medya ile meşgul olurlar. Örneğin; elektronik çalışma sayfaları, oyunlar, kısa sı...
- Öğrencilerim araştırmak, tartışmak ve bilgiyi oluşturmak için dijital teknolojileri sistematik olarak kullanırlar

**18- Öğrencilere bilgilerin güvenilirliğini nasıl değerlendireceğini, yanlış ve taraflı bilgileri nasıl belirleyebileceğini öğretirim.** *

- ◯ Bu benim konu alanımda veya çalışma ortamımda mümkün değil
- ◯ Onlara sık sık tüm çevrimiçi bilgilerin güvenilir olmadığını hatırlatırım
- ◯ Onlara güvenilir ve güvenilmez kaynakları ayırt etmeyi öğretirim.
- ◯ Bilginin doğruluğunun nasıl teyit edilebileceğini, öğrencilerle tartışırım.
- ◯ Bilginin nasıl üretildiğini ve çarpıtılabileceğini kapsamlı bir şekilde tartışırız.

**19- Öğrencilerin birbirleriyle veya dışarıdan bir katılımcıyla iletişim ve işbirliği kurması için dijital araçları kullanmalarını gerektiren ödevler veririm.** *

- ◯ Bu benim konu alanımda veya çalışma ortamımda mümkün değil
- ◯ Sadece nadir durumlarda öğrencilerimin çevrimiçi iletişim kurması veya işbirliği yapması gerekir
- ◯ Öğrencilerim, çoğunlukla kendi aralarında dijital iletişim ve işbirliği kurar
- ◯ Öğrencilerim birbirleriyle ve dışardan bir katılımcı ile iletişim ve işbirliği kurmak için dijital yöntemler kulla...
- ◯ Öğrencilerin becerilerini yavaş yavaş geliştirmesini sağlayan ödevleri sistematik olarak veririm

**20- Öğrencilerin dijital içerik oluşturmalarını gerektiren ödevler veririm. *Örneğin; videolar, müzikler, fotoğraflar, dijital sunumlar, bloglar, wiki'ler***

- Bu benim konu alanımda veya çalışma ortamımda mümkün değil
- Bunu öğrencilerimle uygulamak zor
- Bazen eğlenceli bir aktivite olarak
- Öğrencilerim, çalışmalarının ayrılmaz bir parçası olarak dijital içerik oluşturur
- Bu, öğrenmelerinin ayrılmaz bir parçasıdır ve becerilerini daha da geliştirmek için zorluk seviyesini sistem...

**21- Öğrencilere çevrimiçi ortamda nasıl güvenli ve sorumlu davranacaklarını öğretirim.**

- Bu benim konu alanımda veya çalışma ortamımda mümkün değil
- Kişisel bilgilerini çevrimiçi olarak aktarırken dikkatli olmaları gerektiği konusunda onları bilgilendiririm.
- Çevrimiçi ortamlarda güvenli ve sorumlu davranmak için temel kuralları açıklarım
- Davranış kuralları hakkında tartışır ve fikir birliğine varırız.
- Kullandığımız farklı dijital ortamlarda öğrencilerimin sosyal kural kullanımlarını sistematik olarak geliştirir...

**22- Öğrencileri somut problemleri çözmek için dijital teknolojileri yaratıcı bir şekilde kullanmaları konusunda teşvik ederim. *Örneğin; öğrenme sürecinde ortaya çıkan engellerin veya zorlukların üstesinden gelmek için***

- Çalışma ortamımda, öğrencilerimle mümkün değil
- Öğrencilerin dijital problem çözme becerisini geliştirme fırsatım nadiren olur
- Bazen, bir fırsat ortaya çıktığında
- Sorunlara sık sık teknolojik çözümler deneriz
- Yaratıcı dijital problem çözme fırsatlarını sistematik olarak entegre ederim

## C. PERMISSONS FOR THE INSTRUMENTS

Begüm Hocam Merhaba,

Ekte talep etmiş olduğunuz anketi bulabilirsiniz. İlk bölüm bizim uyarladığımız anket. İkinci bölümde yani son sayfada Öğretmenler İçin Teknoloji Kabul Ölçeği var, onu çıkarırsınız.

Çalışmalarınızda kolaylıklar dilerim.
Işıl Kıran

Merhabalar,

Öncelikle ilginiz için teşekkür ederiz. Bilimsel etik kurallara uygun bir şekilde kaynak gösterek, uyarlama çalışmasını yaptığımız ölçme aracını kullanmanızda bir sakınca yoktur.
Talep ettiğiniz ölçme aracına buradan erişim sağlayabilirsiniz. Çalışmanızı tamamladığınızda sonuçlarınızı bizimle de paylaşırsanız memnun oluruz.

İyi çalışmalar dilerim.

Doç. Dr. Ayça ÇEBİ

## D. THE SIGNIFICANCE TEST OF THE REGRESSION COEFFICIENTS IN THE MODEL RESULTS

- The variable AS from the BTU scale had a significant positive effect on the ATT variable ($\beta = 0.082$, $p < 0.05$). Thus, an increase in the value of the AS variable directly increases the value of the ATT variable.

- The variable AS from the BTU scale was found to have a significant positive effect on the TI variable ($\beta = 0.083$, $p < 0.05$). Therefore, an increase in the value of the AS variable directly leads to an increase in the value of the TI variable.

- The variable AS from the BTU scale had a significant negative effect on the DC variable ($\beta = -0.150$, $p < 0.05$). Therefore, an increase in the value of the AS variable directly leads to a decrease in the value of the DC variable.

- The variable GT from the BTU scale was found to have a significant negative effect on the ATT variable ($\beta = -0.302$, $p < 0.05$). Therefore, an increase in the value of the GT variable directly leads to a decrease in the value of the Attitude ATT variable.

- The variable GT from the BTU scale was found to have a significant positive effect on the TI variable ($\beta = 0.808$, $p < 0.05$). Therefore, an increase in the value of the GT variable directly leads to an increase in the value of the TI variable.

- The variable GT from the BTU scale had a significant positive effect on the DC variable ($\beta = 0.518$, $p < 0.05$). Therefore, an increase in GT leads to a direct increase in DC..

- The variable ATT had a significant positive effect on the DC variable ($\beta = 0.336$, $p < 0.05$). Therefore, an increase in ATT leads to a direct increase in DC.

- The variable TI had a significant negative effect on the DC variable ($\beta = -0.255$, $p < 0.05$). Therefore, an increase in TI leads to a direct decrease in DC.

## E. CURRICULUM VITAE

### EDUCATION AND TRAINING

*2018-present: (Doctorate):* Middle East Technical University Ankara/Türkiye

Early Childhood Education

*2016-2018 (Master):* Middle East Technical University Ankara/Türkiye

Early Childhood Education

*2011-2016 (Bachelor):* Middle East Technical University Ankara/Türkiye

Early Childhood Education

### WORK EXPERIENCE

*2022-* **FAN3D**

Junior Project Manager, Erasmus+ projects

*2019-2022* **University of Tarsus**

Lecturer, Child Development Program

*2016-2019* **University of Tokat Gazi Osmanpaşa**

Research assistant, Early Childhood Education Department

### RESEARCH INTERESTS

Digital technology integration in early childhood education, play, drama

**SELECTED WORK**

1. Canaslan-Akyar Begüm, Sapsaglam Özkan. (2019). The effects of preschoolers' media usage habits on their daily life and sustainability. *Discourse and Communication for Sustainable Education, 2* (10), 112-128. https://doi.org/10.2478/dcse-2019-0022

2. Canaslan-Akyar Begüm. (2020). Investigating the mentoring of collaborative teachers and academic supervisors in pre-service early childhood education teachers' teaching experience. *Kastamonu Eğitim Dergisi, 28*(2), 869-880. https://doi.org/10.24106/kefdergi.702931

3. Canaslan-Akyar Begum, Sevimli-Celik Serap. (2021). Playfulness of early childhood teachers and their views in supporting playfulness. *Education 3-13*, 1-15 https://doi.org/10.1080/03004279.2021.1921824

4. Canaslan, B. and Sungur, S. (2022). Preschool children's digital media usage and self-regulation skill . *Turkish Journal of Education , 11* (2), 126-142 https://doi.org/10.19128/turje.889549

5. Sevimli-Celik, S., & Canaslan-Akyar, B. (2024). Pre-schoolers in nature: A five-week play &learning experience within a Turkish context. *Journal of Environmental Studies and Sciences, 14*(1), 87-101. https://doi.org/10.1007/s13412-023-00867-0

6. Canaslan-Akyar, B., Monteiro, A. & Fernandes, P. Exploring Portuguese preschool educators' attitudes and practices on information and communication technology (ICT). Educ Inf Technol 1-22. https://doi.org/10.1007/s10639-024-12613-2

# F. TURKISH SUMMARY / TÜRKÇE ÖZET

## GİRİŞ

Dijital teknoloji kullanımı günümüzde çocuklar arasında gittikçe daha da popüler hale gelmektedir. Dijital teknolojinin her yerde bulunması ve kolay erişilebilir olması muhtemelen mevcut durumun nedenidir. Son güncellemeler, gelişen teknolojinin bir sonucu olarak 2023 yılında tahmini 5,18 milyar insanın (dünya nüfusunun %64,6'sı) internete eriştiğini göstermektedir (Petrosyan, 2023). Buna ek olarak, World Metrics Reports tarafından belirtildiği üzere, altı yaş ve altındaki çocukların %73'ü mobil cihaz kullanmaktadır (2024). Dünyadaki gelişmelere paralel olarak, 16-74 yaş arası nüfusun %87,1'inin internet kullandığı Türkiye'de de dijital teknoloji kullanımında artan bir eğilim söz konusudur (TÜİK, 2023). Türkiye İstatistik Kurumu'nun (TÜİK) 6-15 yaş arası çocukların internet ve dijital cihaz kullanımını incelediği "Çocuklarda Bilişim Teknolojileri Kullanım Araştırması" raporuna göre çocukların %82,7'si çevrimiçi zaman geçirmekte ve dijital etkinlikler ise çevrimiçi bir kursa katılma (%86,2), ödev yapma veya öğrenme (%83,6), dijital oyun oynama veya indirme (%66,1), video izleme (%61) ve internet üzerinden görüntülü arama yapma (%55,5) olarak ayrılmaktadır (TUIK, 2021). Bakıldığında internet, çocukları eğitime dahil etme, kendi hızlarında öğrenmelerini geliştirme ve sosyal bir ortama dahil etme gibi çeşitli fırsatlar sunmaktadır.

