



**TÜRKİYE CUMHURİYETİ
ADANA ALPARSLAN TÜRKER SCIENCE AND TECHNOLOGY
UNIVERSITY**

**GRADUATE SCHOOL
MANAGEMENT INFORMATION SYSTEMS DEPARTMENT**

**EVALUATION OF DIGITAL COMPETENCIES AND
TRANSFORMATIONAL LEADERSHIP OF SCHOOL MANAGERS :
THE CASE OF ADANA**

ABDURRAHMAN ERSOY

M.A.

ADANA 2024



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**THESIS ADVISOR
ASSOC.PROF.DR. DİLEK PENPECE DEMİRER**

ADANA, 2024

DECLARATION OF CONFORMITY

In this thesis study, which was prepared following the thesis writing rules of Adana Alparslan Türkeş Science and Technology University Institute of Graduate School, I declare that I provide all the information, documents, evaluations and results in accordance with scientific ethics and moral codes without resorting to any means or assistance that would be contrary to scientific ethics and traditions. I also declare that I refer to all of the articles I used in this study with appropriate references and accept all moral and legal consequences if a situation is found contrary to my statement regarding my work.

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[Signature]

Abdurrahman ERSOY

ÖZET

OKUL YÖNETİCİLERİNİN DİJİTAL YETERLİKLERİNİN VE DÖNÜŞÜMCÜ LİDERLİKLERİNİN DEĞERLENDİRİLMESİ : ADANA ÖRNEĞİ

Abdurrahman ERSOY

Yüksek Lisans,Yönetim Bilişim Sistemleri Anabilim Dalı

Danışman: Doç. Dr. Dilek PENPECE DEMİRER

Ocak 2024, 113 sayfa

Bu araştırmada okul yöneticilerinin dijital yeterlikleri ve dönüşümcü liderliklerinin incelenmesi amaçlanmıştır. Araştırmada okul yöneticilerinin dijital yeterlik düzeylerinde cinsiyet, yaş, yöneticilik süresi, okul türü gibi demografik değişkenlere göre farklılaşma olup olmadığını araştırmak için analizler yapılmıştır. Ayrıca okul yöneticilerinin dönüşümcü liderlik özellikleri ile dijital yeterlikleri arasında bir ilişkinin olup olmadığı araştırılmıştır.

Araştırma, nicel araştırma yöntemlerinden ilişkisel tarama yöntemi kullanılarak yapılmıştır. Araştırmanın örneklemi 2022-2023 eğitim öğretim yılında Adana ilinde T.C. Milli Eğitim Bakanlığına bağlı resmi okullarda görev yapan 395 okul yöneticisinden oluşmuştur. Araştırmanın birinci kısmında Gümüş(2021) tarafından geliştirilen Öğretmen Dijital Yeterlik Ölçeği, ikinci kısmında Berger, Romeo, Guardia, Baldó, & Soria (2012) tarafından geliştirilen kısa Dönüşümcü Liderlik Ölçeği ve son kısmında katılımcıların demografik bilgilerini içeren Kişisel Bilgi Toplama formundan oluşan 5'li Likert tipi bir ölçek kullanılmıştır. Veriler kolayda örnekleme yöntemi ile toplanmış ve SPSS 26 Paket Programı ile analiz edilmiştir. Ölçeklerin geçerlik ve güvenirlik analizleri yapılmış,verilerin normal dağılıp dağılmadığına Kolmogorov-Smirnov testi ile bakılmıştır. Verilerin normal dağılım göstermediği görülmüş, bu nedenle hipotezlerin analizinde nonparametrik testlerden Mann-Whithney U ve Kruskal Wallis testleri uygulanmıştır. Dijital yeterlik ve dönüşümcü liderlik arasındaki ilişkiyi ölçmek için Spearman Korelasyon testi uygulanmıştır. Araştırma sonucunda okul yöneticilerinin dijital yeterlik düzeylerinde cinsiyet , çalışılan ilçe, eğitim durumu ve yöneticilik rolü değişkenlerine göre farklılaşma görülmemiştir.

Ancak yaşı, okul türü, yöneticilik süresi ve branş değişkenlerine göre okul yöneticilerinin dijital yeterlik düzeylerinde anlamlı farklılaşma olduğu görülmüştür. Yöneticilerin dönüşümcü liderlik düzeyleri ile dijital yeterlik düzeyleri arasında pozitif yönlü orta düzey anlamlı bir ilişki tespit edilmiştir.

Anahtar Kelimeler:Dijitalleşme, dijital dönüşüm, dijital yeterlik, dönüşümcü liderlik, okul yöneticileri.



ABSTRACT

EVALUATION OF DIGITAL COMPETENCIES AND TRANSFORMATIONAL LEADERSHIP OF SCHOOL MANAGERS : THE CASE OF ADANA

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M.A., Department of Management Information Systems
Supervisor: Assoc. Prof. Dr. Dilek PENPECE DEMİRER

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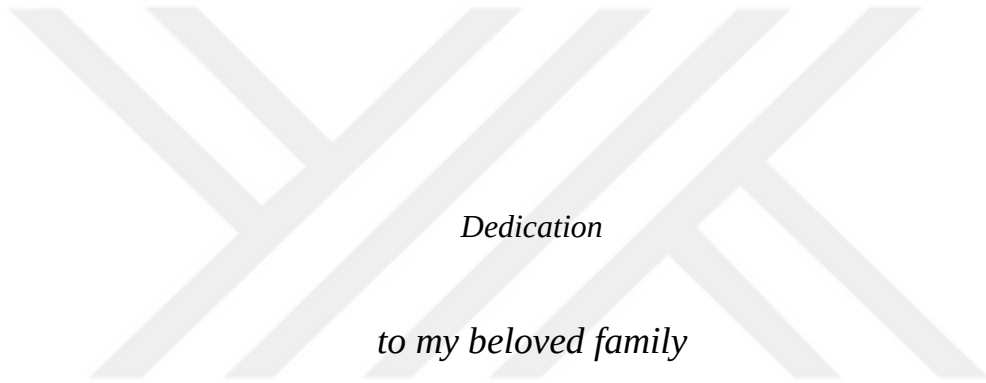
This study aims to examine the digital competencies and transformational leadership of school managers. Analyses were conducted to investigate potential differences in digital competence levels among school managers based on demographic variables such as gender, age, duration of administration, and school type. The study investigated the potential relationship between the transformational leadership characteristics of school managers and their digital competencies.

The study was conducted using the relational survey method, which is one of the quantitative research methods. The study sample comprised 395 school managers working in public schools under the Ministry of National Education in Adana province in the 2022-2023 academic year. The study used a 5-point Likert-type scale consisting of the Teacher Digital Competence Scale developed by Gümüş (2021) in the first part, the Transformational Leadership Scale developed by Berger, Romeo, Guardia, Baldó, & Soria (2012) in the second part, and a personal information form consisting demographic information of the participants in the last part. Data were collected using a convenience sampling method and analyzed with the SPSS 26 Package Program. The scales underwent validity and reliability analyses, and the Kolmogorov-Smirnov test was used to determine normal distribution of the data. As the data did not show normal distribution, nonparametric tests such as Mann-Whitney U and Kruskal Wallis were used to analyze the hypotheses. The Spearman correlation test was used for the determination of the relationship between digital competence and transformational leadership.

As a result of the research, there was no differentiation in the digital competence levels of school managers according to gender, district of working, educational status and administrative roles of managers. However, it was seen that there was a significant difference in the digital competence levels of school managers according to age, school type, duration of administration and branch variables. A positive, medium and significant relationship was found between the transformational leadership levels of managers and their digital competence levels.

Keywords: Digitalization, digital competence, digital transformation, school managers transformational leadership.





Dedication

to my beloved family

ACKNOWLEDGEMENTS

First of all, I would like to thank my dear advisor Assoc. Prof. Dr. Dilek PENPECE DEMİRER who guided me with her knowledge and experience in my study and the faculty members of the department whose knowledge I benefited from. In addition, I would like to thank each member of my family for their support in all matters, especially my beloved wife Lütfiye BİÇER ERSOY, who has always supported me and increased my faith and motivation by saying "You can do it" every time I lost my faith and by sacrificing her precious time for me. Finally, I would like to thank my dear friends who supported me with their ideas and all the participants who contributed to science by participating in this study.

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LIST OF ABBREVIATIONS

DCS	: Digital Competence Scale
DigComp	:European Digital Competence Framework for Citizens
EACEA	:The European Education and Culture Executive Agency
EDSF	: Essential Digital Skills Framework
ESCO	:The European Skills, Qualifications, Competencies and Occupations
ICILS	: International Computer and Information Literacy Framework
ICT CFT	:The ICT Competency Framework for Teachers
ICT	: Information and Communication Technology
IEA	: International Association for the Assessment of Educational Achievement
JRC	: European Commission's Joint Research Centre
MoNE	: Republic of Turkiye The Ministry of National Education
NETS	: National Educational Technology Standards
TLS	: Tarnsformational Leadership Scale

LIST OF SYMBOLS

α	: Alpha Coefficient
df	: Degrees of freedom
H	: Hypotesis
n	: Sample Number
r	: Correlation Coefficient
χ^2	: Eta-squared



1. INTRODUCTION

Digital technologies have transformed many areas of our lives, from communication, work and leisure, to how we receive news, acquire information, behave and organise our daily routines (Redecker, 2017). Accelerated technological advancements have altered the pace of data access, resulting in a change in the way we access information, with implications for pedagogy and an expansion of the range of technological tools used in educational settings. Digital technologies, including video projectors, smart boards, e-books, online social networks, downloadable audio and video files, and mobile devices, have revolutionised daily life. For this purpose, it was imperative to employ technology to meet the needs of the evolving generation and augment their learning environment.

Today's Generation Z grow up surrounded by digital technologies but this doesn't automatically mean they have the skills to use them proficiently. In this point, it is important for educators to have the necessary skills and to be able to guide the people of this generation (Redecker, 2017). Digital transformation has become imperative not only in the field of education but also in other areas such as healthcare, industry, and public administration, among others, to improve the quality of life (Karaoğlu, Çetinkaya, & Cimşir, 2020). School managers play a crucial role in overseeing this transformation process in educational environments by integrating technology with teaching and learning in the digital age. A prosperous digital transformation necessitates cultural and technological modifications. As digital leaders, school managers must possess the knowledge of utilizing digital technology to establish a clear, appealing, motivating, and significant school culture (Ordu & Nayır, 2021). School managers who utilise digital skills and opportunities appropriately can facilitate the digital transformation of their institutions by providing the necessary infrastructure and investments to enhance the digital competencies of both teachers and pupils.

It is crucial to have knowledgeable school leaders who advocate for the integration of digital technologies in education. Constantly evolving work conditions have resulted in a rise in the requirements for school managers in educational settings. There is a clear need for school leaders who are viewed as successful in competently handling human resources and can simultaneously develop soft and digital skills. Furthermore, globalisation, accountability, and competition within the education sector necessitate that school managers meet these demands.

School leaders must possess communication and efficient skills to elevate their schools to meet global education standards and facilitate the establishment of an innovative education framework (Makri & Vlachopoulos, 2019).

In modern educational management, schools are regarded as transformative organisations and principals as transformational leaders. Research has identified significant similarities between the roles of school managers and transformational leadership traits. The objective of transformational leadership at the school level is to establish schools that are suitable for the demands of the 21st century. Schools are no longer mere institutions for imparting knowledge due to changing school missions, needs, expectations, social dynamics, and studies structuring. The evolving landscape of education has transformed the role of school leaders from instructional leadership to transformational leadership. Instead, they are open organisations that encompass beyond just the students and teachers. Schools are organizations encompassing various social, political, economic, and cultural contexts along with their external surroundings. Transformational leadership conducts a crucial function in schools' adaptation to environmental circumstances, keeping up with scientific and technological advancements and elevating educational standards (Eraslan, 2004).

1.1. Clarification of Terminology

For individuals to acquire the skills required in a rapidly globalising and digitising world, national education systems must provide lifelong learning opportunities. Brolopito (2018) states that according to the World Economic Forum's Future of Jobs 19 report, more than 60% of primary school children will be employed in jobs that do not currently exist. The Covid-19 pandemic has resulted in a standstill of the workforce, compelling individuals to enhance their digital proficiencies. Consequently, the digital skills required for newly emerging professions will be shaped based on the requisite knowledge and abilities. A workforce with advanced digital skills can have an accelerating effect in terms of different performance criteria in organizations and provide corporate sustainability more easily. Digitally proficient people can be more productive. In the modern world, there is a requirement for individuals possessing multiple talents, particularly those with digital skills (Bilişim Vadisi, 2022). This report emphasises the need for managers and teachers to possess digital competence to keep pace

with changing trends and advances in education and training, as well as in other industries and sectors.

Digital competence, first recommended in Europe in 2006 and now considered a crucial competency in lifelong learning for years, is defined as follows in the publication in 2018:

"digital competence is defined as 'the confident, critical and responsible use of, and engagement with, digital technologies for learning, work, and participation in society'"(European Education and Culture Executive Agency, Eurydice, 2019, p.25)

From this brief definition of digital competence, it is essential to comprehend that it relates to various areas of life, including work, communication, and leisure activities. It is not solely based on technical skills but also includes confidence and a critical approach (Janssen et al. 2013).

Digital competence has been acknowledged as a vital skillset that individuals ought to acquire recently (Ilomäki, Paavola, Lakkala, & Kantosalo, 2016). Petterson (2018) posits that digital competence refers to the skills and competence that an average citizen ought to possess for learning and navigating in the information society.

Several frameworks have been proposed to define digital competence, with the most significant being DigComp, prepared by the European Commission. DigComp has since been expanded by UNESCO to include hardware and software operations, as well as career-related activities. The UK National Standards have developed the Essential Digital Skills Framework (EDSF), while the International Association for the Assessment of Educational Achievement (IEA) has developed the International Computer and Information Literacy (ICILS) framework. ESCO and the Irish government are among the organisations that define digital competencies (Perifanou & Economides, 2019).

1.2. Problem Statements and Research Questions

In keeping with the evolving demands of the workforce due to digital transformation, the expectation for the new generation is to produce and use information technology actively and efficiently, as opposed to merely consuming information. Prospective employees are now subjected to competence-based evaluations instead of knowledge-based evaluations.

Competence refers to an individual's ability to utilise human traits, including knowledge, skills and attitudes, as well as external resources to solve problems they encounter. Conversely, skill denotes the capability to perform a task or behaviour. In this context, digital competence is highlighted as a necessary competency that the next generation should possess (Toker, Akgün, Cömert, & Edip, 2021). Educational institutions serve as one of the primary locations where these essential skills are acquired.

The vision of the leader is a crucial factor in achieving digital transformation in educational institutions. The achievement of digital transformation is feasible by establishing clarity in digital strategies, where the leader advocates a change-driven culture and supports diverse ideas and practices. The leader must assess the effectiveness of distinct digital technologies and approaches in fueling these changes. Organizational change often commences at the senior management or senior management functions level. However, to ensure victory, the leader must encourage and efficiently guide employees in a way that is aligned with organizational goals. Successfully managing the entire digital transformation process is critical for leaders in organizations (Karaköse, Polat, & Papadakis, 2021).

The participation of educational leaders in the digitization process is critical to the successful adoption of technology in education. The participation of educational leaders in the digitalization process is crucial to achieve successful implementation of technology in education. In numerous countries, schools enjoy greater autonomy, whereby school managers have a significant responsibility for curriculum development and resource utilization. Neglecting the necessary training and skills development of school managers in digital technology diminishes their ability to coordinate school operations effectively. It is the responsibility of school managers to ensure that technology is integrated into every aspect of the curriculum, promoting digital competence as a key skill. A comprehensive approach to education is required to foster ongoing change and innovation in teaching and learning. Pedagogical use of digital technologies must be guaranteed through qualification frameworks or professional standards for managers, highlighting their vital role in this effort. It is recommended to integrate these frameworks into the training programmes of both school managers and teachers (European Education and Culture Executive Agency, Eurydice, 2019).

According to the comprehensive literature review, it has been observed that no study has been conducted on the digital competencies or skills of school managers in the context of transformational leadership and the idea that a study should be conducted on this subject has emerged. Based on this idea, the research questions of our study were prepared as follows:

1- Is there a significant difference in digital competencies according to their :

- Gender,
- Age,
- Districts where they work
- Type of school
- Duration of management/administration
- Managerial role
- Educational/Graduational status
- Branches

2- Is there a significant relationship between school managers' digital competencies and transformational leadership abilities?

1.3. Significance of the Study

Several frameworks for enhancing digital skills have been established globally, including within Europe. The most significant of these is DigComp (Vuorikari, Punie, Carretero, & Van den Brande, 2016), which was published by the Joint Research Centre (JRC) of the European Commission. Other international bodies such as UNESCO, the World Bank, and national governments have also created frameworks for digital competencies and skills. Institutions such as the National Educational Technology Standards (NETS) and the National Institute for Educational Technology and Teacher Training (INTEF), along with global institutions and organizations, have developed frameworks and guidelines for information technology, digital competence and digital skills. Some frameworks and guidelines, such as DigComp, have the objective of enhancing the digital skills of citizens, while certain ones are targeted at particular sectors or demographics. In order to increase the digital competencies of educators and to incorporate information technologies into the field of education, various frameworks such as the Digital Competency Framework for Educators (Redecker, 2017), the Common Digital Competency Framework for Teachers (INTEF, 2017) and NETS have been

established in the field of education. Among these studies, Digital Competence Frameworks are the most comprehensive and reference to others. As a result of the analysis, many studies have been conducted on the digital competencies of pre-service teachers, teachers and students. It has been established that there is sufficient research on the technology leadership of school managers; however, there seems to be a lack of a framework and inadequate research on the digital competencies or digital leadership of administrators, besides NETS for Educational Leader. Deficiencies and gaps in digital competence and skills have been observed among managers in the field of school management. It is believed that comprehending and evaluating the digital competency levels of school managers, who play an important role in schools during the digital transformation process, will be crucial for managing educational institutions and managers. Additionally, this study will ascertain the levels of digital competence, digital leadership, and transformational leadership amongst school managers, making it a valuable point of reference for future research in this field of study.

1.4. Aim of the Study

The aim of this study is to assess the digital competence and transformational leadership of school managers. The research aims to assess whether these managers' levels of digital competency vary based on different variables. Additionally, we will attempt to ascertain whether a significant and positive correlation exists between the levels of digital competence and transformational leadership.

1.5. Limitations

The current research was conducted in Adana province focusing on school managers' digital competencies and transformational leadership skills. Therefore,

- 1- This study is limited to school managers employed in public schools located in Adana during the 2022-2023 academic year.
- 2- It is restricted to the information obtained from the responses to the Digital Competence Scale, implemented to assess the digital competency levels of school managers, and the Transformational Leadership Scale used to measure the characteristics of transformational leadership.

1.6. Definitions

Digital competence: Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.(European Commision,2019, p.10)

Transformational leadership:

“Transformational leadership is a process that changes and transforms people. It is concerned with emotions, values, ethics, standards, and long-term goals. It includes assessing followers’ motives, satisfying their needs, and treating them as full human beings” (Northouse, 2013, p. 185).

Digital transformation :

“Digital transformation is the cultural, organisational and operational change of an organisation, industry or ecosystem through a smart integration of digital technologies, processes and competencies across all levels and functions in a staged way” (Iosad, 2020, p. 12).

2. THEORETICAL FOUNDATIONS AND LITERATURE REVIEW

This chapter includes a literature review on digital competence and transformational leadership. Additionally, it examines digitalisation, digital transformation, digital transformation in education, and digital competence frameworks and models. Moreover, studies on the levels of digital competence and transformational leadership have been incorporated at the end of the chapter.

2.1. Digital Competence

Digital competence is recognised as one of the fundamental skills necessary for lifelong learning. Its significance was first acknowledged in Europe in the 2006 Recommendation, where it was defined as the capability to use information and communication technologies confidently and creatively to achieve objectives associated with learning, employment, leisure, and social inclusion. European Commission/EACEA/Eurydice, 2019; European Commission, 2018; INTEF, 2017) According to the Vocational Qualifications Authority Of Türkiye(2015), which shares the same definition, digital competence requires fundamental skills, including acquiring and assessing information in ICT, producing, safeguarding, showcasing, completing exchanges using computers, participating in shared networks via the internet, and engaging in communication.

Ferrari (2012) posits that digital competence is an essential constituent of 21st century skills that citizens must possess to participate successfully in social and economic life. Digital competence, as stated by the European Commission (2018), incorporates information and data literacy, communication and collaboration, digital content creation, problem-solving and critical thinking, media literacy, intellectual property issues and security. According to the definition provided by the European Commission (2018) and Zhao, Pinto, & Sanches,(2021), digital competence is the skill to utilise digital technologies and their interaction to enhance our lives in a critical, responsible, and self-assured manner for work, recreational activities, education, and participation in the community.

The fourth industrial revolution has spurred the rapid adoption and advancement of digital technologies, resulting in sweeping changes to worldwide production, consumption,

employment, and communication. These changes have led to the emergence of new forms of work, as well as innovative education systems such as Education 4.0. In a society that is complex, interlinked, and increasingly grounded in knowledge, every European citizen should possess basic and cross-functional digital literacy abilities in addition to proficiencies in maths, language and learning, so as to effectively disseminate, work, communicate, learn, actively partake and exist within the information society. As a result, digital competence has become an essential component of education systems (Tsekeris, 2019; Konari et al.2021).

Identified in 2007 by the European Parliament and the Council of Europe as one of the eight fundamental competences for Lifelong Learning, digital competence is consisely defined as the assured and accountable use of Information Society Technology (IST) for work, communication, and leisure. This concise description highlights the importance of digital skills in daily life, including work, free time, and communication. It emphasizes the significance of trust and critical thinking, going beyond technical knowledge and skills. Upon analysing existing frameworks, Janssen and others (2013) identified seven competence areas for digital proficiency. These areas comprise of information management, collaboration, content and knowledge creation, communication and sharing, ethics and responsibility, problem solving and technical operations.

Digital competence is described as the capability to recognise one's own duties and shared rights and obligations. It involves being adaptable when encountering novel technical scenarios, assessing and meticulously electing data and information, efficiently resolving issues, and properly leveraging technological potentials to create collective and shared awareness. The technological dimension necessitates adaptable examination and resolution of issues and recent technological advancements; the cognitive dimension necessitates scrutiny, choice, interpretation and assessment of data and information concerning significance and dependability; and the ethical dimension necessitates beneficial interaction with a duty to oneself and others (Calvani, Fini, & Ranieri, 2010).

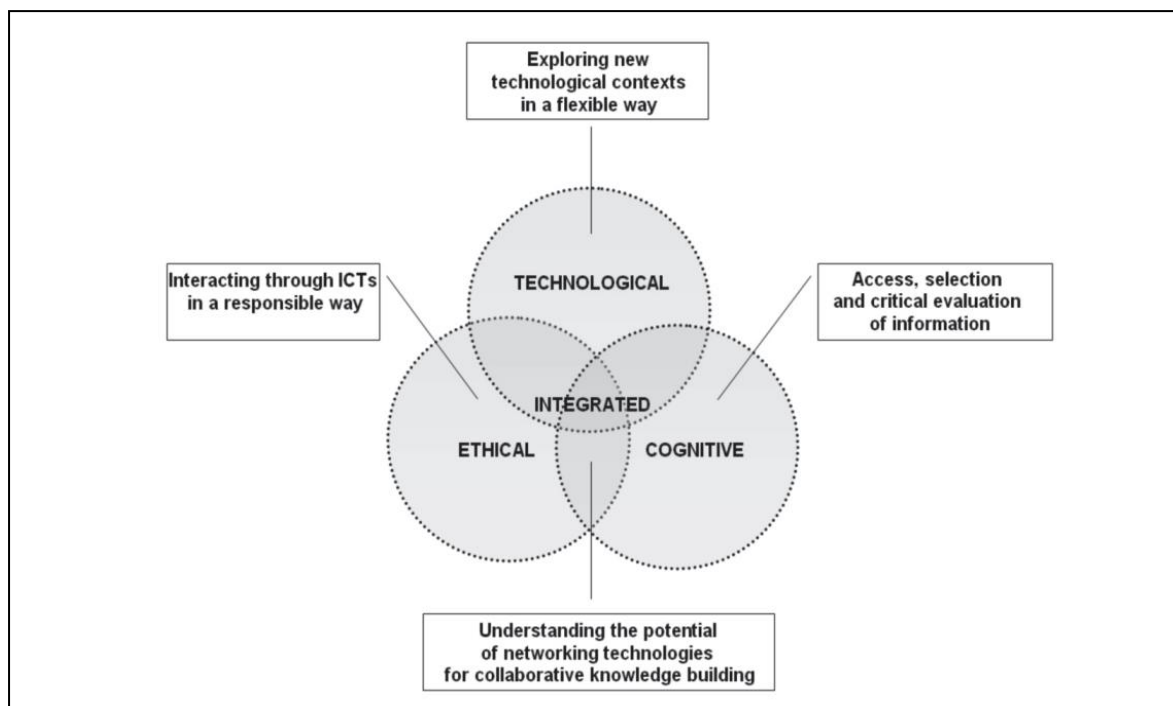


Figure 2.1. Digital Competence Framework

Source : Digital Competence In K-12. Theoretical Models, Assessment Tools and Empirical Research(Calvani et al. 2010,p.187)

Figure 2.1 shows the integration of the technological, informational and ethical dimensions of the digital competence framework.

2.2. Digital Competence and Digital Skills Frameworks

Information about important studies on digital competence and digital skills, which are referenced in many studies, is given below.

- Digital Competence Framework (DigComp)
- European Skills, Competences and Occupations (ESCO)
- The Essential Digital Skills Framework (EDSF)

2.2.1. Digital Competence Framework for Citizens

As a result of the rapid globalisation of the world and the increasing digitisation in the areas of education, training and employment, the European Commission's Joint Research Centre (JRC) published a report entitled European Digital Competence Framework for Citizens (DigComp) in 2013 to explain the concept of digital competence and to improve the digital

competence of citizens. The work presented in this report is based on Digital Competence, which is one of the eight core competences suggested by the European Union for lifelong learning in 2006. The JRC developed DigComp 1.0 after consulting with various stakeholders and policy makers from industries, education, training, employment sectors etc. The project is a result of effective input and consultation with professionals. This report served as a blueprint for formulating strategies and driving digital proficiency initiatives in Europe and its member nations (Vuorikari et al., 2016).

Action plans for the implementation of digital competence were launched in 2010 following the Council Recommendation of 2006. The DigComp reference framework was introduced in 2013 and encompasses 21 competency areas and five principal domains, specifically Information and Data Literacy, Communication and Collaboration, Digital Content Creation, Security, and Problem Solving. Table 1 shows the five main domains and 21 competency areas included in both DigComp 1.0 and the recently published DigComp 2.2 version, as presented by Vuorikari et al. (2022).

Table 2.1. Comparison of competence descriptors in version 1.0 and 2.2

Competence Areas	Competences version 1.0	Competences version 2.2
1.Information and Data Literacy	1.1 Browsing, searching and filtering information 1.2 Evaluating Information 1.3 Storing and retrieving information	1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
2.Communication and Collaboration	2.1 Interacting through technologies 2.2 Sharing information and content 2.3 Engaging in online citizenship 2.4 Collaborating through digital channels 2.5 Netiquette 2.6 Managing digital identity	2.1 Interacting through digital technologies 2.2 Sharing information and content through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
3.Digital Content Creation	3.1 Developing content 3.2 Integrating and re-elaborating 3.3 Copyright and Licences 3.4 Programming	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licences 3.4 Programming

4.Safety	4.1 Protecting devices 4.2 Protecting personal data 4.3 Protecting health 4.4 Protecting the environment	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
5.Problem Solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Innovating and creatively using technology 5.4 Identifying digital competence	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps

Source : (Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G. (2016), pp.14-16; Vuorikari, R., Kluzer, S., Punie, Y. (2022) ,p.4)

Since its publication in 2013, DigComp has had numerous applications in the fields of lifelong learning, education, training, and employment. This report focuses in particular on three main areas:

- instructional planning for education, training, and career;
- policy development and maintenance;
- evaluation and accreditation.

Digcomp has established a digital skills indicator at the EU level for monitoring the digital economy and society throughout Europe. The Europass CV presents another platform for job seekers to evaluate their digital competencies and include them in their CV. The Digital Competence Framework for Consumers, being developed by the JRC and DG Justice and Consumers, aims to empower consumers to effectively and confidently participate in the digital marketplace. A Digital Competence Framework (DigCompTeach) is currently under development for the Directorate-General for Education and Culture within the field of education. This framework is being utilised to introduce new regulations within any environment where digital competence is required (Vuorikari et al.,2016).

Vuorikari and others argue that the DigComp framework is descriptive rather than prescriptive, meaning that it does not present a set of standards or guidelines to follow. Instead, it describes different areas of digital competence that may raise ethical and legal concerns. Therefore, the DigComp model also considers ethical aspects. Additionally, its

descriptive nature enables the design of interventions, such as instruction and curricula that align with the needs of diverse audiences. Using the DigComp framework as a reference point is crucial rather than integrating it into learning activities or measuring students' achievement.

2.2.2. European Skills, Competences and Occupations

European Skills, Competences and Occupations (ESCO)is a multilingual regulation that classifies approximately 3000 professions and 14000 qualifications related to the EU labour market, education and training. It defines these in 25 European languages and provides profiles indicating the connections between occupations, skills, competences and qualifications. ESCO is accessible to all at no cost via an online portal and has been formulated using an open IT format. It was developed by the European Commission with the aim of bridging the divide between the realms of education and training and labour, by facilitating the identification and management of skills, qualifications and competencies in these fields through the introduction of standardised terminology for professions, qualifications, skills and competencies. ESCO, with its multilingual structure, enhances global transparency and cooperation in skills and qualifications (ESCO, 2020).

During ESCO's inception in 2015, the DigComp framework served as one of the assessment tools for competencies and skills. ESCO v1.1 (most recent version) highlights the classifications and descriptions of competencies and skills in line with the five areas and 21 competencies in DigComp 2.0. In some instances, explanatory terms have been added in order to express concepts more clearly and adapt them to the digital world. For instance, the competency "Information and data literacy" has been renamed as "Digital data processing" to simplify its use (Vuorikari et al. 2016). The corresponding qualifications in ESCO and DigComp are illustrated in Table 2.2.