Dijital teknoloji kullanımı ve dijitalleşme, COVID-19 salgını sırasında erken çocukluk döneminden yükseköğretime kadar hız kazanmıştır. Neredeyse tüm eğitim kademeleri COVID-19 salgını süresince çevrimiçi eğitimler gerçekleştirmiştir (TEDMEM, 2021). Eğitimde dijital cihazların kullanımına bazı örnekler vermek gerekirse akıllı sistemler, çocukların öğrenme açığı hakkında bilgi toplamak için çocukların öğrenme sürecini gerçek zamanlı olarak izleyebilen ve ölçebilen bir hizmettir. Tabletler, akıllı telefonlar veya dizüstü bilgisayarlar gibi mobil cihazlar, eğitimcilere veya çocuklara her yerde ve her zaman öğrenme içeriği sağlar. *Sosyal*

*medya*, kullanıcıların sanal topluluklar aracılığıyla bilgi paylaşmak ve tartışmak için tüm paydaşlarla etkileşime girmesine olanak tanır. *Sanal gerçeklik*, çocuklara dünyalarını dokunsal bir şekilde anlamaları için deneyimler sunar. *Yapay zeka,* her öğrenciyi sanal yardım, kendi kendine öğrenme, kişisel ilgi ve öğrencinin verilerle etkileşimine dayalı kişisel verilerin analizi ile destekleyebilir. *Oyun*, video oyunları tasarımı veya oyun öğeleri aracılığıyla çocukları öğrenmeye motive eden bir eğitim aracıdır. *Donanım*, etkileşimi sağlayan ve çocukların öğrenme faaliyetlerine katılma motivasyonunu artıran projektörler, akıllı tahtalar, kameralar vb. yenilikçi ekipmanlardır. *3D baskı*, malzemelerin üç boyutlu olarak basılmasını sağlayan ekipmanlardır; bu teknolojik cihazlar yaratıcı eğitim materyallerinin oluşturulmasını ve tasarlanmasını sağlar (Huawei, n.d).

Bu dijital teknolojileri kullanabilmek için belirli beceri ve yetenekler gereklidir. Avrupa Birliği, gerekli beceri ve yetenekleri dijital yetkinlik kavramı olarak tanımlamış ve şu şekilde tarif etmiştir: "Dijital yetkinlik, öğrenme, çalışma ve topluma katılım için dijital teknolojilerin özgüvenli, eleştirel ve sorumlu bir şekilde kullanılmasını ve bunlarla etkileşim kurulmasını içerir" (2019, s.5). Dijital yetkinliğin özü, uygun kullanım yolları aracılığıyla kendine ve topluma hizmet etmek için dijital teknolojilerin anlaşılmasıdır. Yeni dijital dünyada, insanların dijital teknolojileri öğrenme, sosyalleşme, para kazanma veya vatandaşlık haklarını kullanma gibi farklı amaçlar için kullanma becerisiyle donatılması gerekmektedir (Lucas vd., 2021). Sonuç olarak, birçok ülke dijital yetkinliğin geliştirilmesini en önemli öncelik haline getirmiştir (Avrupa Parlamentosu, 2018; Monteiro vd., 2021).

21. yüzyılda, bu beceriler her meslekte ve günlük yaşamda gereklidir ve öğretmenlik de bu mesleklerden birisidir. Avrupa Komisyonu, toplumsal dönüşüm için dijital becerilerin geliştirilmesine öncelik veren Dijital Eğitim Eylem Planı 2021-2027 (2020) aracılığıyla dijital yetkinliğin önemini vurgulamıştır. Ayrıca, Amerika Birleşik Devletleri (ABD) dijital becerilerin edinilmesine büyük önem vermekte ve Ulusal Eğitim Teknolojisi Planının (NETP, 2017) bir parçası olarak teknolojik dönüşüm konusunda çalışmalar başlatmıştır. Eğitim Teknolojileri Ofisi (2017) tarafından bildirildiği üzere, eğitimde dijital dönüşümün başarısı, eğitimcilerin sınıfları teknoloji destekli etkinliklerle donatmak için gerekli teknik bilgi ve

becerilere sahip olmalarına bağlıdır. Eğitim, toplumlarda dijital yetkinliği teşvik etmenin ve dijital okuryazar bir toplum yaratmanın yaygın bir aracı olarak kabul edilmektedir.

Dijital yeterlilik alanındaki son gelişmeler, eğitimcilerin öğretim uygulamalarında dijital teknolojileri etkili bir şekilde kullanabilmelerini sağlayacak dijital becerilere sahip olmalarına duyulan önemli ihtiyacın altını çizmiştir (Redecker, 2017; UNESCO, 2018). Nihayetinde, eğitimcilerin teknik yeterliliğin ötesine geçen temel becerilere sahip olması beklenmektedir. Zira dijital açıdan yetkin bireyler yetiştirmek, eğitimcilerin çocukları dijital çağda başarılı olmaları için gerekli sosyal ve mesleki becerilerle donatmasına bağlıdır (Lucas vd., 2021). Bu hedefler doğrultusunda, Uluslararası Eğitimde Teknoloji Derneği (ISTE) eğitimciler için temel standartlar belirlemiş ve eğitimcilerin öğrenenler, liderler, vatandaşlar, işbirlikçiler, tasarımcılar, kolaylaştırıcılar ve analistler olarak rollerini vurgulamıştır (2016). Bu standartları yerine getirmek için, eğitimcilerin teknolojik araçlar aracılığıyla profesyonel öğrenme hedefleri oluşturmalarını sağlayacak derin bir teknoloji anlayışına sahip olmaları gerekir. Yeni dijital kaynakları benimseme ve tüm çocuklar için teknoloji odaklı fırsatlar sağlama konusunda akranları arasında lider olarak hizmet etmelidirler. Ayrıca, eğitimciler dijital topluluklara aktif olarak katılmalı, öğrenme deneyimlerini geliştirmek ve teknolojiyle ilgili zorlukları ele almak için meslektaşlarıyla işbirliğini teşvik etmelidir. Teknolojiyi öğretim yöntemlerine ustalıkla dahil ederek sınıf ortamını zenginleştirmelidirler (ISTE, 2016).

Öğretmenlerin dijital yetkinlikleri karmaşık bir yapıdır ve bu yetkinliklerin kazandırılıp geliştirilmesi basit bir süreç değildir. Bu bağlamda, eğitimcilerin dijital yeterliliklerinin şekillenmesinde etkili olan çok sayıda faktör tespit edilmiştir. Örneğin, birinci dereceden engeller olarak da adlandırılan dış faktörler, okul temelli engellerdir ve uygun türde teknolojik araçların eksikliği olan erişim ve destek ile eğitim kurumlarında dijital teknolojiler için teknik destek de dahil olmak üzere önemli bir rol oynamaktadır (Pettersson, 2018). Dijital teknoloji araçlarına erişim artıyor olsa da (Ertmer vd., 2012), bazı çalışmalara göre bu hala bir engeldir (Makki, vd., 2018). Örneğin, Dünya genelinde, nüfusun büyük bir yüzdesi, temel olarak

ekonomik sorunlar nedeniyle internete veya dijital araçlara erişememektedir (Val, S & López-Bueno, 2024). Ayrıca, kapı bekçilerinin eğitimde dijital teknoloji kullanımına yönelik bakış açıları ve tutumları da eğitimcilerin dijital yeterlilikleri üzerinde önemli bir etkiye sahip olabilir (Masoumi & Noorozi, 2023).

Bu çalışmada "kapı tutucular" terimi okul liderlerini ve çocukların velilerini ifade etmektedir. Okul liderleri, yazılım ve donanıma erişim sağlamanın yanı sıra dijitalleşme açısından ortak bir okul kültürü oluşturmada önemli bir rol oynamaktadır. Yönergeleri açıklamaktan, eğitimciler arasında işbirliği yaratmaktan ve eğitimde dijitalleşmeyi gerçekleştirmek için zaman ayırmaktan sorumlu oldukları için ana etkinleştiricilerdir (Reis-Andersson, 2024). Her seviyedeki okul ortamında, dijital yeterlilik, okullarda teknoloji uygulamalarının kullanımını organize etmek ve yönlendirmek için okul liderleri için bile kritik öneme sahiptir (Pettersson, 2021). Velilerin katılımı, yüksek kaliteli erken çocukluk eğitiminin uzun vadeli faydalarını desteklediği için erken çocukluk eğitiminin çok önemli bir bileşeni olarak kabul edilmektedir (Reynolds vd., 2022). Bu nedenle, velilerin katılımı ve tutumları dijital teknoloji entegrasyonu açısından önemli bir faktör olarak değerlendirilebilir ve erken çocukluk eğitiminde dijital teknoloji kullanımına yönelik tutumları hem avantaj hem de dezavantaj olabilir (Zakaria vd., 2022). Okul liderlerinin ve velilerin erken çocukluk eğitiminde dijital teknoloji kullanımına yönelik tutumlarını, erken çocukluk eğitimcilerinin dijital yeterliliklerini anlamada kilit bir faktör olarak değerlendirmek önemlidir.