Table 2.2. The mapping of the competence areas of DigComp and ESCO examples

DigComp	ESCO Transversal ICT Skills
Information and data literacy	Digital data –processing
Communication and collaboration	Digital communication
Digital content creation	Content- creation with ICT software
Safety	ICT safety
Problem solving	Problem –solving with ICT tools and hardware

Source : DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model (Vuorikari et al. 2016, p.20)

2.2.3. The Essential Digital Skills Framework

The Essential Digital Skills Framework (EDSF) aims to improve the digital skills of adults. The objectives of the EDSF include the development of the foundational digital skills needed to participate in an increasingly digital world. Created in 2015 by GoON UK, a UK-based not-for-profit organisation, the framework underwent revision in 2018 following a consultation with a steering group comprising technology firms, civil society organisations, banks, and business consortia (International Telecommunication Union (ITU), 2020). The EDSF framework aims to equip individuals with the skills necessary to securely and competently engage with, benefit from and contribute to today's digital landscape while considering the advancements of tomorrow.

It is comprised of five core skill categories consisting of:

- communication,
- information and content utilisation,
- safe online practices,
- problem-solving,
- and online security.

The structure also encompasses fundamental skills for individuals who have limited experience with or do not currently utilise digital technologies. Individuals who obtain these fundamental skills are anticipated to possess the motivation and self-assurance to interact with digital technologies. The diagram presented in Figure 2.2 depicts this scenario.

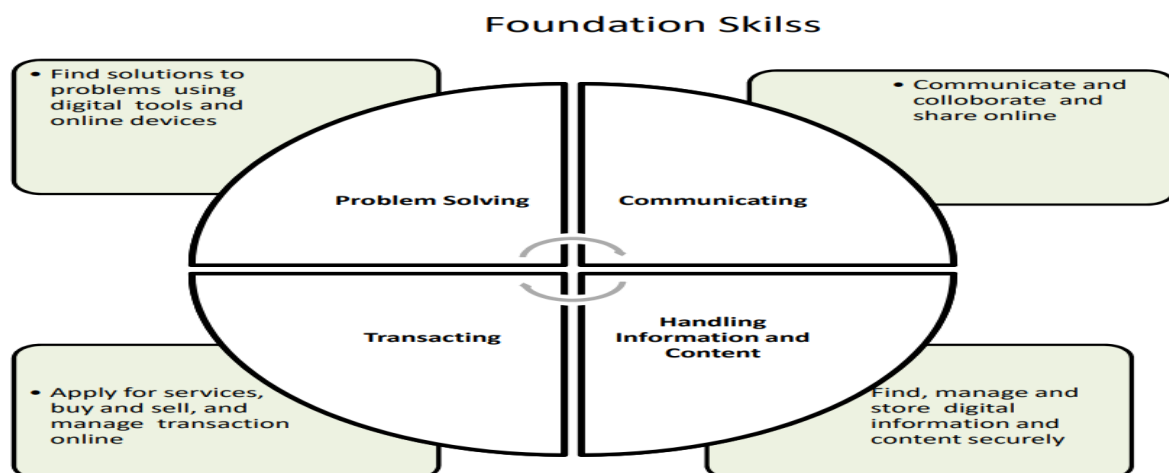


Figure 2.2. Essential Digital Skills-Framework Diagram

Source :Essential Digital Skills Framework (publishing.service.gov.uk)

2.3. ICT and Digital Competence Frameworks Developed for Educational Purposes

The ICT and digital competence frameworks developed for the field of education and educators and examined in our study are as follows;

- Digital Competence Framework for Educators(DigCompEdu)
- UNESCO The ICT Competency Framework for Teachers (ICT CFT) ,
- International Computer and Information Literacy Study
- ISTE Standards for Education Leaders

2.3.1. The European Framework for the Digital Competence of Educators

The European Framework for the Digital Competence of Educators (DigCompEdu) is a framework designed by the JRC to identify digital competencies that are unique to educators by combining national and regional studies. The framework achieves this goal by synthesising national and regional studies, and aims to establish a universal point of reference for member states, regional governments, national and local agencies, as well as educational institutions and both public and private educators. Its primary objective is to aid developers of digital competence models. This framework is intended for educators across all educational levels, from early childhood and adult education to vocational and special needs education, as well as non-formal education. DigCompEdu aims to address the increasing awareness in several member states of career-specific digital competency needs. Its goal is to empower educators to leverage the potential of digital technology for education innovation and improvement.

The DigCompEdu Framework proffers twenty-two core competencies arranged into six sections that ascertain digital competencies that are specific to educators(Redecker,2017).

Area 1. Professional Engagement, is addressed to the larger professional community. It encompasses educators using digital technologies for their own professional growth with pupils, co-workers, parents, and other stakeholders, and for the institution's benefit.

Area 2. Digital Resources covers the essential skills required to efficiently and responsibly use, create, and distribute digital resources for educational purposes.

Area 3. Teaching and Learning focuses on preparing, as well as managing, the utilization of digital technologies in education.

Area 4. Assessment aims to enhance assessment methods through the implementation of digital strategies.

Area 5. Empowering Learners highlights the potential of digital technologies for teaching and learning methods that are centered around the student.

Area 6. Facilitating Learners' Digital Competence outlines pedagogical competences necessary to support students' digital proficiency. Each qualification is accompanied by a concise title and description for reference. Figure 2.3 illustrates these qualifications, which are divided into six categories and a total of 22 core competencies.

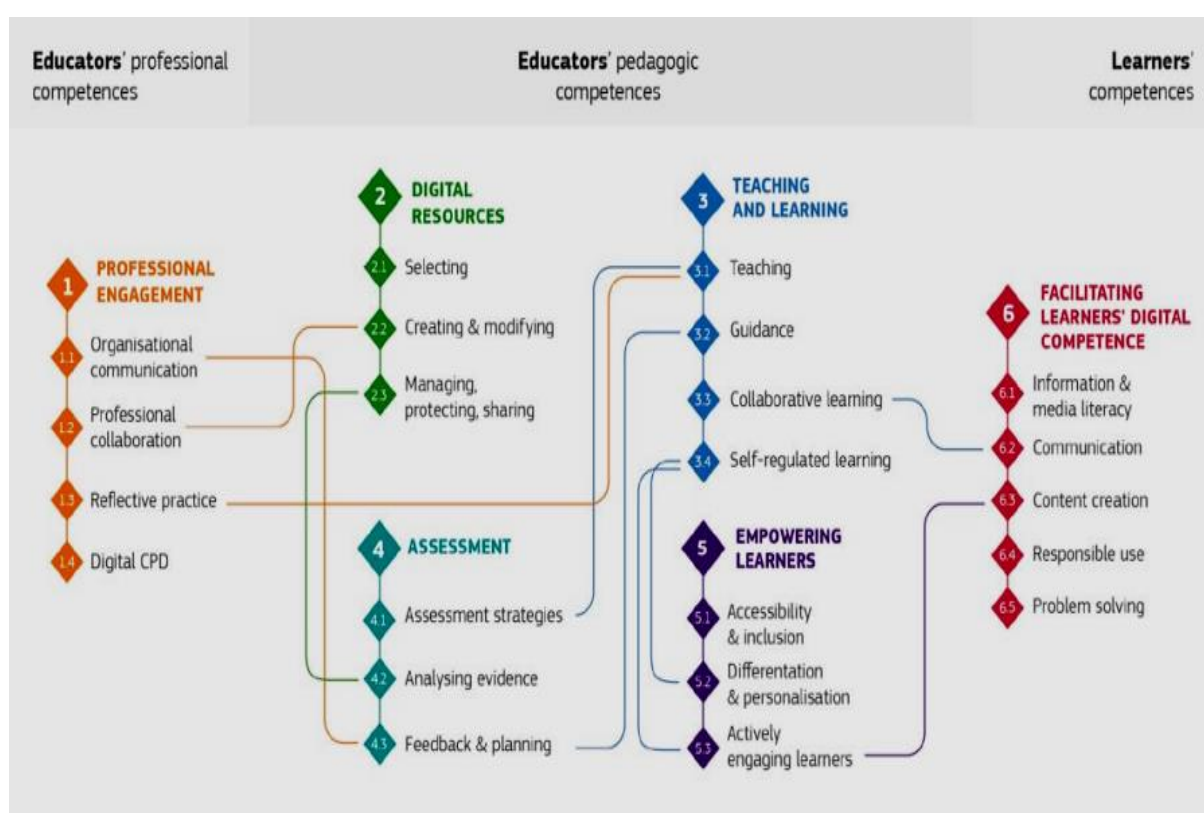


Figure 2.3.DigCompEdu Frameworks

Source :European Framework for the Digital Competence of Educators:DigCompEdu (Redecker, 2017, p.16)

The framework advances a model that assists educators in enhancing their digital competency and determining their current stage. This model outlines the digital proficiency of educators in six distinct stages, presented in ascending order of expertise: Newcomer (A1), Explorer (A2), Integrator (B1), Expert (B2), Leader (C1), and Pioneer (C2). During the Newcomer (A1) and Explorer (A2) phases, educators acquire novel knowledge and acquire fundamental digital competencies. In the subsequent two phases, Integrator(B1) and Leader(B2), educators will

integrate, expand and customize digital applications for wider usage. At the Leader (C1) and Pioneer (C2) levels, which are the highest thresholds, educators will disseminate their knowledge, appraise current practices, and innovate new approaches (Redecker, 2017).

The six different stages of digital competences of educators are summarised in Figure 2.4.

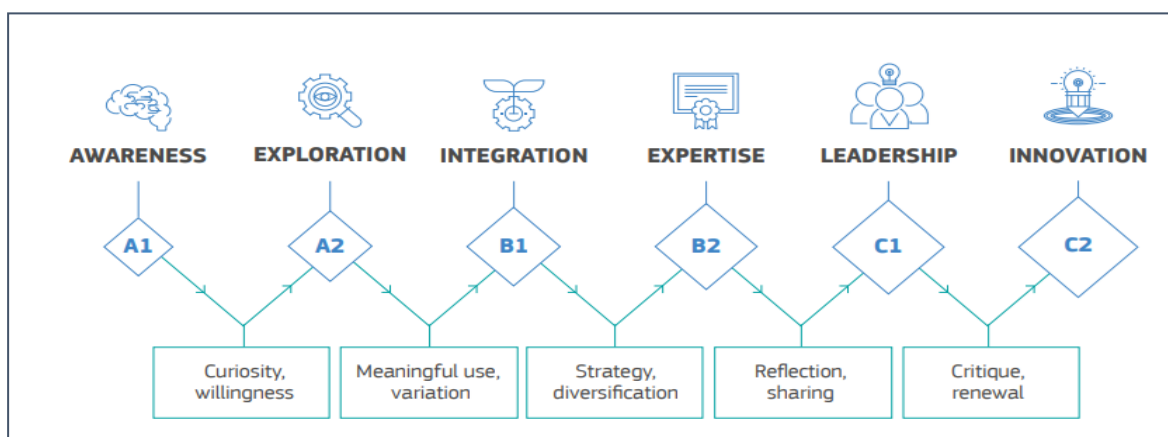


Figure 2.4.DigCompEdu Progression Model

Source: European Framework for the Digital Competence of Educators:DigCompEdu(Redecker, 2017,p.27)

2.3.2. UNESCO The ICT Competency Framework for Teachers

Technology has the potential to provide inventive solutions, allowing students to benefit from lifelong learning opportunities, acquire knowledge and attain achievements, while ensuring their full integration into society. The significance of digital citizenship has increased in recent years. The incorporation of ICT into educational institutions and classrooms has the capability to revolutionize pedagogy and empower students. Therefore, it is imperative for teachers to possess the necessary skills to integrate information and communication technology (ICT) and professional practices to uphold the quality of learning and ensure equal opportunities for all students. Moreover, teachers must employ ICT to direct their students in enhancing their information society skills, including critical thinking, problem-solving, innovative thinking, collaboration, and socio-emotional skills. Notably, investing in ICT will be vital for teachers to receive training and attain continuing professional development. By providing training and continuous support, teachers should enhance their ICT skills and be able to help students develop other relevant skills, particularly their digital competence(UNESCO,2018).

Technology is integral to accomplishing the Sustainable Development Goals (SDGs). Through collaboration with UNESCO, industry leaders, and subject matter experts, the UNESCO ICT Competencies Framework for Teachers (ICT CFT) has been formulated. This worldwide structure recognizes the essential skills needed for successful teaching using ICT. Its initial release dates back to 2008, with updates in 2011 and 2018. In all versions, there are prevalent perspectives on the correlation between education and technology, and suggestions on acquiring expertise by utilising current technology. The structure of ICT CFT is non-discriminatory, being a reaction to recent technological and educational advancements in the sphere of ICT and education. It conforms to the principles of equitable access to information and gender equality in education. The programme investigates the influence of advances in technology, such as artificial intelligence, mobile technologies, Internet of Things, and open educational resources (OER), on education in order to create inclusive information societies.

ICT CFT Version 3 is a framework that directs educators in employing pre-service and in-service digital technologies in both formal and non-formal education systems, ranging from preschool to higher education levels. The framework aims to promote national and institutional goals by establishing an advanced policy and capacity building framework.

ICT CFT version 3 offers a platform for recognising digital competencies and implementing ICT in educational policies, guidelines, curriculum design, pre-service and in-service training. Additionally, it facilitates the ability of educators to adapt and utilise technology. In order to successfully implement the ICT CFT, it is expected that political leaders, authorities responsible for teacher training and in-service professional development, and school principals will work together to establish a supportive environment with strong leadership.

The UNESCO ICT CFT framework outlines 18 ICT qualifications that teachers must possess, alongside 64 key objectives aligned to these qualifications. This framework covers a broad range of competencies, including comprehension of national ICT policies in education, ICT curriculum and assessment strategies, pedagogy, school management and organization, and teacher professional development. (UNESCO,2018)

For an overview of the 18 ICT qualifications in the UNESCO ICT CFT framework, refer to Figure 2.5.

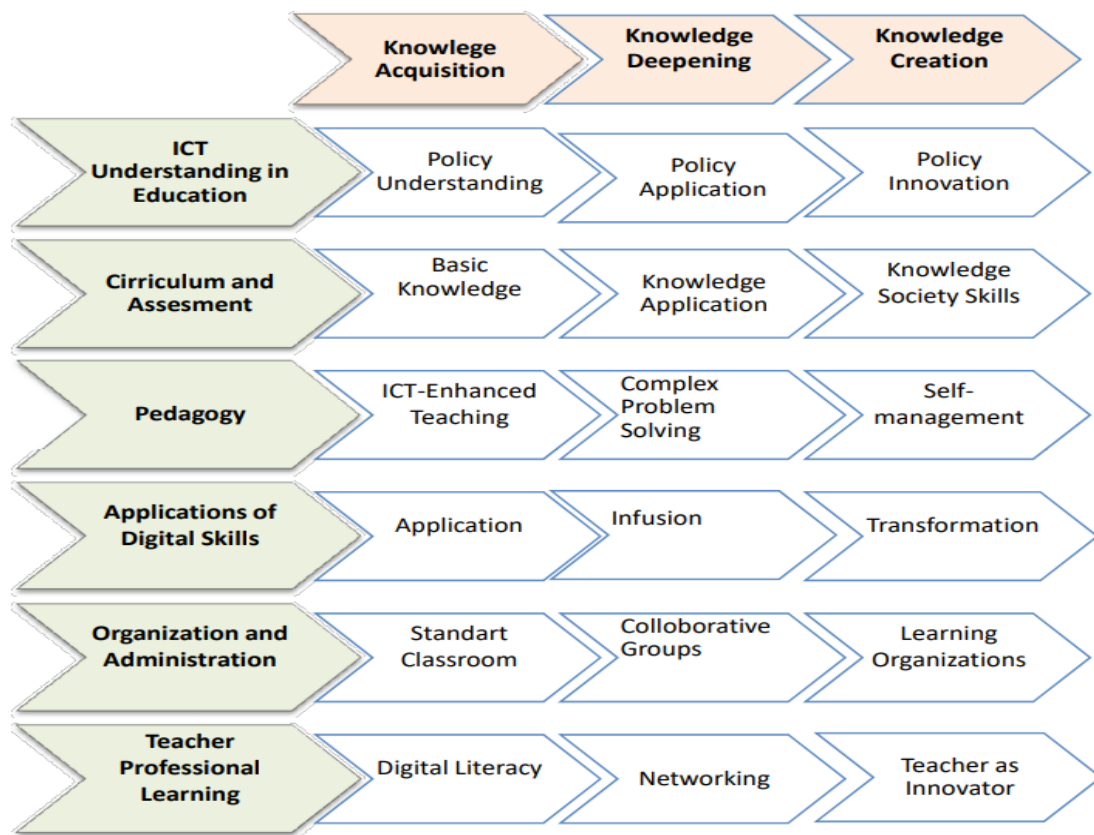


Figure 2.5. The UNESCO ICT Competency Framework for Teachers(ICT CFT)

Source : The UNESCO ICT Competency Framework for Teachers (UNESCO, 2018,p.10)

2.3.3. International Computer and Information Literacy Study

The initial research studies centred on the integration of computer and communication technologies in schools were the Computer Study in Education (COMPED) surveys, conducted in both 1989 and 1992. These surveys were commissioned by the government in order to implement information and communication technology (ICT) into schools and to provide thorough analyses of the use of computers for educational purposes. The International Computer and Information Literacy Study (ICILS) is a subsequent study carried out by the IEA with the same aims as the prior surveys. In this field, the Second Information Technology in Education Study (SITES) carried out Module 1 (1998-1999), Module 2 (2001) and Module 3 (2006) projects. These projects provide updated information pertaining to the provision of computer technology resources in schools and the utilization of said resources within the

educational environment. The rapid advancement in computer and other information technologies has resulted in a transformation of the medium for how young people acquire, create, and distribute information (Fraillon, Schulz, & Ainley, 2013).

The objective of ICILS 2013 is to investigate approaches for enhancing computer and information literacy (CIL) in different countries, with the intention of improving young people's ability to engage in the digital era. In order to attain this objective, the research will assess the accomplishments of students by conducting a genuine, computer-based CIL assessment. This assessment is provided to students in the eighth year of their studies. The study will additionally gather and present data analyses concerning the employment of computers and other digital instruments by students, as well as their viewpoints towards such devices (Fraillon et al. 2013)

The CIL framework is comprised of two components: information collection and management, and information production and exchange. The initial phase encompasses three elements while the subsequent phase incorporates four. The detailed structure can be found in Figure 6. The antecedently discussed definitions of ICT literacy and digital competence share resemblances in regards to comprehension, expertise and abilities. The structure of the CIL framework is visually represented in Figure 6. Upon examination, it will become evident that the CIL framework shares comparable characteristics with the DigComp frameworks (Fraillon et al. 2013).

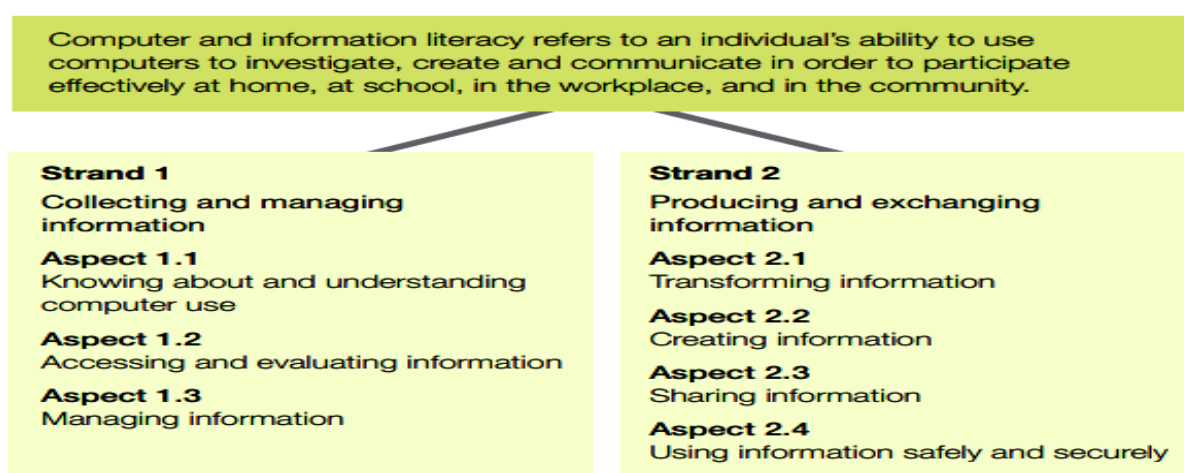


Figure 2.6. Conceptual Structure of the CIL Framework

Source : International Computer and Information Literacy Study: Assessment Framework (Fraillon, Schulz, & Ainley, 2013, p.18)

2.3.4. ISTE Standards for Education Leaders

The ISTE Standards provide extensive guidance for utilising technology in schools globally, to enable proficiency in learning, teaching and leadership within the digital era. These Standards rely on research in educational science and practical know-how. They facilitate the use of technology for learning, which fosters highly efficient, enduring, adaptable and fair learning opportunities for all pupils. The ISTE standards align with the Sustainable Development Goals set forth by UNESCO and are accessible in eight languages. They have been implemented in all 50 states of the US and numerous other countries globally. These standards have undergone extensive research and updates for over two decades, providing evidence-based guidelines for success in technology utilisation for teachers, students, leaders, and coaches alike(ISTE,2023).

The ISTE Standards for educational leaders present a structure that assists in the execution of the ISTE Standards for Students and ISTE Standards for Educators, and navigates digital age learning. This framework for educational leaders' intent is to acquire the necessary knowledge and behaviours to empower teachers and foster an environment conducive to student learning. This section of the Standards addresses topical issues, including equality, digital citizenship, vision, team and system building, constant improvement and professional growth.

Table 2.3.ISTE Standarts for Administrators (ISTE)

Equity and Citizenship	Leaders use technology to increase equity, inclusion, and digital citizenship practices.	a-Ensure all students have skilled teachers who actively use technology to meet student learning needs. b- Ensure all students have access to the technology and connectivity necessary to participate in authentic and engaging learning opportunities. c- Model digital citizenship by critically evaluating online resources, engaging in civil discourse online and using digital tools to contribute to positive social change. d- Cultivate responsible online behavior, including the safe, ethical and legal use of technology
Visionary Planner	Leaders engage others in establishing a vision, strategic plan and ongoing evaluation cycle for transforming learning with technology. Education leaders:	a- Engage education stakeholders in developing and adopting a shared vision for using technology to improve student success, informed by the learning sciences. b- Build on the shared vision by collaboratively creating a strategic plan that articulates how technology will be used to enhance learning. c- Evaluate progress on the strategic plan, make course corrections, measure impact and scale effective approaches for using technology to transform learning. d- Communicate effectively with stakeholders to gather input on the plan, celebrate successes and engage in a continuous improvement cycle.

Empowering Leader	Leaders create a culture where teachers and learners are empowered to use technology in innovative ways to enrich teaching and learning. Education leaders	a-Empower educators to exercise professional agency, build teacher leadership skills and pursue personalized professional learning. b- Build the confidence and competency of educators to put the ISTE Standards for Students and Educators into practice. c- Inspire a culture of innovation and collaboration that allows the time and space to explore and experiment with digital tools. d-Support educators in using technology to advance learning that meets the diverse learning, cultural, and social-emotional needs of individual students. e-Develop learning assessments that provide a personalized, actionable view of student progress in real time.
Systems Designer	Leaders build teams and systems to implement, sustain and continually improve the use of technology to support learning. Education leaders:	a- Lead teams to collaboratively establish robust infrastructure and systems needed to implement the strategic plan. b-Ensure that resources for supporting the effective use of technology for learning are sufficient and scalable to meet future demand. c-Protect privacy and security by ensuring that students and staff observe effective privacy and data management policies. d-Establish partnerships that support the strategic vision, achieve learning priorities and improve operations.
Connected Learner	Leaders model and promote continuous professional learning for themselves and others. Education leaders:	a-Set goals to remain current on emerging technologies for learning, innovations in pedagogy and advancements in the learning sciences. b-Participate regularly in online professional learning networks to collaboratively learn with and mentor other professionals. c- Use technology to regularly engage in reflective practices that support personal and professional growth. d- Develop the skills needed to lead and navigate change, advance systems and promote a mindset of continuous improvement for how technology can improve learning.

Source:<https://iste.org/standards/education-leaders>

2.4. Digitization and Digitalization

The digital revolution has impacted all facets of modern life. It commenced in the mid-twentieth century with cybernetics, mathematical advancements in management and the development of computing hardware. The widespread availability of computers exceeded the initial luxury of ownership by official institutions and private sector organisations. Computers have spread from families, individuals, and small businesses to include young people. The Internet's proliferation has accelerated this process further. The affordability and widespread availability of personal computers (PCs) have been the key drivers behind the digital age. In addition, the low cost and global reach of the internet have made it another crucial axis of this technological revolution (Parlak, 2017).

Catherine Berth sees the invention of the telegraph as a turning point for digitalisation, which has many definitions, but the event that will be accepted as the beginning of digitalisation is the first programmable computer in 1936. Digitisation is not exactly the same as information, it is the transformation of information from one form to another. Digitisation is the process of

making written, oral, and printed (analog) items recordable by computers (Sürer, 2020). Fischman, Santos, & Zheng (2014) define digitisation as the practice of taking content or objects from processes that are primarily physical or analogue and transforming them to become primarily or completely digital. Çizmecı (2020) also provides a definition that supports this definition in his study and defines digitization as the process of converting existing resources such as documents, files, and accessible information into digital form through computer reading. Digitalisation is also about solving problems with new methods, improving business performance and creating remarkable experiences.

Ersöz and Özmen (2020) provide a definition of digitalization as the process of digitising data obtained from various platforms, while digitization is defined as the conversion of analog operations stored in a computer environment into a digitised format. Although "digitalization" and "digitization" are often used interchangeably, these related concepts have distinct meanings. Digitalisation involves the leveraging of digital communication technologies to facilitate various areas of social life. Conversely, digitisation entails the conversion of analogue information into digital formats (Gbadegeshin, 2019). That is, raw information is first digitized and then organized using a set of digital or communication tools. Such a process is at the heart of the transformation from digitization to digitalization.

The distinction between digitalization and traditional methods of acquiring information lies in its reliance on a coding system and high-speed, multi-layered communication. A message with visual content comprises of numerical codes, which place this system at the forefront of facilitating human life (Radmard & Atik, 2019). As a result, the term "digitalization" can be understood from two perspectives. The digital transformation of analog data and the social impact of electronic data processing are the two main factors driving change in society. Digitalisation presents both challenges and opportunities, contributing to significant changes in every facet of society.

2.5. Digital Literacy

The emergence of digital literacy and competence within the past three decades can be attributed to the computerisation of production activities within modern society. Consequently, it has become a crucial matter. The concept of digital literacy was introduced in 2002 by the Educational Testing Service (ETS) in the ICT literacy panel and has since

leaned towards transformational approaches. In this section, ICT literacy denotes the capacity to use communication technologies and tools to access, manage, consolidate, appraise, and generate information in daily existence (Calvani et al. 2010).

Glister, who originated and described the notion of digital literacy, prioritised critical thinking abilities rather than IT skills. Several writers view digital literacy as a stratified and mixed blend of competencies, aptitudes, and knowledge. According to the European Commission's definition of digital literacy, it encompasses the capability to acquire, comprehend, administer, integrate, communicate, scrutinise, establish and distribute secure and suitable information. This encompasses information literacy, computer literacy, media literacy and information and technology literacy proficiencies (Calvani et al. 2012). They propose that digital literacy encompasses five distinct types of literacy: photo-visual literacy, information literacy, branching literacy, socio-emotional literacy, and reproduction literacy. It is important to note that digital literacy extends beyond mere software utilization.

2.6. Digital Transformation

The concept and definition of digital transformation, which differs depending on the context, was first introduced in Springer's publication "Information Systems Research: Relevant Theory and Informed Practice". It encompasses changes initiated and influenced by digital technologies across all aspects of human existence. Westerman, Tannou, Bonnet, Ferraris and McAfee (2012) define digital transformation as the use of data or digital technologies to enhance company performance and explore new business opportunities. The impact of digital transformation is felt across macro and micro processes, organizational structures, and supporting business strategies. Therefore, digital transformation represents a disruptive process of renewal (Machado, Secinaro, Calandra, & Lanzalonga, 2021).

Entering the digital age drives society towards rapid digital transformation. Digitalization has become instrumental in both social and industrial realms due to significant developments. Studies emphasize that digital transformation, as one of the dynamics of Industry 4.0, exerts various effects on social life. Examining the historical progression, the initial industrial revolution was achieved through the creation of the steam engine, followed by the second industrial revolution with the introduction of electricity and the initiation of mass production, the third industrial revolution brought about advances in information and communication

technology and the advancement of automation, and lastly, the fourth industrial revolution occurred with the swift proliferation of digital and autonomous systems (Mert, 2021).

Digital transformation is the gradual and intelligent adoption of digital technologies, processes, and competencies throughout all levels and functions to create cultural, organizational, and functional change within an organization, business, or ecosystem. By using technology, digital transformation creates value and fosters agility and resilience, enabling organizations to adapt to changing conditions. Digital transformation is not simply the adoption of technology, but rather the fundamental redesign of an organization's culture and understanding by leveraging the powerful impact of technology. This approach to transformation is distinct from earlier efforts which concentrated on digitisation and digitalization. Digitisation is the process of converting analog or physical materials into digital formats (e.g. converting paper forms into web forms). Digitalisation, on the other hand, involves the use of digital and information technologies to improve operations or benefit specific localities (Iosad, 2020).

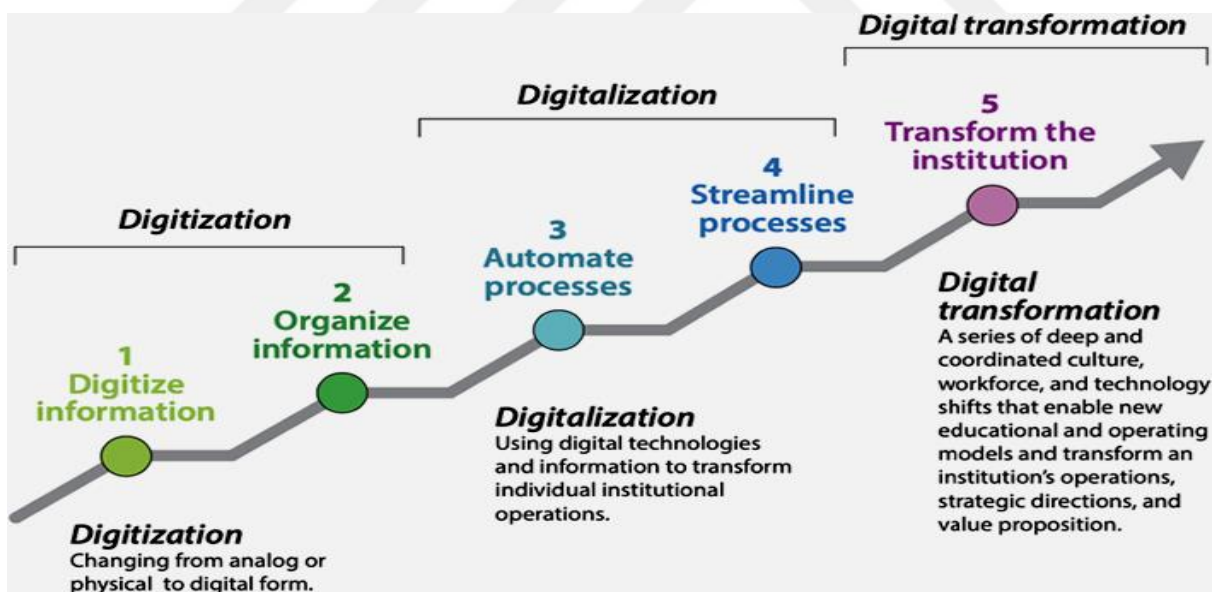


Figure 2.7. 3D of Digital Transformation

Source : Consider the Three Ds When Talking about Digital Transformation | EDUCAUSE Review

When the figure 2.7 is examined, it is seen that in the process of evolving from digitization to digital transformation; digitization of information, organization of information, automation of the process, flow of the process and transformation of the institution.