Buna ek olarak, eğitimcilerin ikinci dereceden faktörler olarak adlandırılan kişisel faktörleri de dijital yeterlilik düzeylerini etkilemede rol oynamaktadır. Cattaneo ve diğerleri (2022) tarafından vurgulandığı üzere, bunlar eğitimcilerin eğitimde dijital teknolojiye yönelik olumlu ya da olumsuz olabilecek tutumlarını içermektedir. Eğitimcilerin dijital teknoloji kullanımına yönelik olumlu tutumları, bu alandaki yeterlilik düzeylerinin bir göstergesidir (Štemberger & Čotar Konrad, 2021). Buna karşılık, bazı erken çocukluk eğitimcileri, çocukların gelişimi üzerindeki potansiyel olumsuz etkilerine ilişkin endişelerini gerekçe göstererek eğitimde dijital teknolojinin kullanımına ilişkin şüphelerini dile getirmiştir. Örneğin, dijital teknoloji kullanımı çocukların motor gelişimi, özdenetim, görme sorunları ve diğer gelişimsel

sorunlar üzerinde olumsuz etkilerle ilişkilendirilmiştir (O'Connor ve Fotakopoulou, 2016). Sonuç olarak, eğitimde dijital teknoloji kullanımını destekleyen eğitimciler, dijital yetkinliklerini de geliştirmeye isteklidirler. Buna karşılık, dijital teknolojiyi kullanmaktan yana olmayan eğitimciler dijital yetkinliklerini geliştirme konusunda isteksiz olabilirler.

Öğretmenlerin öz yeterliliğinin, etkili öğretim uygulamalarının hayata geçirilmesinde çok önemli bir faktör olduğu açıktır. Dahası, dijital teknolojinin eğitime entegrasyonu, eğitimcilerin dijital eğitimdeki öz yeterlilikleri ile önemli ölçüde ilişkilidir (Hatlevik, 2016). Eğitimcilerin dijital yeterlilik bilgisi, teknoloji kullanımındaki öz yeterlilikleri ve eğitimde dijital teknoloji kullanımını öğrenmedeki zaman kısıtlamalarına ek olarak, öğretmen engelleri gibi faktörler de dijital yeterliliklerini artırabilir veya engelleyebilir (García-Vandewalle García vd., 2023; Yada vd., 2022). Eğitimciler dijital yetkinliklerini geliştirmek için uygulama ve eğitim yapmak (Reis-Andersson, 2024) ve dijital teknolojileri eğitime entegre etmeye hazırlanmak için zamana ihtiyaç duyarlar. Eğitimciler çok sayıda öğretimsel ve/veya öğretimsel olmayan sorumlulukla yüklendiklerinde, dijital teknolojileri öğrenmek ve bunları eğitim çerçevesine etkili bir şekilde nasıl entegre edeceklerini anlamak için gerekli zamanı belirlemede önemli zorluklarla karşılaşırlar. Bu nedenle, eğitimcilerin dijital yetkinliklerini geliştirmeleri ve çocukları dijital çağa daha iyi hazırlayabilmeleri için bu farklı faktörleri anlamak ve ele almak büyük önem taşımaktadır.

**Problem Durumu**

Eğitimciler, teknolojinin geleneksel pedagojik uygulamalara entegrasyonunu gerektiren gelişen eğitim ortamına uyum sağlamak için önemli bir dönüşüm geçirmelidir (Pettersson, 2018). Eğitimde teknoloji entegrasyonunun önemi, özellikle küresel salgının ardından daha da vurgulanmıştır. Eğitimciler artık sadece araçlara hâkim olmak yerine bilgi, beceri ve tutumların geliştirilmesine öncelik vermelidir (Mishra ve Warr, 2021). Bu değişim, dijital araçlarla problem çözme (Sailer vd., 2021), uygun dijital medya ve içerik seçimi, dijital okuryazarlık yoluyla içerik ve pedagojik bilginin entegrasyonu (Guggemos ve Seufert, 2020), yeterlilik inançlarının beslenmesi (Rubach ve Lazarides, 2021) ve muhakeme becerilerinin geliştirilmesi

(Tondeur ve Howard, 2020) dahil olmak üzere teknolojinin öğretim sürecinin çeşitli yönlerine etkili bir şekilde dahil edilmesini gerektirmektedir.

Dijital açıdan yetkin eğitimciler, dijital teknolojilerin sınıf ortamına entegrasyonuna ilişkin bilinçli pedagojik karar alma sürecinde önemli bir rol oynar. Ayrıca, çocukların dijital yetkinliklerinin gelişimini kolaylaştıran öğrenme araçlarının hazırlanmasında da etkili olurlar (Krumsvik, 2014). Özellikle eğitimcilerin dijital yetkinliği, teknoloji kullanımının pedagojik boyutlarını kapsamalıdır. Sadece kişisel yaşamında teknolojiyi kullanma becerisine sahip olmak, bir eğitimciyi dijital açıdan yetkin olarak nitelendirmek için yeterli değildir. Buna ek olarak, eğitimciler dijital teknolojinin eğitim amaçları doğrultusunda nasıl etkili bir şekilde kullanılabileceğini ayırt edebilmeli ve teknolojiyi bir eğitim aracı olarak kullanabilmelidir (Johannesen vd., 2014). Özünde, eğitimciler bir dizi dijital aracı kullanma ve bunları dönüşüm için öğrenme ortamına nasıl entegre edecekleri konusunda bilinçli kararlar verme becerilerine güvendiklerinde dijital olarak yetkin hale gelirler. Dijital açıdan yetkin profesyoneller haline gelmek işte bu yüzden çok önemlidir (Johannesen vd., 2014).

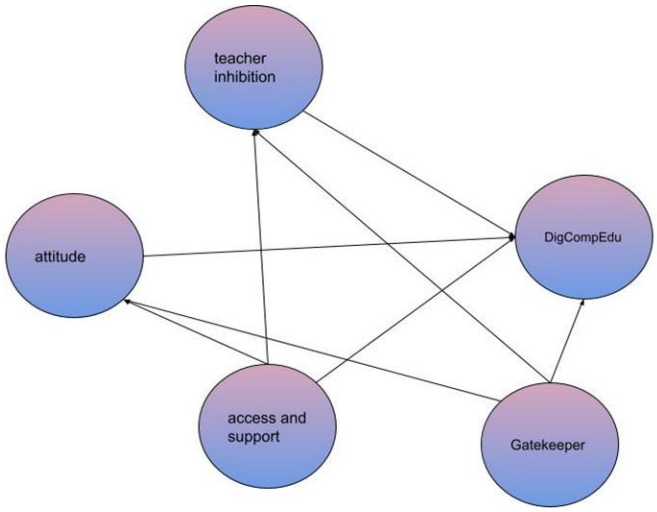
Yapılan bir araştırma bu durumun önemini bir kez daha vurgulamaktadır, buna göre erken çocukluk eğitimcilerinin dijital teknolojiye erişimi olmasına ve eğitimde kullanımı konusunda eğitim almış olmalarına rağmen, dijital teknolojinin çocuklar tarafından doğru şekilde veya pedagojik olarak uygun bir şekilde kullanımının her zaman söz konusu olmadığını ortaya koymuştur (Rosen & Jaruszewicz, 2009). Türkiye'deki durumun ortaya konduğu bir diğer çalışmaya göre ise erken çocukluk eğitimcileri kişisel yaşamlarında dijital teknolojileri kullanmalarına rağmen, dijital araçları erken çocukluk eğitimi bağlamında uygulamak için gerekli bilgi ve deneyime sahip değillerdir (Demirtaş-İlhan, 2023).

Yukarıda bahsedilen koşullar ışığında, erken çocukluk eğitimcilerinin dijital yetkinliklerinin artırılmasına yönelik acil bir ihtiyaç olduğu açıktır. Ancak mesele göründüğü kadar basit değildir. Kavram çok yönlü olduğundan, belirli faktörler dijital yetkinliğin gelişimini kolaylaştırabilir ya da engelleyebilir. Dijital yetkinliği etkileyen başka faktörler olsa da bu çalışma, erişim ve desteğin yanı sıra kapı

bekçileri gibi birinci dereceden engellere ve dijital teknolojiye yönelik tutumlar ve öğretmen engelleri gibi ikinci dereceden engellere odaklanmıştır.

**Çalışmanın Amacı**

Yukarıda belirtilen nedenler, erken çocukluk eğitimcileri arasında dijital yeterliliklerin geliştirilmesine katkıda bulunmayı amaçlayan bu çalışmanın temelini oluşturmaktadır. Çalışmanın amacı, Şekil 1'de sunulan erişim ve destek ve kapı bekçileri gibi dış faktörler olan birinci dereceden engeller ile dijital teknolojiye yönelik tutumlar ve öğretmen engelleri gibi iç faktörler olan ikinci dereceden engeller ve erken çocukluk eğitimcilerinin dijital yeterlilikleri arasındaki ilişkiyi araştıran bir yapısal modeli test etmektir. Bu bağlamda, çalışmanın amaçları üç kategoriye ayrılır. İlk amaç, erken çocukluk eğitimcilerinin dijital yeterliliklerini etkileyen örgütsel faktörlerden kaynaklanan birinci dereceden engelleri belirlemektir. İkinci amaç, erken çocukluk eğitimcilerinin (EÇE) dijital yetkinlik gelişimiyle ilişkili olan eğitimcilerin kendileriyle ilgili ikinci dereceden engelleri belirlemektir. Son olarak, bu çalışma ikinci dereceden engellerin birinci dereceden engeller ile eğitimcilerin dijital gelişimi arasındaki ilişkiye aracılık edip etmediğini araştırmayı ve EÇE'lerin dijital yetkinlik gelişimini etkileyen faktörleri kapsamlı bir analiz yöntemiyle incelemeyi amaçlamaktadır. Ayrıca bu araştırmanın amacı, erken çocukluk eğitimcilerinin (EÇE) dijital yetkinlik düzeylerini belirlemek ve dijital teknolojiyi erken çocukluk eğitimi alanına etkili bir şekilde entegre edebilmeleri için geliştirmeleri gereken dijital yetkinlik alanlarını tespit etmektir.




Şekil 1: Öğretmen dijital yetkinlikleri bariyerleri modeli

**Araştırma Soruları**

Bu amaçla, araştırma için aşağıdaki sorular formüle edilmiştir:

S1: Birinci dereceden engeller ile erken çocukluk eğitimcilerinin dijital yetkinlikleri arasındaki ilişki nedir?

S1.1: Erişim ve destek ile erken çocukluk eğitimcilerinin dijital yetkinliği arasındaki ilişki nedir?

S1.2: Kapı bekçileri ile erken çocukluk eğitimcilerinin dijital yetkinliği arasındaki ilişki nedir?

S2: İkinci dereceden engeller ile erken çocukluk eğitimcilerinin dijital yetkinliği arasındaki ilişki nedir?

S.2.1: Eğitimcilerin dijital teknolojiye yönelik tutumları ile erken çocukluk eğitimcilerinin dijital yetkinlikleri arasındaki ilişki nedir?

S.2.2: Öğretmen engellemeleri ile erken çocukluk eğitimcilerinin dijital yetkinlikleri arasındaki ilişki nedir?

S3: İkinci dereceden engeller, birinci dereceden engeller ile erken çocukluk eğitimcilerinin dijital yetkinliği arasındaki ilişkiye ne ölçüde aracılık etmektedir?

**Çalışmanın Önemi**

Türkiye bağlamında eğitimcilerin dijital yetkinliklerini özellikle uluslararası bir çerçeve (DigcompEdu) ile araştıran çalışmaların eksikliği de söz konusudur (Kuş ve Mert, 2024). DigCompEdu çerçevesi, erken çocukluk eğitimcilerini yükseköğretim seviyesine kadar incelemek için ortak bir çerçeve olarak kabul edilmiş ve Avrupa Birliği ülkelerinde veri toplamak için 24 dile çevrilmiştir (AB Komisyonu, t.y.). Araç Türkçeye de çevrilmiştir, araçla ilgili daha fazla ayrıntı yöntem bölümünün araçlar kısmında bulunabilir. Bu uluslararası aracın Türkiye bağlamında kullanılması, Türkiye'deki erken çocukluk eğitimcilerinin düzeyini incelemek için önemlidir, çünkü aynı ölçüm aracını kullanan diğer ülkelerle karşılaştırarak durumu eleştirmeye olanak tanır. Ayrıca, Türkiye bağlamında sadece erken çocukluk eğitimcilerine odaklanan ve bu uluslararası çerçeve ile yeterlilik düzeylerini ölçen çalışmaların eksikliği söz konusudur. Çalışma sonucu, Türk Milli Eğitim Bakanlığı'nın (MEB) 2023 Eğitim Stratejisi'ni (MEB, 2018) yerine getirmek için eğitimcilerin dijital yetkinliğini artırmakla ilgilenmesi nedeniyle önemlidir.

Eğitimcilerin dijital yetkinliğinin hem teknolojik hem de pedagojik yönleri olduğu için çok yönlü bir süreç olduğu (Ilomäki vd., 2016; Redecker, 2017) ve birbiriyle ilişkili çeşitli faktörlerden etkilendiği bilinmektedir (Lucas vd., 2021; Pettersson, 2018; Tondeur vd., 2021). Bu faktörlerin anlaşılması, eğitimciler arasında dijital yetkinliğin geliştirilmesi için elzemdir. Bu faktörler altyapı, teknik destek, teknolojiye erişim ve kullanılabilirlik gibi birinci dereceden engeller (Lucas vd., 2021; Atman Uslu & Usluel, 2019; Lawrence & Tar, 2018; Masoumi & Noroozi, 2023) ve yaş gibi ikinci dereceden engeller (Almerich vd, 2016; Tondeur, vd., 2018), cinsiyet (Scherer & Siddiq, 2015; Teo, 2014; Tondeur, vd., 2018), eğitim durumu (Mumtaz, 2000; Scherer vd., 2017) ve teknolojiye yönelik genel tutumlar (Al-Zaidiyeen vd., 2010; Casillas Martín vd., 2020; Yulisman vd., 2019) gibi ikinci dereceden engellerdir. Yaş, cinsiyet, öğretmenlik deneyimi yılı, öğretmenlik alanları gibi demografik faktörler arasındaki ilişkiyi açıklayan çok sayıda faktör olmasına rağmen (Cattaneo vd., 2022; Hinojo-Lucena vd., 2019; Inamorato dos Santos vd., 2023; Lucas vd, 2021) ve eğitimcilerin dijital yeterlilikleri gibi faktörlerin yanı sıra dijital teknoloji kullanımına yönelik tutumlar, öz yeterlilik, dijital teknolojiye erişim ve destek (Krumsvik vd., 2016; Cattaneo vd., 2022), eğitimcilerin iş yükü ve kurum kültürü (Masoumi ve Noroozi, 2023) gibi faktörlere ilişkin sınırlı sayıda çalışma bulunmaktadır. Ayrıca, Lucas ve arkadaşları mevcut çalışma sonuçlarının çelişkili olduğunu ve daha fazla araştırma gerektirdiğini belirtmiştir (2021).

Bu çalışmanın önemi, araştırmacılar ve uygulayıcılar, birinci ve ikinci dereceden engeller ile EÇE'lerin dijital yetkinlikleri arasındaki ilişkiyi araştırarak, eğitimcilerin dijital yetkinliklerinin karmaşıklığı hakkında daha derin bir içgörü ve anlayış kazanabilirler (örn. Durff ve Carter, 2019; Guillén-Gámez vd., 2022). Araştırmacılar ve uygulayıcılar ayrıca eğitimcilerin teknolojik altyapıya veya desteğe erişim gibi dış faktörlerde (birinci dereceden engeller olarak da adlandırılır) veya eğitimde teknoloji kullanımına yönelik tutumlar gibi kişisel faktörlerde (ikinci dereceden engeller olarak da adlandırılır) nerede zorlanabileceklerini belirleyebilirler.

Çalışmada ayrıca ikinci dereceden engellerin, birinci dereceden engeller ile eğitimcilerin dijital yetkinlikleri arasındaki ilişki üzerindeki aracılık etkisi de araştırılmıştır. Ertmer'in belirttiği gibi, ikinci dereceden engellerin üstesinden gelmek

daha karmaşıktır çünkü bunlar genellikle eğitimcilerin öğretme ve öğrenmeye ilişkin temel inançlarından kaynaklanır ve bazen eğitimciler bunların farkına bile varmayabilir (1999). İkinci dereceden engeller, teknoloji entegrasyonu üzerinde en önemli etkiye sahip olarak tanımlanmaktadır (Ertmer & Ottenbreit-Leftwich, 2010) ve birinci dereceden engeller ortadan kaldırıldığında bile devam eden daha zorlu engeller olarak kabul edilmektedir (Abedi vd., 2023). Bu nedenle çalışmada, bu daha karmaşık ve köklü engellerin eğitimcilerin birinci dereceden ve dijital yeterlilikleri arasındaki ilişkiye müdahale edip edemeyeceğini aydınlatmak için ikinci dereceden engellerin aracılık etkisi araştırılmıştır. Aracılık rolünü anlamak, eğitimcilerin dijital yetkinliklerini geliştirmeye yönelik destek mekanizmaları geliştirmek için önemli hale gelmektedir. Eğer ikinci dereceden engeller birinci dereceden ve dijital yetkinlik arasındaki ilişkiye önemli ölçüde aracılık ediyorsa, bu durum sadece çevresel ya da dışsal zorluklarla mücadele etmenin beklenen sonuçları sağlamayabileceği anlamına gelmektedir.

Pratik olarak, bu engellerin ve mücadelelerin farkında olan eğitimciler, bu zorlukların üstesinden gelmek için stratejiler ve beceriler geliştirmeye başlayabilir (Ertmer, 1999). Bu bilgi, dijital yetkinliği bütüncül bir şekilde geliştirmeye çalışan EÇE'nin özel ihtiyaçlarına hitap eden hedefli mesleki gelişim, destek ve politika geliştirme tasarlamak için de çok önemlidir. Ayrıca bu çalışma, DigCompEdu gibi teorik çerçevelerin uygulama alanına taşınması için de bilgi sağlayabilir.

## YÖNTEM

Çalışma, algılanan birinci dereceden engeller (erişim ve destek; kapı bekçileri), ikinci dereceden engeller (öğretmenlerin dijital teknolojiye yönelik tutumları ve engelleri) ve erken çocukluk eğitimcilerinin dijital yeterlilikleri arasındaki ilişkiyi incelemek ve ayrıca ikinci dereceden engellerin birinci dereceden engeller ve dijital yeterlilik arasındaki ilişkiye aracılık edip etmediğini incelemek üzere yürütülmüştür. Ayrıca, erken çocukluk eğitimcilerinin (EÇE) dijital yeterlilik düzeyleri de belirlenmiştir.

Araştırma amacına uygun olarak korelasyonel bir araştırma deseni seçilmiştir. Korelasyonel desenler, nedensellik kurmadan iki veya daha fazla değişken arasındaki

ilişkinin derecesini ölçmek ve tanımlamak için çok uygundur (Fraenkel vd., 2012). Bu tasarım, yordayıcı ve sonuç değişkenleri arasındaki karmaşık ilişkilerin keşfedilmesini sağlar.