Iosad (2020) notes that organizations have different visions and values and it is crucial to adapt methods, technologies and strategies to align with these values. Therefore, we can say that there is no clear path to digital transformation.

2.6.1. Digital Transformation in Education and School Management

Education has undergone many renewals in terms of methods, policies and pedagogy, but the pace of change fostered by digitalisation has been transformative and fundamental. Technology has been the foundation for innovation in education. The application of ICT technologies, including printing, computers, media and the Internet, has significantly influenced teaching methods. The fast pace of technology has hastened the transformation of education globally, with schools mobilising to effect fundamental changes across all levels (Gillpatrick, 2020).

This transformation mirrors the widespread overhaul of the business world, with digitalisation catalysing far-reaching transformation in education. These changes embrace multifaceted and intricate themes that extend beyond the confines of schools and classrooms, including but not limited to infrastructure and technological tools. For sustainable change in education and training, a comprehensive approach is required that includes adapting the digital school organization, designing curricula, addressing the competency needs of school managers and staff, and fostering an overall school culture (Rauseo et al. 2023).

ICT has had a significant impact on the global economy and society, and this extends to the education system. As a result, it has brought about changes in both pedagogy and school administration, leading to a transformation in the way education is approached and delivered. The implementation of new technologies has reshaped the school management and culture, with learning, knowledge creation, and innovation at the forefront of this transformation, supported by digitalisation. This necessitates an overhaul of education, notably in school management (Altınay, Dagli, & Altınay, 2016).

With the emergence of the Internet in modern society, access to diverse information has been widely democratised. A plethora of electronic resources, such as encyclopedias, dictionaries, articles, and archives, as well as social networks, blogs, and web pages, are readily at our fingertips. Digital private and public libraries, books, and discussion forums have likewise

become easily accessible with a mere click of a button. While digital transformation, which is fundamentally altering the way we access and share information, is happening at a rapid pace globally, educational institutions are determinedly striving to keep up with this speed (Taşkıran, 2017).

Digitalisation, which extends the concept of space beyond physical boundaries, has rendered education no longer reliant on physical location. Education used to be constrained to school and university premises, but it is no longer confined to such spaces today. With digital education gaining steam and replacing traditional face-to-face learning, it can take place anywhere for an individual. To ensure digital transformation in education is fruitful, we must bear in mind that education is a lifelong process, not limited to the lecture halls or classrooms. Technology bridges all education stakeholders, including teachers, parents, experts, and administrators, by providing a wider and more flexible learning tool than schools offer (Sürer, 2020).

Digitalisation processes are frequently prioritised in education. In recent years, they have become a necessary implementation, particularly in developed countries, and have transformed education's identity. Today, digital elements are widely utilised in a range of educational levels, from pre-school to higher education. Digital education, aimed at delivering prompt, effective and qualified results, is now an integral part of educational processes, yet its cost is still a topic of debate (Radmard & Atik, 2019).

According to Petterson (2017), in order to promote the development of digital competence in education, policy documents should be drafted to realize realistic and adaptable goals and visions at institutional, regional and national levels of the education system. Initially, policies should be adapted to the school level. Educational institutions should build institutional infrastructure to enable their staff to work effectively in digitized schools. Furthermore, school leaders should facilitate goal setting and help staff to recognize their specific needs, promote digital competence throughout the school and include a variety of roles and competencies. Digital leadership should not depend on a single person; instead, it should involve a range of professions and skills at the school level. School leaders ought to take responsibility for enhancing their digital skills and display how these are implemented in their practice.

Developments in technology are causing changes to take place at a faster pace in the management of educational institutions as compared to the past. Those responsible for the management of educational institutions must adjust to prevailing circumstances and shift their attitudes and management practices in order to remain updated and deliver quality management across all spheres (Khumsamart, 2022). The primary stumbling block to organisations achieving a prosperous digital transformation is the inability to motivate and guide individuals in a unified direction. The person who comes into play here is the leaders who have the ability to realise a real digital transformation (Ordu & Nayır, 2021).

Ensuring the participation of school managers in the education and digitalisation processes is crucial for effective digital education. In numerous countries, schools have greater autonomy, with school principals holding key responsibilities for curriculum development and resource utilisation. The failure to satisfy school principals' professional digital development requirements diminishes their ability to coordinate school-wide efforts. It is the responsibility of more stakeholders than just teachers to guarantee the integration of technology in all aspects of the curriculum and cultivate digital proficiency as a key skill. A comprehensive approach to the school is necessary to foster and maintain progress and innovation in teaching and learning. School managers play a vital role in achieving this. Professional standards or competence frameworks for school managers should guarantee the effective pedagogical use of digital technologies. Furthermore, these frameworks ought to be incorporated into the training programmes for school managers and teachers (Eurydice, 2019).

Leadership holds paramount importance in academic institutions. The leader's objective is to guide and supervise individuals appropriately. This facilitates the leader in discharging their responsibilities efficiently, handling adversities and resolving predicaments (Antonopoulou, Halkiopoulou, Barlou, & Beligiannis, 2020). Leadership and management play a crucial role in the process of digital transformation. Effective leadership, strategic planning, and systematic integration of digital technologies in education systems provide the necessary foundation for successful digital transformation. The incorporation of ICT developments into school life, and the experiences of staff and students alike, heavily rely on the policies and preparedness of leadership and management (Timotheou et al. 2023).

Ordu and Nayır (2021) argue that digitalisation and technological advancements, which have become commonplace in all aspects of life, are also impacting education. The authors suggest that it is the role of school managers to lead the way in managing this process of change, incorporating technology to enhance both teaching and learning in the digital era. As leaders in education, school managers must be knowledgeable in the use of digital technology to establish a school culture that is transparent, appealing, and stimulating.

According to Karaköse et al.(2021), one of the foremost factors in guaranteeing digital transformation in educational institutions is the leader's vision. The effectiveness of a leader's strategy in promoting a culture that embraces change and fosters innovation can significantly impact an institution's ability to achieve digital transformation. In addition to identifying the existing cultural drivers of digital transformation, the leader should assess the value that alternative approaches and digital tools may bring to fostering change. In addition to identifying the existing cultural drivers of digital transformation, the leader should assess the value that alternative approaches and digital tools may bring to fostering change. Only leaders who possess the capability to effectively manage all processes within their organisation can actualise genuine digital transformation for their enterprise.

Nalda et al. (2020) assert that the digital transformation is a crucial educational concern for schools. They also stress that digital content plays a vital role in achieving success. School principals hold a decisive influence in this process, as they affect the development of digital skills among both teachers and students and determine the correct matching of learning goals with educational digital resources and their acceptance and use. Principals who are knowledgeable about the educational context and equipped with leadership qualities are crucial in the incorporation of high-quality digital content.

Therefore, digital transformation is imperative in the education sector, as well as in other fields. Educational institutions and their staff play a significant role in fulfilling this requirement. School managers should prioritize the development and application of their digital skills and competencies to effectively lead the digital transformation of their institutions. By utilizing their personal skills and institutional opportunities, they can prepare both teachers and students for the digital future. This task is crucial, thus school leaders must be equipped with the necessary tools to ensure success.

2.6.2. Digital Transformation Process in Education in the World and in Turkey

Instruction tailored to the learning needs of the 19th century persists to this day with only minor alterations. The integration of technology in classrooms has been an established and sustained phenomenon. The inclusion of radio in the 1920s and television post-World War II has created novel approaches to the teaching process. The demand for education has been propelled by the pervasive spread of the internet and digital transformation has been widely discussed (Karaoğlu et al. 2020). (Garrison, 2000) states that geographical distance is no longer a hindrance in gaining access to information, and libraries worldwide are just a 'click' away. Various platforms such as social networks, web pages, discussion forums, participation in distance education, smartphones and mobile devices have made information exchange possible without any limitations on space and time. Technological innovations such as mobile technologies, three-dimensional printers, the Internet of Things (IoT), cloud technology, robotics applications, and artificial intelligence (AI) are driving an unprecedented transformation.

The rapid advancements in technology have influenced the education and training sector, leading to a digital transformation. Pedagogically effective learning experiences, including MOOCs, flipped classrooms, and mobile learning, are now prevalent or have gained increased attention in this process. To enhance our comprehension of the digital revolution in education, let us briefly discuss some of its applications. Karaoğlu et al. (2020) have described several features and applications that facilitate digital transformation in education, such as:

- **Massive Open Online Courses:** These platforms, which are distance education models, are one of the digital transformation applications that do not provide unlimited and open access over the Web and offer learning opportunities to all users without space limitations. Coursera, Khan Academy, edX are examples of the most widely used massive open online platforms. Khan Academy's slogan "Free education for everyone, everywhere, at world standards!" in a sense reflects the purpose of MOOCs.
- **Flipped Classroom:** It is realised by students accessing information from digital media and participating in discussion and application activities under the guidance of the teacher in the classroom.

- **Adaptive Learning Technologies:** This technology, which is used to measure the student level using advanced algorithms, supports the learning environment according to the characteristics of the learner. It helps the learner to progress by measuring the level of knowledge and tries to design the best learning path.
- **Games and Gamification:** Games used in learning environments can contribute to achieving the learning goal or gaining skills by providing a fun interaction environment.
- **Mobile learning:** The technique utilised to facilitate teaching in formal educational settings has the potential to support distance education. One of its primary advantages is its ability to overcome constraints of time and space by providing constant learning access, enabling learning anytime and anywhere.
- **Bring Your Own Device (BYOD):** This system involves teachers and learners utilizing common mobile devices like laptops, tablets, computers, and smartphones in the learning environment. With this approach, students and educators can engage in lessons with the digital device they are accustomed to and familiar with.
- **3D Printing:** The production of physical models designed by students in digital environments using 3D printers has been positively linked to enhanced creativity among students. Additionally, teachers can leverage 3D printing to simplify the teaching and learning process for their disciplines.
- **Artificial Intelligence:** These machines are programmed to exhibit characteristics associated with the human mind, such as learning and problem-solving. They operate using digital data, often called big data, to carry out tasks. This technology can be utilised to create personalised learning experiences in academic settings.
- **Next-Generation Learning Management Systems (Next-Generation LMS):** Cloud-based e-learning models are crucial for digital progress and change in education. Individual learning platforms and open learning networks are two examples of learning models. Next-generation learning management systems can boost the motivation to learn through the use of gamification and social media applications.

The Ministry of National Education (MoNE) in Turkey has undertaken various initiatives for integrating technology into educational settings. In 1952, the Teaching Films Centre was established with the goal of producing audio-visual educational resources for all levels of educational institutions and adult learners via mass media. In 1961, the Teaching Tools

Production Centre was established with the objective of dubbing educational films in Turkish and creating course materials for formal education institutions. The Radio Education Unit was established in 1962, followed by the broadcast of curriculum-based trial trainings for schools and lecture programmes for adults on radio in 1963. "School Radio" commenced broadcasting on TRT channel in 1968, and "School Television" programmes were introduced in 1973. In 1981, the "Literacy Campaign" received support from television programmes, and subsequently the TV School Project was initiated. The following year, the Test Research Bureau adopted the use of computers and information technologies, resulting in its renaming as the Department of Information Processing. In 1992, the General Directorate of Computer Education and Services (BİLGEM) was founded with the aim of consolidating all computer-related activities under one roof. Six years later, in 1998, the General Directorate of Educational Technologies was established and the Open Primary School was subsequently set up within EĞİTEK(Milli Eğitim Bakanlığı [MEB], 2022).

MoNE experienced a major acceleration in educational technologies and digitalisation, propelled by the launch of the Movement for Increasing Opportunities and Improving Technology (FATİH) project in 2010. The aim of the FATİH Project was to enhance the utilisation of information technology tools in education and training procedures to guarantee equal opportunities in education and upgrade technology (MEB, 2022b). To date, the FATİH Project has installed interactive whiteboards in 559,691 classrooms, implemented .infrastructure in 13800 schools, and set up 105000 webcams. During the Covid-19 pandemic, EBA Support Points were established in schools, and a total of 2,148,607 tablets were distributed amongst students and teachers. In various fields and subjects, teacher and manager trainings are still being organised(Milli Eğitim Bakanlığı [MEB], 2023).

In 2012, the Education Informatics Network (EBA), which was developed within the scope of providing and managing educational e-content within the FATİH Project, was established. EBA, which combines the concepts of web-based education and e-learning, was designed as a social education platform and has been continuously developed and updated by taking into account the developing technology and needs since its inauguration. EBA Professional Development Module has been created where teachers can access online courses that will contribute to their personal and professional development, access various digital contents and share their experiences (MEB, 2022b). In addition, as a separate platform on the MoNE

Informatics System, it was introduced and put into service as the Teacher Informatics Network (TIN) on 23 January 2022. ÖBA serves as a digital platform where teachers can receive in-service training services through distance education for their professional development and benefit from virtual libraries. (MEB, 2022a)

MoNE, which is an actor in ensuring the transformation from traditional system to digital in education, has ensured the development of digital applications to manage and improve resource, infrastructure problems, teacher, student and parent relations. For this reason, MEBBİS and e-School systems were established first (Karaoğlu et al. 2020). The digital transformation process in MoNE also includes administrative activities. In 2013, the Document Management System (DYS), a digital platform, was established first in 10 provinces and then in all provinces to facilitate and speed up correspondence between the provincial organisation and the central administration.

2.7.Leadership

Leadership, which has been the focus of definitions, opinions, approaches and theories for centuries and remains relevant in today's changing world due to globalization and current events, holds significant importance. The depth and breadth of the subject is evident from numerous studies that have been conducted. Therefore, this study defines the concept of leadership in general and only examines the approaches of digital leadership and transformational leadership, which serve as the foundation for this research.

According to Mayeski, Gaddy, and Goodwin (1999), leadership can be defined as the individual or manager who is responsible for leading and managing the organization. It has been a well-studied concept for many years. Etymologically, the term "leadership" originates from the root "lead", meaning "to be a pioneer", augmented with the suffix "er", denoting a person who fulfils a role or task, and the suffix "ship", signifying talent, skill, and art. Consequently, leadership can be defined as the competence utilized to determine the direction for a team, guide them towards the objective, and galvanize followers with intrinsic motivation (Bickes and Yılmaz, 2020).