Bu çalışmanın temel amacı, erken çocukluk eğitimcilerinin birinci dereceden, ikinci dereceden ve dijital yeterlilikleri arasındaki ilişkileri incelemektir. Bu ilişkiler, özellikle ikinci dereceden engellere odaklanarak, tutumlar ve öğretmen engellemeleri yoluyla aracılık edilen etkiler bağlamında araştırılmıştır. Çalışmada ayrıca, Türk erken çocukluk eğitimcilerinin dijital yeterlilik düzeylerinin durumu da incelenmiştir. Yapısal eşitlik modellemesi (YEM), birinci ve ikinci dereceden engeller ile EÇE'lerdeki dijital yeterlilik arasındaki karmaşık etkileşimi araştırmak için kullanılmıştır.

Araştırmacılar, teorik bir modelin doğruluğunu test etmek için YEM'i kullanarak araştırmacının belirli bir teoriyi destekleyen bir modeli tanımladığını ve bu modelin tahminlerini test etmek için uygun gözlemlenebilir değişkenlerle ölçülen olası yapıları belirlediğini fark eder (Kline, 2016). Ayrıca bu yöntem, eş zamanlı gizil ve gözlenen değişkenlerin kurulan modeldeki diğer değişkenler üzerindeki etkisine ilişkin hipotezleri test etmek için kullanılan sağlam bir analiz yöntemidir (Lee, 2007). Dolayısıyla, bu yöntem teorik modelin test edilmesi ve genişletilmesi için iyi bir kanıt sağlamaktadır (Thakkar, 2020).

Araştırmada, her biri araştırma kapsamındaki genel olguya farklı boyutlarda katkıda bulunan çok yönlü değişkenler (öğretmen engelleri, kapı bekçileri, tutumlar, erişim ve destek ve DigCompEdu gibi) arasındaki ilişkileri kapsamlı bir şekilde anlamak ve ayrıca araştırma sorularının karmaşıklığı nedeniyle tüm soruları yanıtlamak ve değişkenler arasındaki karmaşık ilişkiyi açıklamak için YEM kullanılmıştır. Bunların basit regresyon veya korelasyon analizleri gibi geleneksel istatistiksel yöntemlerle ele alınması mümkün değildir çünkü bu yöntemler mevcut kavramsal model içerisindeki ilişkilerin birbirine bağlı doğasını araştırmak için yeterince güçlü değildir.

Çalışmanın katılımcıları uygun örnekleme yöntemi ile seçilmiştir. Örneklemin kriterleri, şu anda bir erken çocukluk eğitimi kurumunda öğretmenlik yapıyor olmak,

üniversitelerin erken çocukluk eğitimi veya çocuk gelişimi programından veya lisede ilgili programdan mezun olmaktır. Bu çalışmanın örneklemi Türkiye'nin her yerinden 713 öğrenciden oluşmaktadır. YEM analizi yapılırken, örneklem büyüklüğü ile ilgili olarak şu iki nokta göz önünde bulundurulmalıdır (1) yeterli istatistiksel kesinliğe sahip olmak için vaka sayısını sağlamak, (2) YEM'deki anlamlılık testinin yeterli güce sahip olması için minimum örneklem büyüklüğüne sahip olmak (Kline, 2016). YEM'de makul sonuçlar elde etmek için, vaka sayısının (N) istatistiksel tahmin gerektiren parametre sayısına (q) oranına göre hangi minimum örneklem büyüklüğünün dikkate alınabileceği konusunda önerilen farklı yaklaşımlar vardır. Önerilen bir oran N:q 20:1 olacaktır; 10:1 (Kline, 2016) veya 5:1 kabul edilebilir (Bentler & Chou, 1987).

Örneklem seçimi Türkiye'nin tüm bölgelerini kapsamaktadır. Veri toplamak için çevrimiçi bir Google formu kullanılmıştır. Etik kuruldan onay alındıktan sonra çevrimiçi form ülke genelinde dağıtılmıştır. Araştırmacı, erken çocukluk eğitimcileri ile iletişim kurmak ve katılımlarını teşvik etmek için sosyal medya platformlarını etkin bir şekilde kullanmıştır. Örneğin, "Okul Öncesi Öğretmenleri, Okul Öncesi, okul öncesi" gibi Telegram grupları ve "Tüm Anaokulu ve Okul Öncesi Öğretmenleri Topluluğu" gibi Facebook grupları, Okul Öncesi Anasınıfı Öğretmenleri, Okul Öncesi Öğretmenleri, Okul Öncesi Öğretmenleri Etkinlik Havuzu, Okul Öncesi Etkinlik ve Çocuk Dünyası" mevcuttur. Araştırmacı ya genel duyuru göndermiş ya da bu grupların üyelerine bizzat ulaşmıştır. Bunlara ek olarak Instagram'daki erken çocukluk eğitimcileri bulunmuş ve anket linki bu sosyal medya kanalı üzerinden gönderilmiştir. Ayrıca, erken çocukluk eğitimi kurum yöneticilerinin telefon numarası bulunmuş ve çalışma hakkında bilgi vermek ve çalışma linkini paylaşmak için WhatsApp mesajı gönderilmiştir. Bu süreçte sistematik bir yaklaşım izlenmiş ve çalışmanın linki Türkiye'nin tüm illerinde okul web sitelerinden iletişim bilgilerine ulaşılabilen okul yöneticilerine dağıtılmıştır.

Çevrimiçi Google formlarının doldurulması yaklaşık 20-30 dakika sürecek şekilde tasarlanmıştır. Katılımcılara anonimlik güvencesi verilmiş ve çalışmaya katılımları tamamen gönüllülük esasına dayandırılmıştır. Veri toplama süreci 2022-2023 akademik dönemine yayılmış ve yaklaşık 6 ay sürmüştür.

Çalışmanın örneklemi toplam 713 erken çocukluk eğitimcisinden oluşmaktadır. Bu örneklemin 616'sı kadın, 97'si ise erkek eğitimcilerden oluşmaktadır. Eğitimcilerin yaşları 20 ile 69 arasında değişmekte olup, yaş ortalaması 34,8±7,6'dır. Eğitimcilerin mesleki yaşamlarına ilişkin bilgiler ise şu şekildedir; 72 eğitimci 36-48 ay aralığında, 285 eğitimci 48-60 ay aralığında, 356 eğitimci ise 60-72 ay aralığında çalışmaktadır. Eğitimcilerin toplam öğretmenlik deneyim sürelerine bakıldığında, 205 eğitimcinin 0-5 yıl, 150 eğitimcinin 6-10 yıl, 290 eğitimcinin 11-20 yıl, 54 eğitimcinin 21-30 yıl ve 14 eğitimcinin 31 yıldan fazla öğretmenlik deneyimine sahip olduğu görülmektedir.

Çevrimiçi anket, teknoloji kullanımının önündeki engeller, eğitimcilerin dijital teknoloji kullanımına yönelik tutumları ve dijital yeterlilik öğeleri olmak üzere üç ana bölümden oluşmaktadır. Anketin tamamı "Öz değerlendirme aracı" olarak adlandırılabilir.

Bu çalışmada, engeller ve erken çocukluk eğitimcilerinin dijital yetkinlikleri arasındaki ilişkiyi ölçmek için *Erken Çocukluk Eğitiminde Teknoloji Kullanımı Ölçeği Teknoloji Kullanımının Önündeki Engeller* anket aracı (Blackwell vd., 2013) kullanılmıştır. Orijinal anket, birden fazla teknolojiye erişim ve kullanımlarını, mesleki gelişim tutum ve inançlarını ve ayrıca dışsal ve içsel engelleri ele almak için 46 madde içermektedir. Blackwell ve diğerleri (2013), birinci ve ikinci dereceden engellerin özelliklerini araştırmak için sorular geliştirmiştir. Mevcut çalışmada aracın bu bölümü kullanılmıştır. Engel indeksinde araştırmacılar üç boyut bulmuşlardır: ilk faktör "öğretmen engelleri" olarak adlandırılmış, ikinci faktör "erişim ve destek" olarak adlandırılmış ve son faktör ise "kapı bekçisi" olarak adlandırılmıştır. Ölçeğin birinci ve ikinci dereceden engeller bölümünde (1) hiç katılmıyorum ile (5) tamamen katılıyorum arasında değişen 5'li Likert ölçeği şeklinde toplam on madde yer almıştır.

Ölçek ilk olarak 2013 yılında geliştirilmiş olmasına rağmen, araç Ömrüuzun (2019) tarafından Türkçeye uyarlanmış, ölçeğin tüm geçerlilik ve güvenilirlik gereksinimleri 2019 yılında kontrol edilmiştir. Ölçeğin Cronbach alfa değeri .87 olarak hesaplanmıştır. Bu çalışmada Cronbach alfa, teknoloji kullanımının önündeki genel

engeller için .84, öğretmen engelleri için .88, erişim ve destek için .75 ve kapı bekçisi için .74 olarak hesaplanmıştır. Ölçek, teknoloji entegrasyonunun önündeki engellerle doğrudan ilişkili olduğu için erken çocukluk eğitiminde kullanılmak üzere bu çalışma için seçilmiştir.

Eğitimcilerin dijital teknoloji kullanımına yönelik tutumları Kol (2012) tarafından geliştirilen "Okul Öncesi Eğitimde Teknolojik Araç-Gereç Kullanımına Yönelik Tutum Ölçeği" ile değerlendirilmiştir. Cronbach alfa değeri ölçek için .92, bu çalışma için ise .93 olarak hesaplanmıştır. Ölçek 5'li Likert tipi bir ölçektir. Yanıt ölçeği (1) hiç katılmıyorum ile (5) tamamen katılıyorum arasında değişmektedir. Eğer eğitimciler yüksek puan alırlarsa, teknolojiye karşı olumlu bir tutuma sahiptirler.