Despite being a subject with a theoretical heritage stemming from the contributions of philosophers like Aristotle, Plato, Machiavelli, Sun Tzu and Confucius, leadership is a phenomenon that has primarily taken place within the context of ancient literature's politics,

government, religion and society. Its first known definition appeared in the Oxford English Dictionary (OED) in 825 AD. The term 'leadership' has its origins in pre-Anglo-Saxon cultures and is derived from the words 'loeda' or 'lithan', meaning to travel. It is included in the OED as 'to take with oneself' or to bring a person or animal to a place. According to the modern definition in 1225 AD in the OED, leadership is defined as the ability to lead actions and thoughts, using persuasion and advice to reach a result and encouraging others to act. (Toor & Ofori, 2008)

Leadership is the ability of an individual to guide and influence the members of a group, directing the group and organisation towards their own objectives. Leaders shape organisational behaviour, influencing various aspects of the work group such as learning, attitude, stress, and motivation, and have the power to impact decisions including performance, absenteeism, and quitting of those who work beneath or follow them (George & Jones, 2012). Gandolfi and Stone (2018) provide a definition of leadership as the purposeful guidance of a group towards a common goal.

According to this definition, leadership involves influencing others through behavior, role relationships and interaction patterns, and is commonly associated with administrative positions. The primary objective of a leader is to provide direction, structure and support for group and organizational activities by exerting deliberate influence over group members. Technical terms are introduced gradually and explained when first used to ensure comprehensibility. The majority of definitions share the characteristic of intentionally applying an effect. The majority of definitions share the characteristic of intentionally applying an effect. However, this effect varies depending on the applicator, intended outcome, method of application, and resultant effects (Yukl, 2013).

According to Yukl (2013), leadership revolves around influencing others through behavior, role relationships, and interaction patterns, often linked to administrative positions. The primary obligation of the leader is to offer guidance, arrangement and backing to group and organizational activities, by exercising conscious influence over the members of the group. Technical terminology is introduced gradually and explained upon first use to ensure it is easily understood. Most definitions feature the deliberate application of an effect, though the precise nature of this effect differs based on the applicator, desired outcome, mode of

Nevertheless, this impact differs based on the implementer, objective, approach, and resulting effects.

2.7.1. Digital Leadership

The transition to an information society began at the end of the 20th century and has rapidly continued into the 21st century. Information-based and information-oriented structures are prioritised. With extraordinary advances in information technology and activities that demand the use of information exponentially increasing, access to information has become ubiquitous across society. Therefore, the shift from an industrial society to an information society occurred in a shorter duration than the transition from an agricultural society to an industrial one (Çizmeci, 2020).

Information technologies, particularly the internet, have facilitated the provision of many novel services for individuals and businesses, such as communication and interaction, employment opportunities, economic growth, enhanced welfare and governance. This is exemplified by various services such as online search engines, social networks, wiki sites, online libraries, blogs, email, e-health, e-government, e-commerce and e-banking (Jesus, Vicente, Bacao, & Oliveira, 2016).

Digital leadership, which theoretically draws on transformational leadership theory, centres on vision and impact to guide followers in a particular environment, much like transformational leadership theory (Özmen, Eriş, & Özer, 2020). It is characterised as the capability of leaders to establish a significant and unambiguous vision for the digitalisation process and apply strategies to achieve that vision (Yusof, Yaakob, & Ibrahim, 2019). Asri & Darma (2020) assert that digital leadership requires the ability to keep pace with rapidly advancing technology, which is crucial for success in the Fourth Industrial Revolution. Although technology is advancing at a remarkable pace in all fields, it is a leader's ability to perceive, confront and leverage these resources that can bring about change. Such a paradigm shift is indispensable and unavoidable, whether in education, finance, banking, industry, sports or the arts.

When examining the definitions of digital leadership, the focus centres on themes of change, incorporating technology and innovation. Some studies suggest that the term digital

leadership, which is used interchangeably with technology leadership, means having a sound knowledge of technology, being innovative and adaptable to change. In accordance with these three aspects, digital leadership may be characterised as the proficient application of technology in managerial operations and the formulation of a creative perspective to produce a resilient and transformative organisational culture (Ordu & Nayır, 2021).

Digital leadership requires the leader to comprehend and assimilate swift alterations and technology, and to equip the organisation and its team, particularly oneself, to meet the demands of the advanced technological era. Digital leaders who can accomplish this are those who can compete, and who bring about a change with regards to information management in line with the organisational vision and actions taken. A digital leader is a person who can be both a leader and an entrepreneurial, enthusiastic and innovative member of the team, and who can create a vision with his team. With the followers he gathers around his goals, he enters the hearts of others and wins their minds. The digital leader adopts a just and transparent approach, shares their earnings, and pursues enterprising and innovative endeavours aligned with the value proposition they create with their followers (Çizmeçi, 2020). Digital leaders who exhibit an enthusiastic and integrative nature are best suited to lead integration initiatives that transform employees (Benitez, Arenas, Castillo, & Esteves, 2022).

The digital leader should possess a comprehensive digital outlook of the future. Those digital leaders who keep up with the progress in leadership technology must exhibit the expertise to inspire, motivate, guide, oversee, and rally others in the age of the fourth industrial revolution (Eryeşil, 2021). Digital leaders possess the ability to adopt a global perspective, are digitally literate, and remain open to innovation and change. They display competence in collaborating with diversified groups across cultures and generations. Cooperation, participation and determination constitute their behavioural characteristics (Yusof et al. 2019).

The integration of digital processes into education has led to a significant rise in the importance of digital competencies for school managers. The conventional duties and responsibilities assumed by school managers have undergone a transformation with the advent of digitalization. In order to be effective in the digital era, school managers are expected to possess digital leadership skills. Administrators who are proficient in digital leadership will be able to adeptly manage digital processes at every stage of school management, generate opportunities for digital transformation in education, leverage digital

processes in communication and facilitate digital collaboration (Yaraş, 2021). According to Zhong (2017), the roles of school managers have shifted from school leadership towards curriculum and technological leadership. Therefore, principals should aid the technological literacy of teachers, help them to be effective in teaching and thus increase the academic success of students through technology. Moreover, enhancing the efficacy of educational reforms necessitates the development of learning and teaching methods, and effective communication and collaboration. Principals need to focus not just on hardware for integrating technology and digital leadership, but also on supplying resources that teachers may use in the classroom.

2.7.2. Transformational Leadership

Northouse (2013) argues that the concept of transformational leadership (Bass & Avolio, 1990; Bass, & Riggio, 2006) was first articulated by Downton and started with MacGregor Burns' study "Leadership" in 1978 which he related the roles of leaders and followers. Burns linked the roles of leaders and followers and defined leaders as individuals who utilise their followers' motivation to accomplish organisational goals. According to Burns (1978), leadership is distinct from power, given it is reliant on meeting the needs of followers. Burns categorized leadership into two distinct groups: transformational and transactional. While transactional leadership pertains to models that concentrate on the exchange event between the leader and the follower, transformational leadership can be portrayed as a process in which an individual increases the level of motivation and morale of both the leader and the followers by relating to others. The transformational leader is considerate of the needs and motives of their followers and assists them in achieving their potential.

Transformational leadership is a style of leadership within the new paradigm. This type of leadership prioritises charisma and emotional components. It is based on the principle of transforming and altering the beliefs of followers through emotions, ethical values, standards, and long-term goals. Transformational leadership also satisfies followers' needs while assessing their motives, thereby treating them as individuals. Transformational leadership, characterised by charismatic and visionary leadership attributes, commonly exerts an influence that motivates its members to surpass their anticipated success levels (Northouse, 2013).

Although transformational leadership and transactional leadership exhibit contrasting features, they are not mutually exclusive practices. In transformational leadership, followers exhibit trust, admiration, close affiliation, and great respect for their leader. Therefore, individuals possess the aspiration to exceed their initial goals. In contrast, the transformational leader facilitates transformation and incentivises members of the organisation by promoting awareness of their obligations, prioritising the best interests of both the organisation and the group, motivating them to overcome personal desires, and rallying the members together. In transactional leadership, the leader's desires may lead to follower conformity. However, this conformity can potentially lead to a change process that is incongruent with the task goals and fails to generate enthusiasm and commitment. Bass argues that while effective leaders employ both leadership styles, transformational leadership engenders increased motivation and performance among members (Yukl, 2013).

Transformational leadership, introduced by Bass and Avolio (1990), is based on idealised influence (charisma), inspirational motivation, intellectual stimulation, and individualised evaluation/interest factors (Dionne et al., 2004; Barling et al., 2000; Judge & Piccolo, 2004) outlines a leadership approach that alters the conduct of subordinates through the standards it establishes, provides a fresh perspective, and promotes revolutionary transformations in the organizational framework (Anderson, 2017).

Four sub-dimensions of transformational leadership (Bass & Avolio, 1990; Bass, & Riggio, 2006; Judge & Piccolo, 2004; Northouse, 2013; Yukl, 2013) :

- ❖ The sub-dimension **idealized influence (charisma)** is closely linked to the extent to which group members adopt the leader due to demonstrating admirable conduct. A charismatic leader employs emotional appeals to followers, reflects his or her beliefs, and takes a stance (Judge & Piccolo, 2004). The idealised impact, portraying the emotional aspect of leadership, depicts leaders who possess robust ethical and moral principles, who are relied upon to make the right decisions, and who inspire their followers to strive for self-improvement and follow in the leader's example. Such leaders have followers' trust, offer a mission and vision, and are held in high regard by their followers (Northouse, 2013).
- ❖ **Inspirational motivation** involves the objective presentation of a compelling and inspiring vision to followers by a leader. Such a leader with this trait has a positive outlook towards achieving future goals, endows the task at hand with significance,

and challenges their followers to perform at a higher level (Judge & Piccolo, 2004). The leader utilises this leadership style to foster team spirit by incorporating expressive symbols and emotional messages to motivate their followers to achieve beyond their personal interests (Northouse, 2013).

- ❖ **Intellectual stimulation** is vital to the leader's approach, whereby they solicit members' opinions, take risks responsibly, and demonstrate a willingness to challenge the odds. These leaders inspire their followers to be imaginative (Judge & Piccolo, 2004). Northouse suggests that Intellectual stimulation encourages members to scrutinize the convictions and principles of both the leader and the organization, while also fostering creativity and innovation.
- ❖ The fourth element, **individualised assessment/interest or personal views**, entails the leader creating a supportive environment by attentively listening to the concerns and requirements of their followers, coaching them, and demonstrating their care for their needs (Judge & Piccolo, 2004; Northouse, 2013).

Transformational leaders typically possess a clear vision and strive to expand and promote it. They encourage their followers and remain receptive to self-improvement, engaging in lifelong learning at every opportunity. They also demonstrate the ability to initiate change within their environment and manage crises effectively. In addition, charisma and exemplary conduct are commonly observed traits of these leaders (Ünsal, 2019).

The transformational leader educates their members on the significance and worth of labour whilst encouraging them to relinquish personal interests in favour of the organisation's betterment. The leader aims to win their trust and enhance their proficiencies so that members are more inclined to participate actively and assume additional duties. The organization provides support and encouragement to its members, enabling them to persist in their endeavours despite obstacles, problems, and fatigue. This, in turn, fosters confidence in the leader and motivates members to exceed their initial performance expectations (Judge & Piccolo, 2004). They demonstrate self-assurance, expertise, eloquence, and ambitious ideals. Transformational leaders serve as influential models for their followers when striving for change. They possess a robust personality with a strong moral code that determines their destiny independently. Their framework prioritises the input from team members and

welcomes opposing viewpoints, resulting in a cohesive bond between themselves and their followers. Followers emulate their leader due to their trust and belief in the ideas they promote. During the transformational process, leaders succeed in working with those around them and foster collaboration by providing reassurance, encouragement and acknowledgement of accomplishment. Ultimately, transformational leadership causes people to feel much better spiritually because they provide great benefits to themselves and the public (Northouse, 2013).

2.7.3.The Relationship Between Digital Leadership and Transformational Leadership

Özmen et al.(2020) argue that digital leadership, which is theoretically based on transformational leadership theory, focuses on the ideals of vision and influence to shape the behaviour of followers in a particular environment. Research confirms a critical and positive impact of transformational leadership on digital leadership. A competent leader who exhibits transformational leadership traits, possesses essential digital skills and is well-equipped to utilise them, has increased opportunities to demonstrate digital leadership and performs more efficiently when undertaking administrative obligations (Antonopoulou et al. 2020).

Brown, Czerniewicz, Huang and Mayi (2016) argue in their study that for digital leadership to be considered successful, transformational success must be achieved and therefore the digital leader must adopt a strategic designer leadership approach. This is crucial because in order to create the desired educational environment, the leader needs to effectively utilize the available resources with appropriate strategic skills. According to the researchers, in order to achieve the competencies required to be a strategic designer, it is necessary to have a combination of knowledge, skills and attitudes.

Leaders recognise digital technologies as innovative methods of communication and organisation. Consequently, digitalisation is recognised as a pivotal force behind organisational success in the future, although the traditional leadership approach does not effectively address the prospects and challenges arising from digitalisation. In the realm of digitalization, which has gained impetus with Industry 4.0, transformational leaders are required to adhere to the requisites of the 4.0 industrial revolution in the digital era, oversee the conversion process, and apply it throughout all stages (Mert, 2021). In this specific context, the concept of digital leadership assumes a prominent role in fulfilling the need for

effective leadership capable of uniting its followers and implementing advancements through information technology (Asri & Darma, 2020; Eryeşil, 2021).

2.8. Studies in the Literature

Firstly, this section discusses foreign studies in the literature, followed by studies conducted in our country. Upon reviewing the literature, there is a lack of research exploring the digital competence capabilities of school managers from a transformational leadership perspective. Therefore, this section includes research on digital leadership, digital competence, and digital skills of school managers, which are investigated using various concepts and frameworks, alongside transformational leadership characteristics of school managers.

2.8.1. Studies in the Field of Digital Competence

Zhong (2017) provided a definition of digital leadership in the study, adhering to ISTE-A criteria, with the aim to examine performance indicators for digital leadership. Digital leadership involves utilizing instructional technologies, such as digital devices, resources, and services, to inspire and guide the digital transformation of schools. It also encompasses fostering and maintaining a digital learning culture, promoting and enhancing technology-based development, enabling and maintaining digital organizational management, and facilitating and managing digital citizenship. The argument is that digital leadership enhances and encourages teaching and learning. Furthermore, the effectiveness of teaching and the integration of technology into teaching are impacted by principals' attitudes, knowledge, and skills regarding technology.

A recent study conducted in Swedish schools by Lindqvist and Pettersson (2019) examined the understanding of digitalization among school leaders and the digital competencies necessary for leading digitalization. The study employed reflective diaries and interviews with school leaders. The study concludes that school leaders view digitalisation as a multifaceted and intricate notion encompassing technical, pedagogical, organisational, and managerial challenges across all institutional tiers. Digitalisation is perceived as a comprehensive and multifarious concept by linking it to such responsibilities as mandated in teachers' and students' digital responsibilities reflected in student products, lesson plans, and curricula. To overcome this challenge, school leaders require digital competencies that encompass pedagogical, technical, organizational, and leadership skills.

The study by Yusof, Yakoob, and Ibrahim (2019) aimed to establish the roles and behaviours of digital leadership among school leaders and devise a measurement system. In this study, the researchers identified nine different functions and 42 corresponding behaviours within two key dimensions: school climate and communication. These dimensions were defined in terms of virtual meetings, virtual conversations, virtual information sharing, virtual document exchanging, virtual interaction, virtual supervising of teaching and learning, virtual monitoring of student performance, virtual enhancement of development and professionalism, and virtual school goals.