"Eğitimciler için Dijital Yetkinlik" öz değerlendirme ölçeği, Redecker tarafından 2017 yılında ana hatlarıyla açıklanan Eğitimcilerin Dijital Yetkinliği için Avrupa Çerçevesi temel alınarak geliştirilmiştir. Bu öz değerlendirme aracı altı boyuttan oluşmakta ve toplam 22 ifade içermektedir. Katılımcılardan mevcut beş seçenek arasından kendi uygulamalarını en iyi yansıtan bir ifadeyi seçmeleri istenmektedir. Her bir ifadeye 0 ile 4 arasında bir değer atanmakta ve böylece araç için 0 ile 88 arasında değişen bir toplam puan elde edilmektedir.

## BULGULAR VE TARTIŞMA

Yapısal eşitlik modellemesinin varsayımlarından birini güçlendirmek için normallik, çarpıklık ve basıklık değerleri kullanılarak kontrol edilmiştir. Sonuçlara göre çarpıklık ve basıklık değerleri +2 ile -2 arasında bulunmuştur, bu da verilerin kabaca normal dağıldığını göstermektedir (Byrne, 2010).

Erken çocukluk eğitimcilerinin DigCompEdu düzeyi tanımlayıcı istatistiklerle analiz edilmiştir. Analiz sonuçlarına göre eğitimcilerin DigCompEdu yeterlilik düzeyi B1'dir, yani bütünleştiricidir. Alanlara göre yeterlilik düzeyleri de mesleki katılım B1 düzeyine karşılık gelmektedir; dijital kaynaklar A2 düzeyine karşılık gelmektedir, öğretme ve öğrenme A2 düzeyine karşılık gelmektedir; değerlendirme B1 düzeyine

karşılık gelmektedir; öğrencileri güçlendirme B1 düzeyine karşılık gelmektedir ve son olarak öğrencilerin dijital yeterliliklerini kolaylaştırma A2 düzeyine karşılık gelmektedir.

Bu verilere dayanarak, okul öncesi eğitimciler, çocukların dijital yetkinliklerini kolaylaştırmak için bazı faaliyetler uygulayabilmelerine rağmen, yetkinliklerini pedagojik stratejileri entegre etmek için gereken seviyeye kadar geliştirmeleri gerekmektedir. Bu şekilde, eğitimciler çocukların dijital teknolojiyi olumlu bir şekilde kullanmalarını kolaylaştırabilir ve topluma katkıda bulunabilirler (Güven, 2018).

Yapısal eşitlik modeli, AMOS programı sürüm 24.0 aracılığıyla hesaplanan değişkenlerle yol analizi kullanılarak test edilmiştir. Dolaylı etkileri incelemek için, modeldeki dolaylı etkilerin istatistiksel olarak anlamlı olup olmadığının değerlendirilmesine olanak tanıyan bootstrap yeniden örnekleme yöntemi ve %95 güven aralığı (Preacher & Hayes 2008) kullanılmıştır.

Analiz sonuçlarına göre çalışma, birinci dereceden engellerin erken çocukluk eğitimcilerinin (EÇE) dijital yetkinlikleri üzerindeki etkisini değerlendirmiştir. Erişim ve desteğin erken çocukluk eğitimcilerinin dijital yetkinliği üzerindeki etkisi negatif ve anlamlıdır ($\beta = -0{,}150$, $p < 0{,}05$), dolayısıyla H1 kabul edilmiştir. Kapı bekçilerinin EÇE'lerin dijital yetkinliği üzerindeki etkisi pozitif ve anlamlıdır ($\beta = 0{,}518$, $p < 0{,}05$), dolayısıyla H2 kabul edilmiştir.

Öncelikle, erişim ve destek engellerinin EÇE'lerin dijital yeterlilikleri üzerinde olumsuz bir etkisi olduğu tespit edilmiştir. Bu bulgu, Inamorato dos Santos ve diğerlerinin (2023) vurguladığı gibi önceki araştırmalarla tutarlıdır; araştırmaları, sağlam dijital teknoloji altyapısının sağlanmasına öncelik veren ve sürekli teknik destek sunan eğitim kurumlarının oynadığı önemli rolü vurgulamaktadır. Bu tür kurumlar, eğitimcilerin teknolojiyi güvenle keşfedebilecekleri ve öğretim uygulamalarına sorunsuz bir şekilde entegre edebilecekleri bir ortam yaratmaktadır. Bulgulardaki bu uyum, eğitimcilerin dijital yetkinliklerinin geliştirilmesinde bir kolaylaştırıcı olarak eğitim kurumlarındaki sağlam dijital teknoloji altyapısının kritik öneminin altını çizmektedir.

Bu görüşler, eğitimcilerin dijital yetkinliklerini etkileyen faktörleri anlamamıza katkıda bulunmakta ve eğitim bağlamında erişim ve destek engellerini ele almanın önemini vurgulamaktadır. Kurumlar, teknoloji kaynaklarına ve destek mekanizmalarına yeterli erişim sağlayan bir ortamı teşvik ederek eğitimcilerin dijital yetkinlik kazanmalarını ve teknolojiyi pedagojik uygulamalarına etkili bir şekilde entegre etmelerini kolaylaştırabilir.

Lucas ve arkadaşları (2021) ve Almerich (2016) tarafından öğrencilerin teknolojiye erişiminin eğitimcilerin dijital yetkinliği üzerindeki etkisine ilişkin yapılan araştırmalar, bu döngüye ilişkin değerli bilgiler sunmaktadır. Dijital teknoloji araçlarının yokluğunda, eğitimciler teknoloji odaklı öğretim stratejilerini uygulamada zorluklarla karşılaşabilir. Bu durum döngüsel bir model yaratmaktadır: eğitimcilerin dijital yetkinliklerini geliştirme kapasiteleri, öğrencilerinin teknolojiye erişimiyle içsel olarak bağlantılıdır. Bununla birlikte, eğitimcilerin yetkinliğinin, öğrencilerin öğrenme deneyimlerini zenginleştirmek için teknolojiyi etkili bir şekilde kullanmalarını sağlamak için bir ön koşul olarak hizmet ettiğini kabul etmek de aynı derecede önemlidir.

Bu karmaşık ilişki, eğitim ortamında eğitimcilerin ve çocukların dijital deneyimleri arasındaki karşılıklı bağımlılığın altını çizmektedir. Sonuç olarak, gelecekteki çalışmalar, EÇE ortamlarında erişim ve desteği hem eğitimcilerin hem de çocukların bakış açılarından incelemekten fayda sağlayabilir. İkili bir bakış açısı benimseyerek, eğitim ortamlarında dijital yetkinlik gelişiminin çok yönlü doğası hakkında daha kapsamlı bir anlayış elde etmek mümkündür.

Türkiye'deki bazı bölgelerin erken çocukluk eğitimi (EÇE) ortamlarında dijital teknoloji ekipmanlarının mevcudiyetinde sınırlamalarla karşılaştığını kabul etmek özellikle önemlidir (Ozel, 2019). Bu sınırlama, dijital uçurumu kapatmak ve erken çocukluk eğitimi ortamlarının gerekli teknolojik araçlara ve kaynaklara erişimini sağlamak için bu bölgelerde hedefe yönelik müdahalelerin ve yatırımların gerekliliğinin altını çizmektedir. Bu tür eylemler, eğitimcilerin tüm yetkinlik alanlarında dijital yeterliliklerini artırmada önemli bir rol oynayabilir ve bu bölgelerdeki genç öğrenciler için daha eşit bir dijital öğrenme ortamına katkıda

bulunabilir. Erken çocukluk eğitiminde erişilebilir teknoloji ve kaynak eksikliğinin getirdiği kısıtlamalar çoğu zaman o kadar belirgindir ki, Ozel'in (2019) çalışmasında da belirtildiği üzere, eğitimciler bu kısıtlamaları hafifletmek için kendilerini ebeveynlerden bağış isteme yoluna başvururken bulabilmektedir.

Çalışma, kapı bekçilerinin EÇE'lerin dijital yeterlilikleri üzerindeki etkisine ilişkin şaşırtıcı bir sonuç ortaya koymuştur. Çalışma, beklenmedik bir şekilde, kapı bekçisi engelinin EÇE'lerin dijital yetkinliği üzerinde olumlu bir etkisi olduğunu ortaya koymuştur. Bu beklenmedik sonuç ilginç olmakla birlikte, benzer bir sonuç gözlemleyen Lucas ve diğerlerinin (2021) bulgularıyla da tutarlıdır. Çalışma, okul kolaylaştırma ile mesleki bağlılık arasında negatif bir korelasyon olduğunu ortaya koymuştur. Bu durum, okul kolaylaştırmadaki düşüşün eğitimcilerin mesleki bağlılık yeterliliklerindeki artışla ilişkili olduğunu göstermektedir. Mevcut çalışmada, kapı bekçileri ile dijital yetkinlik arasındaki ilişkinin tüm yetkinlik alanlarını kapsayacak şekilde pozitif olduğu görülmüştür. Bu bulgular, okul liderleri ve velilerin dijital teknoloji kullanımına yönelik olumsuz tutumları gibi faktörlerin erken çocukluk eğitimcilerinin dijital yetkinliklerinin gelişmesine katkıda bulunabileceğini göstermektedir.

Bununla birlikte, çalışmamızın bulgularının, bir okulun eğitimde teknoloji entegrasyonuna yaklaşımının eğitimcilerin dijital yetkinliği üzerinde önemli bir etkisi olduğunu bildiren Masoumi ve Noorozi'nin (2023) bulgularından farklı göründüğünü belirtmek önemlidir. Okullar, eğitimcilere dijital teknolojiyi sınıflarına entegre etmeleri için gerekli kaynakları sağlamadığında, eğitimciler dijital yeterlilikleri üzerinde bir kısıtlama algılamışlardır. Bu durum, teknoloji entegrasyonuna yönelik fırsatların sınırlı olmasından kaynaklanmaktadır.

Çalışmanın bir diğer bekçisi olarak, ayrıca, velilerin teknoloji kullanımına yönelik tutumları, eğitimcilerin dijital teknolojiyi eğitime entegre etmelerini etkileyen bir faktör olarak tanımlanmıştır (Forsling, 2019, aktaran Lindeman vd., 2021). Zaman zaman, eğitimcilerin eğitimde teknoloji kullanımı, dijital teknolojilerin çocuklar üzerindeki olumsuz etkilerine ilişkin medya tartışmalarından etkilenen velilerin eleştirilerine maruz kalmaktadır (Blum-Ross ve Livingstone, 2018). Bununla birlikte,

Lindeman ve diğerleri (2021) tarafından yapılan çalışma, velilerin erken çocukluk eğitimi ortamlarında dijital teknoloji kullanımına ilişkin daha az endişe gösterme eğiliminde olduğunu ortaya koymuştur. Bunun nedeni, eğitimcilerin dijital teknolojiyi sınıfta oyun oynamak için değil, bir eğitim aracı olarak kullanma amacı konusunda her zaman şeffaf olmalarıdır.

Çalışmamız ile literatür arasındaki bulgu farklılığının makul bir açıklaması, okul liderlerinin gerekli kaynakları sağladığı belirli bir seviyeye kadar eğitimcilerin dijital yeterliliklerinin geliştirilebilmesidir. Ancak, belirli bir eşikten sonra, EÇE'ler dijital yeterlilikleri yüksek olduğunda okul liderlerinin desteğinin yeterli olmadığını, hatta bazen ihtiyaçlarına ters düştüğünü algılayabilmektedir. Örneğin, eğitimciler öğretme ve öğrenmeyi geliştirmek için dijital araçlar satın alma isteklerini ifade ettiklerinde, okul liderleri eğitimde dijital teknoloji kullanımını desteklemiyormuş gibi algılanabilir. Dolayısıyla, eğitimcilerin dijital yetkinliklerine bağlı olarak, okul liderlerinden beklentileri farklılaşabilir ve okul liderlerinin teknoloji kullanımına yönelik tutumlarına ilişkin algıları olumsuz hale gelebilir. Bu durum veliler için de aynı olabilir. Eğitimciler yüksek derecede dijital yeterliliğe sahip olduklarında, velilerin evde dijital teknoloji tabanlı faaliyetleri destekleme beklentileri artabilir.

Tersine, eğitimciler velilerden yeterli yanıt alamadıklarında velilerin dijital teknoloji temelli faaliyetleri desteklemediklerini düşünebilirler. Örneğin, Huang ve diğerleri (2016) okul liderlerinin ve velilerin erken çocukluk eğitiminde artırılmış gerçekliğin potansiyel olumsuz etkileri konusunda endişelerini dile getirdiklerini ortaya koymuştur. Bu çalışmanın da gösterdiği gibi, daha yüksek düzeyde dijital yetkinliğe sahip olan ve çeşitli dijital araçları ya da acemi stratejileri entegre etmek isteyen eğitimciler velilerin direnciyle karşılaşabilir. Sonuç olarak, eğitimcilerin dijital yetkinlikleri velilerin beklentilerini etkileyebilir. Eğitimciler beklentilerini yüksek tuttuklarında, velilerin erken çocukluk eğitiminde dijital teknoloji kullanımını desteklemediğini algılayabilirler. Bu sonucun daha iyi anlaşılması için daha fazla araştırma yapılması önerilmektedir. Bu faktör, eğitimcilerin dijital yeterliliklerinde kapı bekçilerinin rolünü ele alan ilk çalışma olması nedeniyle sonraki çalışmalarda araştırılmalıdır.

Çalışmada ayrıca ikinci dereceden engellerin erken çocukluk eğitimcilerinin dijital yetkinlikleri üzerindeki etkisi de değerlendirilmiştir. Dijital teknolojiye yönelik tutumların erken çocukluk eğitimcilerinin dijital yetkinlikleri üzerindeki etkisi pozitif ve anlamlıdır ($\beta = 0.336$, $p < 0.05$), dolayısıyla H3 kabul edilmiştir. Öğretmen engellerinin erken çocukluk eğitimcilerinin dijital yetkinlikleri üzerindeki etkisi negatif ve anlamlıdır ($\beta = -0.255$, $p < 0.05$), bu nedenle H4 kabul edilmiştir.

Eğitimcilerin teknoloji kullanımına yönelik tutumları, dijital yetkinliklerini önemli ölçüde etkilemektedir. Eğer eğitimciler dijital teknolojiyi kullanmanın zor olduğunu ya da çocukların öğrenmesi ve gelişimi için faydalı olmadığını düşünüyorlarsa, dijital yetkinliklerini geliştirme ya da teknolojiyi eğitime entegre etme olasılıkları daha düşüktür. Ayrıca, teknoloji entegrasyonuna yönelik öz yeterlilik ve hazırlık engelleri gibi öğretmen engelleri de eğitimcilerin dijital yetkinliklerini olumsuz etkilemektedir. Dolayısıyla, eğitimciler eğitim, deneyim eksikliği veya zaman kısıtlamaları nedeniyle dijital teknolojiyi kullanmaya kendilerini yeterince hazır hissetmiyorlarsa, dijital yetkinliklerini geliştirme kapasiteleri kısıtlanabilir. Sonuç olarak, bu eğitimcilerin dijital teknolojiyi mesleki gelişim, değerlendirme veya öğrencilerin dijital yetkinliklerini geliştirme gibi eğitim bağlamında kullanma olasılıkları daha düşük olabilir.

Çalışmanın dikkat çeken bir diğer bulgusu da dijital teknoloji kullanımına yönelik olumlu tutumların eğitimcilerin dijital yeterlilikleri üzerinde olumlu bir etkiye sahip olduğudur. Önceki bulgulara paralel olarak (Bariu ve Chun, 2022; Ursavaş vd., 2019; Runge vd., 2023; Verma vd., 2018), bu çalışma da EÇE'lerin dijital teknoloji kullanımına yönelik tutumlarının eğitsel dijital yeterlilikleri üzerinde anlamlı ve olumlu bir etkisi olduğunu ortaya koymaktadır. Bu faktör aynı zamanda dijital teknolojinin pedagojik entegrasyonu ile de ilişkilidir (Altun, 2019). Bu, eğitimcilerin EÇE ortamlarında dijital teknolojinin entegrasyonuna yönelik olumlu tutumlara sahip olduklarında, dijital yeterliliklerinin çalışma modelinde belirtildiği gibi karşılık gelen bir artış gösterdiği anlamına gelir.

Ayrıca, EÇE ortamlarında teknoloji kullanımına yönelik tutumların etkisi, profesyonel katılım, dijital kaynaklar, öğretme ve öğrenme, değerlendirme,

öğrencileri güçlendirme ve öğrencilerin dijital yeterliliğini kolaylaştırma dahil olmak üzere eğitimcilerin tüm dijital yeterlilikleri üzerinde olumlu bir etkiye sahiptir. Bu etkiler, eğitimcilerin erken çocukluk eğitimi uygulamalarını iyileştirmek için dijital teknolojiyi kullanma yeterliliklerini şekillendirmede tutumların oynadığı yaygın rolün altını çizmektedir. Bu bulgu, İngilizce öğretmenleri (Benali vd., 2018), ortaokul (Demissie vd., 2022) ve öğretmen adayları (Tondeur vd., 2018) gibi farklı alanlardan eğitimcilerin, literatürde EÇE'lerle sınırlı çalışma olduğu için farklı öğretmen yeterlilikleriyle karşılaştırıldığını gösteren önceki araştırmaları desteklemektedir.

Dijital pedagoji eğitimi vermek, eğitimcilerin dijital teknolojiye yönelik tutumlarını geliştirmek için uygun bir yaklaşım olabilir (Pongsakdi vd., 2021). Eğitimcilerin dijital teknolojiye yönelik tutumları, dijital yetkinliğin ve teknoloji entegrasyonunun geliştirilmesinde kritik bir faktör olduğundan (Tondeur vd., 2018), tutumları destekleme çabaları, teknolojinin eğitime daha etkili bir şekilde entegre edilmesine katkıda bulunabilir. Bununla birlikte, düşük tutum seviyelerini düzeltmenin, okul liderliği düzeyinde sürekli bir zaman yatırımı ve sürekli eğitim gerektirdiğini kabul etmek önemlidir (Skantz-Åberg ve ark., 2022). Bu tür çabalar, eğitimcilerin tutumlarında olumlu bir değişimi kolaylaştırmak ve sonuç olarak dijital yeterliliklerini artırmak için gereklidir

Öğretmen engelleri arasında, eğitimcilerin öz yeterlilik eksikliği, dijital yeterlilik konusunda yetersiz eğitim veya öğretim ve zaman kısıtlamaları dijital yeterliliklerini engellemektedir. Bu sonuç, öz yeterliliğin ortaokul eğitimcilerinin dijital yeterliliklerini etkilemede önemli bir rol oynadığını gösteren Hatlevik ve Hatlevik'in (2018) bulgularıyla tutarlıdır. Örneğin, dijital teknoloji kullanımında yüksek öz yeterlilik sergileyen eğitimciler, yüksek dijital yeterlilik sergileme eğilimindedir (Yada vd., 2022). Eğitimcilerin teknoloji kullanımındaki öz yeterlilikleri, başlangıç eğitiminde veya hizmet içi eğitim yoluyla aldıkları mesleki eğitimle yakından ilişkili olabilir (Birisci ve Kul, 2019). Nitekim García-Vandewalle García ve diğerleri (2023), erken çocukluk eğitimi programlarındaki öğretmen adaylarının ilkokuldaki meslektaşlarına kıyasla önemli ölçüde daha düşük dijital yeterlilik sergileme eğiliminde olduğu gibi ilginç bir konunun altını çizmektedir. Bu tutarsızlık, erken

çocukluk eğitimi için başlangıç eğitim programının dijital yeterlilik konusunda ilkokul programı kadar kapsamlı bir eğitim sağlamamasına bağlanabilir. Sonuç olarak, dijital teknoloji kullanımında rehberliğin olmaması, eğitimcilerin dijital yetkinliklerinin ilerlemesini engelleyebilir. Bu bağlantı, eğitimcilerin teknoloji kullanımında öz yeterliliklerinin artırılmasının, hem başlangıç eğitimleri sırasında hem de devam eden mesleki gelişim girişimleri yoluyla kapsamlı eğitim fırsatlarının sağlanmasıyla kolaylaştırılabileceği anlamına gelmektedir.