During the COVID-19 pandemic, Asio & Bayucca (2021) conducted a descriptive study through an online survey to analyse the digital competence levels of school managers, school availability status, and perceived challenges in providing distance education. The report adheres to academic writing principles, with appropriate structure and terminology, ensuring objectivity, comprehensibility, and logical flow of information. Consistent citation and footnote style are maintained, accompanied by grammatical accuracy and a balanced tone to avoid bias. The study included 36 managers from the province of Bulacan in the Philippines. The collected data were coded and tabulated. The study's findings indicate that the managers displayed varying digital competence characteristics as determined by statistical analysis, and that none of the schools had any distance education plans established for distance education readiness. The primary challenge reported by the participants pertained to internet connectivity, followed by preparation for distance education, competencies, financing, and devices.

García-Vandewalle García, García-Carmona, Trujillo, & Fernández (2023))carried out an investigation employing the Spanish version of the DigCompEdu framework to analyse the self-evaluation status of educators trained in the Faculty of Education and Sports Sciences in the autonomous city of Melilla, Spain. The findings of the study revealed that there was a variation among pre-service teachers in digital competence self-assessment levels and undergraduate-graduate programs. The research findings highlight digital competency gaps in teacher education and the need for higher levels of digital security and skill facilitation. Educators are advised to focus not only on context but also on the technological, educational, and content-based knowledge required for effective teaching. Teachers need to be supported

in acquiring the knowledge, skills and competencies necessary to fulfil their job requirements. To remain up-to-date in their careers, face-to-face or remote training opportunities must be made readily available.

In a recent study conducted by Koniari and Raftoulis (2023) on the special educational needs of students in Greece, 174 principals from private secondary schools participated. The study concludes that school leaders possess the necessary digital competence for school management, and their digital competencies facilitate leadership by saving time and reducing document volume, thereby enabling easy access to the digital world.

Andersson (2023) carried out a study involving 96 school leaders from K-12 schools across all levels in three municipalities in Sweden. The school leaders who participated in the group interviews had 5-20 years of work experience and four school leaders from each municipality, representing different school levels, participated in each group interview. The participants were interviewed in groups and surveys were conducted. Thematic analysis was performed to analyze the research data. In this study, school leaders define the process of digitalisation as involving the enhancement of teachers' digital competence, access to hardware and software, and the development of a shared culture. The results indicate that clear directives from school leaders facilitate collaboration among teachers and that adequate time promotes digitalisation in education, whilst highlighting that inadequate resources and support inhibit progress. The author highlights the significance of school leaders in the digitisation of K-12 schools, stressing the need for these leaders to possess digital competence to effectively oversee the digitisation process.

Aksal (2015)'s study, "Are Headmasters Digital Leaders in School Culture?" investigates the perspective of managers on digital leadership. In order to understand the differences between conventional and digital leadership, metaphorical meanings were used to help leaders. The study concludes that school leaders utilise digital tools and integrate technology in the learning process, with an awareness of the significance of adapting to the digital age and embracing digital leadership.

Altınay, Dagliand Altınay (2016) conducted a qualitative investigation to assess the significance of technology and the effectiveness of symbols, rituals, and values in rural

educational establishments. Reflective reports were collected to comprehend the awareness of digital transformation and readability among school managers during this investigation conducted in Northern Cyprus. The conclusions drawn from this research indicate that school principals are cognizant of the employment of digital and technological opportunities.

Şahin, Avcı and Anık (2020) undertook research in which they investigated the perceptions of digital leadership through metaphorical analysis by managers and teachers working in official educational institutions. The findings of the study highlighted the various dimensions of digital leadership including transformational, administrative, and servant dimensions, in addition to the systematism, versatility, and abstraction aspects. Upon analysing the research data, all the metaphors created by educators and managers were found to be associated with various facets of digital leadership. Additionally, it has been determined that rather than focusing on one's administrative position, the digital leader must emphasise their opinions, capabilities, and guidance in the digital era to effect a transformation.

Beytekin and Çiğdem (2020) designed a qualitative case study in which they interpreted the data they received from eight teachers with semi-structured interview forms by thematic content analysis method, and according to the opinions of the teachers, they aimed to explore the digital organizational competencies of secondary school managers from the context of Industry 4.0. This study identifies the themes of visionary innovation, networking, digital intelligence, talent acquisition through use of digital platforms, chaos management, coordination and bidirectionality. These themes were found through an analysis of the data. The study's findings revealed that secondary school managers displayed visionary behaviour that was innovative in nature and readily adapted to innovation. Additionally, concerning networking, the managers expressed optimism regarding the progress of interpersonal skills and digital competence development. It is understood that managers seldom instruct teachers to attend in-service training and instead, they tend towards a democratic management approach in chaos management, which is concomitant with their adherence to regulations. The study indicates that managers face limitations when they take the initiative, or teachers may have reservations about facing sanctions when they take the initiative.

2.8.2. Studies in the Field of Transformational Leadership

Keung and Rockinson-Szapkiw (2013) conducted a study to investigate any potential correlation between intelligence factors and transformational leadership in the context of international school leadership. The study involved 193 managers, including school principals, vice principals, school leaders, and department heads, from 90 different countries. These managers were officially appointed by their respective schools and held leadership positions. The research team performed various regression analyses to establish whether cultural intelligence elements forecast transformational leadership traits. The team arrived at the conclusion that there exists a notable and positive correlation between cultural intelligence and transformational leadership. The researchers highlighted that behavioral cultural intelligence and cognitive cultural intelligence hold greater weight in the prediction of transformational leadership.

Ruloff and Petko (2021) conducted a qualitative study through interviews with nine high school principals, concluding that principals have shifted towards student-centered teaching by integrating technology into their curriculum. The study revealed significant contrasts between leadership processes and concluded that the principal following transformational leadership demonstrated a greater degree of rapid and comprehensive changes than those following transactional leadership. It is postulated that transformational leadership is notable for its clear emphasis on educational objectives rather than digital technology tools.

Schmitz, Antonietti, Consoli, Cattaneo, Gonon, and Petko(2023) carried out an inquiry involving 2247 senior secondary school educators in Switzerland to ascertain whether leadership practices of school principals aid teachers in utilizing digital technologies in such a way as to foster students' involvement in intellectually challenging exercises within the class. The research relies on questionnaires and applies multilevel and structural equation modeling. The study concluded that transformational leadership has a clear and substantial impact on teachers' beliefs concerning digital technology and teaching with such technologies, the digital infrastructure of schools, and the technical and professional skills of teachers. The research findings suggest that the adoption of transformational leadership strategies by school principals can play a crucial role in supporting key teachers responsible for integrating technology into the classroom.

Çelik (2010) conducted a study with 400 school managers to explore the relationship between transformational leadership characteristics and self-consciousness competencies. The findings suggest that an increase in self-consciousness competencies positively correlates with transformational leadership traits. As a result of the research, it was seen that there was a positive and significant relationship between managers' transformational leadership characteristics and self-consciousness competencies, but it was determined that there was no significant difference according to demographic variables. Male managers had a higher mean score than their female counterparts, and principals had a higher mean score than vice principals. Additionally, managers working in secondary education scored higher than those working in primary education, and those with high seniority scored higher than those with low seniority. However, no significant difference was found in the transformational leadership characteristics of the managers according to their graduation status.

In her Master's study, Kuğu(2019) analysed public and private kindergartens in Istanbul as the research population and observed 147 managers from these schools as the sample. The objective of the study was to investigate the correlation between transformational leadership approach and problem-solving competence of managers employed in public and private kindergartens. The study aimed to investigate whether demographic variables have any impact on the transformational leadership styles and problem-solving skills of managers. Upon analysis of managers working in kindergartens based on demographic variables like age, gender, seniority, and graduation status, no significant difference in transformational leadership styles was observed. A comparable issue has emerged concerning problem-solving abilities. Therefore, researchers found a moderately significant adverse correlation between the transformational leadership styles of preschool education managers and their problem-solving skills. The researcher suggests that further investigation is required on the transformational leadership model and its impact on problem-solving skills during the initial years of management.

Kahya (2020) conducted a quantitative study in which school managers utilized the relational survey model to investigate the effects of transformational leadership behaviours on teacher motivation. The study aimed to analyse whether demographic variables like gender, seniority, and marital status, as well as working time and school type, have an impact on the relationship between educators and managers, according to teachers' opinions. The study

comprised 393 teachers who were selected through simple random sampling from public schools located in the four central districts of Antalya. Based on the teachers' feedback, there was a positive and significantly weak association between the motivation levels of teachers and the transformational leadership behaviors of education managers.

Argon and Ertürk (2021) conducted a case study to examine the transformational leadership characteristics and behaviours of school managers, based on the opinions of teachers. The study was conducted during the 2020-2021 academic year and included 32 teachers from Yeniçağa district in the Bolu province. Data was collected through semi-structured interviews and analysed using a descriptive method. Upon analysis of the research findings, school managers were identified as having a prominent role in the idealised impact aspect of transformational leadership. Consequently, the study's authors recommend that school managers adopt innovative and change-oriented leadership styles that provide motivation, inspiration, support, and guidance to teachers.

3. RESEARCH METHOD

In this section, information about the model of the research, sample group, data collection tools and data analysis methods are presented.

3.1. Research Model and Hypotheses

The research is a descriptive study in the survey model, which is one of the quantitative research methods. Karasar (2012) describes survey models as research approaches aimed at describing a situation that has existed in the past or is still existing. The person, object or event that is the subject of the research is attempted to be defined in its current form within its own conditions. In this study, the digital competence and transformational leadership skills of school managers were attempted to be defined in their current state.

In this context , the aim of this study is to assess the digital competencies and transformational leadership of school managers. The research model of this study, which was conducted to assess the digital competencies of school managers based ono various variables and to examine the relationship between digital competencies and transformational leadership, is presented in Figure 3.1.

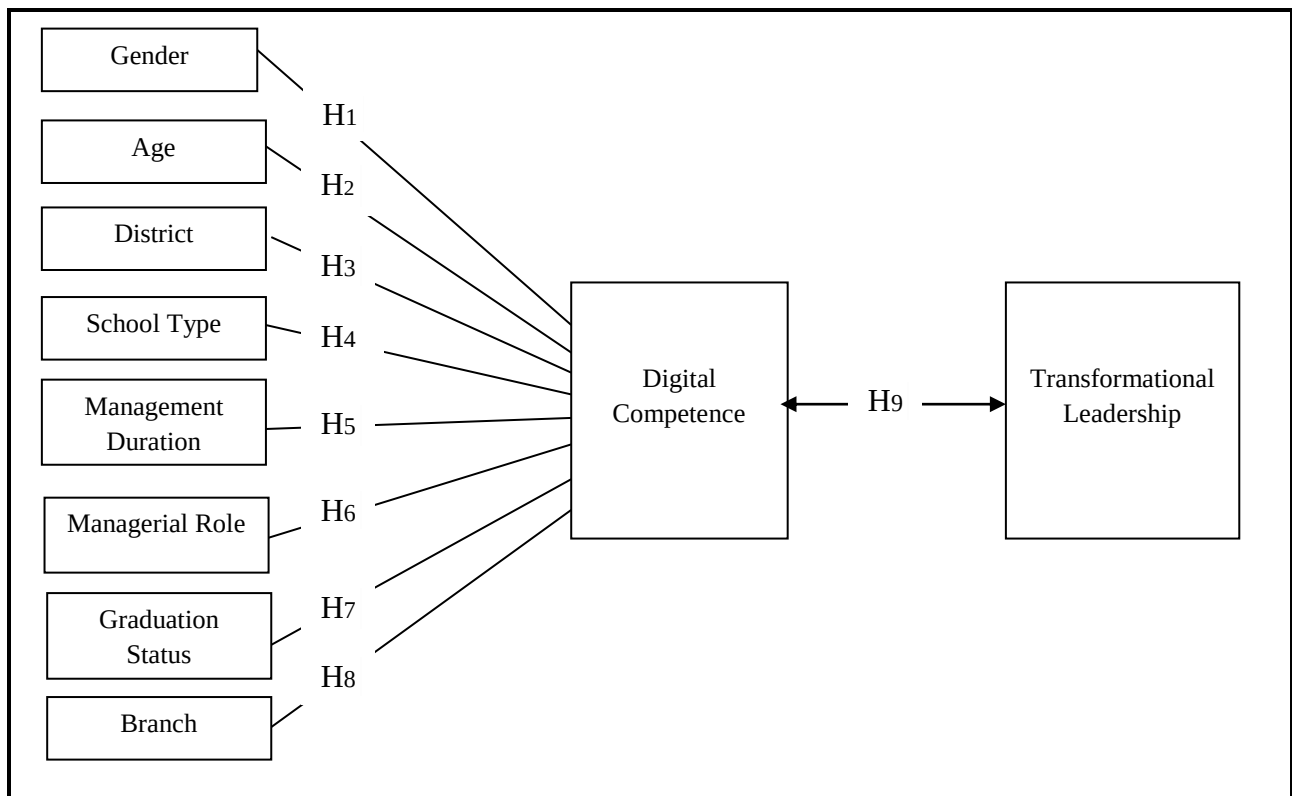


Figure 3.1.The Research Model

The study examined whether there was a significant difference between the scores of the digital competence test and the variables. Hypotheses testing was conducted, and the acceptability of the hypotheses was tested.

Hypotheses of the study:

H0: There is no significant difference in digital competence levels of school managers based on gender.

H1: There is a significant difference in digital competence levels of school managers based on gender.

H0: There is no significant difference in digital competence levels of school managers based on age.

H2: There is a significant difference in digital competence levels of school managers based on age.

H0 : No significant difference exists between the digital competence levels of school managers and the district where they work.

H3 : A significant difference exists between the digital competence levels of school managers and district where they work.

H0 : No significant difference exists between the digital competence levels of school managers and the type of school where they work .

H4 : There exists a noteworthy difference between the level of digital competence of school managers and the type of school they work .

H0: There is no significant difference between school managers' digital competence levels and their management duration.

H5: There is a significant difference between school managers' digital competence levels and their management duration.

H0: No significant difference exists between school managers' digital competence levels and their managerial roles.

H6 - A significant difference exists between school managers' digital competence levels and their managerial roles.

H0: No significant difference exists between school managers' digital competence levels and their educational status.

H7: A significant difference exists between school managers' digital competence levels and their educational status.

H0: There is no significant difference in digital competence levels among school managers across branches.

H8: There is a significant difference in digital competence levels among school managers across branches.

H0: There is no significant relationship between the transformational leadership skills of school managers and their level of digital competence.

H9 : There is a significant relationship between the transformational leadership skills of school managers and the level of their digital competence.

3.2. Research Universe and Sample

The research population consists of public educational institutions in Adana province, and the sample group consists of school managers working in public schools in 2022-2023 academic year. The convenience sampling method was used to collect the data. Although this method is one of the least desirable methods, it can be preferred because it is generally easy and quick to access the participants and saves time and cost for the researcher (Patton, 2002; Büyüköztürk, Kılıççakmak, Akgün, Karadeniz, & Demirel, 2018). The study was conducted by quickly delivering the questionnaire forms, which were created on Google forms , to school managers via email or Whatsapp. Participation in the study was voluntary, and a declaration of voluntariness was presented to the participants. 395 participants took part in the study, and the data collected was transferred to Microsoft Excel, with the information of four participants who provided incorrect or incomplete information removed from the study. A total of 391 school managers participated in the study. The data obtained were analysed using the SPSS 26.0 package and the reliability analyses of the scales were carried out using the Cronbach's alpha reliability coefficient.