Mevcut literatür de eğitimcilerin haftalık iş yükünün teknolojinin öğretim uygulamalarına entegrasyonu üzerinde önemli bir etkisi olduğunu göstermektedir (Cattaneo vd., 2022). OECD'nin "Erken çocukluk eğitimi ve bakımı personelinin çalışma koşulları ve refahı" başlıklı raporu, Türkiye'nin personel için en uzun haftalık çalışma saatlerine sahip ülkeler arasında yer aldığını göstermektedir (2020). Dolayısıyla, çalışmamız bu bulgularla uyumludur ve öğretmenler için bir engelleme olarak tanımlanan zaman sıkıntısının, EÇE'ler arasında dijital yeterliliğin gelişimini olumsuz etkilediğini göstermektedir. Eğitimde dijital teknolojinin en iyi şekilde kullanılmasını teşvik etmek ve eğitimcilerin dijital yetkinliğini artırmak için, hükümetlerin iş yüklerini değiştirmeyi ve daha esnek hale getirmeyi düşünmeleri zorunlu hale gelmektedir (Alexander vd., 2019). Yetkililer, eğitimcilerin programlarına esneklik getirerek onlara beceri teknolojisi entegrasyonuyla daha etkin bir şekilde ilgilenmeleri ve dijital yetkinliklerini geliştirmeleri için zaman ve alan sağlayabilir.

Çalışmada, dijital teknolojiye yönelik tutumların, birinci dereceden engeller (erişim ve destek) ve kapı bekçileri) ile erken çocukluk eğitimcilerinin dijital yetkinlikleri (DY) arasındaki ilişkideki aracılık rolü değerlendirilmiştir. Sonuçlar, erişim ve desteğin dijital teknolojiye yönelik tutumlar aracılığıyla DY üzerinde anlamlı bir dolaylı etkisi olduğunu ($\beta = 0.028$, $p < 0.05$) ve H9'u desteklediğini; kapı bekçilerinin dijital teknolojiye yönelik tutumlar aracılığıyla DY üzerinde anlamlı bir dolaylı etkisi olduğunu ($\beta = -0.102$, $p < 0.05$) ve H10'u desteklediğini ortaya koymuştur. Ayrıca, erişim ve desteğin DY ve kapı bekçileri ile DY üzerindeki doğrudan etkisi sırasıyla anlamlıdır ($\beta = -0.150$, $p < 0.05$); ($\beta = 0.518$, $p < 0.05$),

dolayısıyla, dijital teknolojiye yönelik tutumlar erken çocukluk eğitimcilerinin erişim ve destek, kapı bekçileri ve DY arasındaki ilişkiye kısmen aracılık etmektedir.

Çalışmada ayrıca erken çocukluk eğitimcilerinin dijital yeterliliklerinin birinci dereceden engelleri (erişim ve destek ve kapı bekçiler) ile dijital yeterlilikleri (DY) arasındaki ilişkide öğretmen engellerinin aracılık rolü değerlendirilmiştir. Öğretmen engellerinin erişim ve destek ve DY üzerinde anlamlı bir aracılık rolü ($\beta$ =-0.021, $p$ <0.05) olduğundan, H11'i desteklemektedir ve öğretmen engelleri kapı bekçileri ve DY üzerinde anlamlı bir aracılık rolü ($\beta$ =-0.206, $p < 0.05$) bulunmuştur, H12'yi desteklemektedir. Ayrıca, erişim ve destek ile DY ve kapı bekçileri ve DY üzerindeki doğrudan etkisi sırasıyla anlamlıdır ($\beta$ =-0.150, $p$ <0.05); ($\beta$ = 0.518, $p <$ 0.05), dolayısıyla öğretmen engelleri, erken çocukluk eğitimcilerinin erişim ve destek, kapı bekçileri ve DY arasındaki ilişkiye kısmen aracılık etmektedir.

Son olarak, erken çocukluk eğitimcileri arasında birinci dereceden engeller ve dijital yetkinlik arasındaki ilişkide ikinci dereceden engellerin aracılık rolüyle ilgili olan son araştırma sorusunu ele almaya çalıştık. Modelimiz, ikinci dereceden engellerin aslında birinci dereceden engeller ile erken çocukluk eğitimcileri arasındaki dijital yetkinlik arasındaki ilişkiye aracılık ettiğini göstermiştir. Analiz, dijital teknoloji kullanımına yönelik tutumların, erişim ve destek ile dijital yetkinlik arasındaki ilişkide bir aracı görevi gördüğünü göstermiştir. Aracı rol oynadığı ortaya çıkan dijital teknoloji kullanımına yönelik olumlu tutumlar, erişim ve destek eksikliğine rağmen eğitimcilerin dijital yetkinliklerinin geliştirilebileceğini düşündürmektedir. Bu sonuç, Forsling'in (2022) okul öncesi eğitim kurumlarının yeterli dijital teknoloji kaynaklarına sahip olsalar bile, eğitimcilerin çeşitli faktörler nedeniyle bunları kullanamayabileceğini gösteren bulgularıyla tutarlıdır. Buna göre, politika yapıcıların, okul liderlerinin ve diğer paydaşların, EÇE'ler arasında dijital teknoloji kullanımına yönelik olumlu bir tutum geliştirmenin gerekliliğini kabul etmeleri zorunludur. Bu, dijital yeterliliklerini artırmak ve pedagojik olarak dijital teknolojinin eğitim bağlamına entegrasyonunu teşvik etmek için çok önemlidir.

Ikinci dereceden engeller, dijital teknoloji kullanımına yönelik tutumlar ve öğretmen engellemeleri, kapı bekçileri ile dijital yeterlilik arasındaki ilişkide aracı değişkenler

olarak belirlenmiştir. Dolayısıyla, eğitimciler dijital teknoloji kullanımına yönelik olumsuz tutumlara sahip olduğunda, bekçilerin olumsuz tutumları eğitimcilerin dijital yetkinlik gelişimi üzerinde zararlı bir etki olarak algılanabilir. Ayrıca, öğretmen engellemeleri mevcut olduğunda, bekçilerin dijital teknoloji kullanımına yönelik olumsuz tutumları eğitimcilerin dijital yetkinlik gelişimini engelleyecektir.

Dijital kaynaklara erişim ve destek ile dijital yeterlilik arasındaki ilişkiye öğretmen engellerinin aracılık ettiği bulunmuştur. Öğretmen engelleri yüksek olduğunda, erişim ve destek eksikliği daha önemli olarak algılanabilir. Sonuç olarak, eğitimciler dijital yeterlilikleri geliştirmeyi göz ardı edebilirler. Bu sonuçlar, dijital teknoloji kullanımına yönelik tutumlar ve öğretmen engellemeleri gibi ikinci dereceden engellerin, erişim ve destek eksikliği ya da kapı bekçileri gibi birinci dereceden engelleri hafifletmedeki önemine işaret eden önceki araştırmalarla tutarlıdır (Inan ve Lowther, 2010; Miranda ve Russell, 2012; Lucas vd., 2021). Çalışma sonucu, ikinci dereceden engellerin dijital yeterlilik üzerindeki birinci dereceden etkilere aracılık ettiğini açıkladığından, örneğin İnan ve Lowther'ın (2010) çalışması, teknoloji desteğinin eğitimde teknoloji entegrasyonunu dolaylı olarak etkilediğini göstermektedir. Çünkü bir sorun yaşadıklarında ve yardıma ihtiyaç duyduklarında bu desteğin varlığından haberdar olmak, eğitimcilerin kendilerini teknolojiyi entegre etmeye daha yetkin ve hazır hissetmelerini sağlamaktadır (Hernandez-Ramos 2005).

Sonuç olarak, bu çalışma DigCompEdu çerçevesini zenginleştirerek mevcut literatüre katkıda bulunmaktadır. Çalışma, birinci dereceden engeller ile eğitimcilerin dijital yetkinlikleri arasındaki ilişkide ikinci dereceden engellerin aracı rolünü açıklamaktadır. Erken çocukluk eğitimcilerinin dijital yetkinliklerini artırmaya yönelik etkili destek mekanizmaları geliştirmek için ikinci dereceden engellerin aracı rollerini anlamak çok önemlidir. Çünkü yalnızca çevresel ya da dışsal engellerin ele alınması, eğitimciler arasında beklenen dijital yetkinlik düzeyini garanti etmeyebilir.

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