3.3. Data Collection Tools

The research was conducted as a descriptive study in the survey model from quantitative research methods. In the study, school managers' views on digital competence and transformational leadership were tried to be determined as they exist. In this study, a questionnaire form consisting of three parts was used as a data collection tool. In the first part, the "Teacher Digital Competence Questionnaire" developed in the study titled "Digital Competences of Teachers" published by (Gümüş, 2021) was used. The questionnaire covers six dimensions of digital competence ("information and data literacy", "communication and

collaboration", "digital content creation", "security", "problem solving" and "ethics") and consists of 46 items. In the second part of the questionnaire, the English version of the short transformational leadership scale consisting of eight items developed by (Berger, Romeo, Guardia, Baldó, & Soria, 2012) for their study titled "Psychometric Properties of the Spanish Human System Audit Short-Scale of Transformational Leadership" was used. The items in the scale were translated into Turkish and adapted for managers. A validity test was applied for the scale. In the first two parts of the questionnaire, a 5-point Likert-type scale was used for each item from 1 (Strongly disagree) to 5 (Strongly agree). In the last part of the questionnaire, a Personal Information Form was used in which demographic information such as age and gender of the participants and characteristics such as branch, school type, manager role were asked.

3.4. Data Analyses Methods

The research data was analysed using the statistical software SPSS 26. For the validity study, we conducted exploratory factor analyses and calculated the Cronbach Alpha coefficient for reliability studies. Based on the results of the validity analysis, the item variances and factor loads of the scales were determined, and the unnecessary items were removed from the test. Descriptive statistics were computed, including frequency, percentage, mean, and standard deviation. The data's normality was assessed by using the Kolmogorov-Smirnov test. Nonparametric tests were employed since the data did not follow a normal distribution. Digital competence scores were examined according to various variables using the Mann Whitney U and Kruskal Wallis tests. A Spearman correlation test was conducted to investigate whether a correlation exists between the scores of digital competence and transformational leadership.

4. ANALYSES AND RESULTS

4.1. Analysing The Demographic Variables of the Participants

Table 4.1 presents the demographic data of the school managers who took part in the study.

Table 4.1.Demographic frequencies of the participants

Variables		f	%
Gender	Male	281	71,9
	Female	110	28,1
	Total	391	100
Age	43-57 yearsold	185	47,3
	36-42 yearsold	121	30,9
	25-35 yearsold	77	19,7
	57 yearsoldandolder	8	2
	Total	391	100
Districts	Yüreğir	133	34
	Seyhan	80	20,5
	Rural	65	16,6
	Çukurova	62	15,9
	Sarıçam	51	13
	Total	391	100
School Types	High Scool	153	39,1
	Secondary School	108	27,6
	Primary School	79	20,2
	Kindergarten (Preschool)	27	6,9
	OtherEducationalInstitutions	24	6,1
	Total	391	100
Management Period	6-10 years	117	29,9
	1-5 years	114	29,2
	11-15 years	57	14,6
	0-1 years	52	13,3
	16 yearsandabove	51	13
	Total	391	100
Managerial Role	AssistantPrincipal	236	60,4
	School Principal	141	36,1
	ChiefAssistant	14	3,6
	Total	391	100

Graduation Status	Bachelor's Degree	222	56,8
	Postgraduate (Master or Doctorate)	164	41,9
	Other Graduation Degree	5	1,3
	Total	391	100
Branch	Primary School Teaching	76	19,4
	Turkish- Turkish Language and Literature	50	12,8
	Social Studies (History-Geography)	43	11
	Maths	37	9,5
	Pre-School Teaching	30	7,7
	Science (Physics-Chemistry-Biology)	29	7,4
	Foreign Languages (German, English, Arabic,...)	29	7,4
	Vocational High School Field Teaching	21	5,4
	Physical Education and Sports	16	4,1
	Other Branches	16	4,1
	Information Technologies	12	3,1
	Religious Culture and Moral Knowledge	12	3,1
	School Counseling	9	2,3
	Visual Arts	5	1,3
	Philosophy- Philosophy Group	3	0,8
	Imam Hatip Vocational Teaching	3	0,8
	Total	391	100

Looking at Table 4.1 , 71.9% of the participants were male managers and 28.1% were female managers. A total of 391 school managers participated in the study, of which 281 were male and 110 were female.

When analysing the data with regard to the variable of age, it was found that the group with the highest participation in the study were the managers aged 43-57 (47%) with 185 participants. The age group with the highest number of participants was the 36-45 age group with 121 participants (30.9%), followed by the 25-35 age group with 77 participants (19.7%). The lowest participation was in the age group 57 and over, with only 8 participants.

Upon examining Table 4.1, it becomes apparent that Yüreğir district has the highest manager participation rate at 34%, while Sarıçam district has the lowest at 13%. The rate of managers from rural districts, excluding the four central districts, is 16.6%.

In terms of school type, the highest participation was in secondary schools with 153 managers, while other educational institutions (such as guidance research centres, public education directorates or special education schools) had the lowest participation with only 24 individuals. 77 managers from primary schools, 108 from secondary schools and 27 from nursery schools participated in the study. The highest participation rate was 39% from upper secondary schools, while the lowest was 6.1% from other school groups.

The analysis of Table 4.1 shows that 29.9% of the 391 participating managers had 6-10 years of administrative seniority. Managers with 16 years or more seniority had the lowest participation rate at 13%.

Looking at seniority, it is clear that a significant proportion of the participants held assistant head positions. The participation rate of assistant principal was 60.4%. While 36.1% of the participating managers were school principals, only a limited number of chief assistants were included in the study.

Looking at the educational status of the participating managers, more than half of them had a bachelor's degree (56.8%), while 41.9% had a master's or doctoral degree. A small proportion of managers were graduates, accounting for only 1.3% of the sample.

An analysis of the sectors of the managers who took part in the study showed that primary school teachers had the highest participation rate at 19.4%. This was followed by managers in the fields of Turkish and Turkish literature with a rate of 12.8%. On the other hand, the fields of philosophy and Imam Hatip teaching had the lowest participation rate of 0.8%.

4.2.Validity Studies for the Digital Competence and Transformational Leadership Scales

Exploratory factor analysis (EFA) was conducted to determine the construct validity of the digital competence scale and to reveal its factor structure. Principal components and Varimax, one of the direct vertical rotation methods, were used for this purpose. First, the Kaiser-Meyer-Olkin (KMO) sampling adequacy value was found to be 0.978, indicating that the sample size was sufficient for EFA. Field (2009: 647) states that this value is sufficient if it is greater than 50%, and this value is considered excellent if it is greater than 0.90. In the KMO values calculated for each item, the lowest value was found to be 0.741, confirming that the sample was sufficient. In addition, as a result of the Barlett's test, $\chi^2(703) = 24.124$; p

<0.05 and this result showed that the correlation between the items was large enough for EFA. The table of KMO values is shown in Table 4.2below.

Table 4.2. KMO and Barlett's test results of the digital competence scale

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,978
	Approx. Chi-Square	24124,689
Bartlett's Test of Sphericity	df	703
	Sig.	.00

Table 4.2 presents the distribution and factor loadings of the items. Following EFA, it was determined that the Digital Competence Test comprises of 38 items which are organized into four sub-dimensions resulting in a four-factor structure. These four factors collectively account for 84.617% of the total variance, thereby endorsing the validity of the Digital Competence Scale (DCS). The first sub-dimensions explains 72.49% of the variance, second sub-dimension 78.33% of the variance, third sub-dimension 82.06% of variance and fourth sub-dimension explains 84.61% of the variance respectively.

Table 4.3. Exploratory factor analysis results of the digital competence scale

Item Numbers	Items	Explained Variance	Item Total Correlation Value
Factor 1 : Information and Data Literacy, Problem Solving		27.547	
11	I can find data, information and content by searching in digital environments.		.646
12	I can filter what I need from the data, information and content I access in digital environments.		.679
13	I can use different search strategies to find the most appropriate data, information and content in digital environments.		.683
14	I can help my colleagues to browse, search and filter data, information and content.		.667
15	I can interpret the data, information and content I access in digital environments.		.772

16	I can judge the reliability of data, information and content sources I access in digital environments.	.667
17	I can compare the data, information and content I access in digital environments in different sources.	.672
18	I can share the data, information and content I access in digital environments when necessary.	.680
19	I can determine how to store data, information and content in digital environments.	.664
20	I can create different information by using digital environments creatively.	.620
21	I can use different tools and technologies to create innovative processes and products in the digital environment.	.630
23	I am aware of the ways in which my digital competence needs to be developed.	.645
24	I can tell where to look for opportunities to improve my digital competence.	.618
25	I can follow current developments to overcome my deficiencies in digital competence.	.574

Factor 2 : Safety

2.221

1	I can take precautions against risks and threats in digital environments.	.736
2	I can help my colleagues to ensure safety and privacy in digital environments.	.756
3	I can choose appropriate ways to protect my personal data and privacy in digital environments.	.683
4	I can interpret privacy policy statements about how personal data is used in digital services.	.612
5	I can use information to protect myself and others from dangers in digital environments.	.699
6	I can share information that can protect myself and others from dangers in digital environment.	.680
7	I can protect myself and others against cyberbullying (attack) in digital environments.	.730
8	I can help my colleagues to recognise threats in digital environments.	.732

9	I can tell ways to protect myself from the negative effects of digital technologies.	.728
10	I can help my colleagues to protect themselves from the negative effects of digital technologies.	.701
Factor 3: Digital Content Creation - Communication and Collaboration		1.418
29	I can define copyright rules and licences of data, information and content in digital environments.	.741
30	I can apply copyright rules and licences of data, information and content in digital environments.	.764
31	I can produce solutions for copyright and licence applications of data, information and content in digital environments.	.809
32	I can help my colleagues with copyright and licensing practices of data, information and content in digital environments.	.820
33	I can design the most appropriate programme to solve a problem and perform a specific task in a digital environment.	.850
34	I can develop the most appropriate programme to solve a problem and perform a specific task in a digital environment.	.824
35	I can help my colleagues to share information through digital technologies.	.624
36	I can offer different services to other people (my students, colleagues, etc.) to participate in society through digital technologies.	.627
37	I can help my colleagues with issues related to digital citizenship.	.626
Factor 4 : Ethics		.969
42	I act in accordance with ethical principles when using or disseminating content belonging to others in the digital environment.	.798
43	I act in accordance with ethical principles when using digital technologies.	.804
44	I can act in accordance with ethical principles while interacting in the digital environment.	.780
45	I pay attention to ethical principles when determining communication strategies in the digital environment.	.767
46	I respect the digital etiquette of different audiences, cultures and generations.	.771
Total		84.617

As can be seen in Table 4.3 the digital competence scale consists of four factors and 38 items, with the problem solving dimension combined under the information and data literacy dimension, and the communication and collaboration dimension combined under the digital content creation dimension. Thus, the digital leadership scale has become a four-dimensional scale with the dimensions of information and data literacy-problem solving, security, digital content creation-communication and collaboration, and ethics. The DigComp 2.0 framework by Vuorikari et al. (2016), on which Gümüş (2021) relied in the process of developing the scale, states that due to the artificial division of fields and competencies in the digital competence framework, there may be many overlaps and intersections between fields and competencies, and that the most intersecting field is problem solving, which may be present in all fields.

Exploratory factor analysis was performed to assess the structural validity of the Transformational Leadership Scale (TLS) in conjunction with the Digital Competence Scale (DCS).

Table 4.4. KMO and Barlett's test results for the transformational leadership scale

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.958
Approx. Chi-Square		4832.627
Bartlett's Test of Sphericity	df	28
	Sig.	.00

Upon examination of Table 4.4, we observe that the sampling adequacy value for KMO and Barlett's test (KMO) is .958, indicating a sufficient sample size for exploratory factor analysis (EFA). Furthermore, the examination of the KMO values for each item confirmed the suitability of the sampling, with the lowest value being .918. Moreover, the results of Barlett's test demonstrated a significant correlation between the items ($\chi^2(28) = 4.832$, $p < 0.05$) and supported the appropriateness of EFA. KMO values are shown in table 4.5 below. After EFA, it was found that the 8-item TLS was grouped under a single dimension and explained 88.158% of the total variation. This confirms the validity of the TLS.

Table 4.5. The transformational leadership exploratory factor analysis results

Item Number	Items	Item Total Correlation Value
1	I know how to motivate my colleagues.	.918
2	My colleagues are proud to work with me.	.934
3	My colleagues have confidence that I can overcome any obstacle.	.926
4	I am interested in the training of colleagues in need.	.934
5	I give advice to my colleagues in need.	.959
6	I enable my colleagues to rely on reasons and evidence to solve problems.	.948
7	I encourage the use of intelligence to overcome obstacles.	.941
8	I present situations in a way that encourages my colleagues.	.950
Total		88.158

The factor loadings for the TLS are presented in the Table 4.5.

4.3. Studies on Scale Reliability

Reliability is the concept that expresses the scale's accuracy in measuring the feature it aims to assess. Additionally, reliability pertains to the consistency of participant responses to the scale items (Cevahir, 2020). Consequently, the scales used in the study underwent reliability analysis to determine consistency between items and assess accuracy in measuring the characteristics of interest. Various methods can be used to determine the reliability of scales, including test-retest, parallel form, two-half test, and Cronbach's Alpha (Cevahir, 2020; George & Mallery). This study utilized the Cronbach's Alpha method for reliability analysis.

Büyüköztürk (2011) and Field (2013) suggest that a Cronbach's alpha coefficient of $\alpha > 0.70$ is adequate for ensuring the reliability of the measurement tool. The reliability of a scale is inversely proportional to the proximity of its Cronbach's Alpha coefficient to 0, and directly proportional to its proximity to 1. Infact, a satisfactory Alpha coefficient is $\alpha > 0.80$ and above, according to Cevahir (2020). The closer the alpha approaches 1.00, the more internally consistent the items in the scale are.

In order to determine the reliability of the Digital Competence Scale and the Transformational Leadership Scale, Cronbach's Alpha reliability analysis was conducted and high reliability coefficients were found for both scales, indicating the reliability of the scales.

4.3.1. Reliability Analysis of the Digital Competence Scale

After conducting the validity analysis, we carried out a Cronbach Alpha reliability analysis for DCS, revealing a reliability coefficient of $\alpha=0.990$. In addition, the DCS's safety sub-dimension demonstrates a reliability coefficient of $\alpha = 0.977$. The sub-dimension of Information and Data Literacy - Problem Solving maintains a reliability coefficient of $\alpha = 0.983$. Meanwhile, the sub-dimension of Digital Content Creation - Communication & Collaboration demonstrates a reliability coefficient of $\alpha = 0.971$, and the Ethical sub-dimension shows a reliability coefficient of $\alpha = 0.982$.

Table 4.6. Reliability statistics of the digital competence scale

Dimensions	Number of items	Internal Consistency Coefficient (Cronbach's Alpha)	Reliability Level
Digital Competence	38	.990	High
Safety	10	.977	High
IDL-PS*	14	.983	High
DCC-CC**	9	.971	High
Ethics	5	.982	High

Note : IDL-PS* : Information and Data Literacy - Problem Solving

DCC-CC** : Digital Content Creation- Communication&Collaboration

Table 4.6 shows that the reliability coefficient $\alpha > 0.70$ in both the total scale and sub-dimensions. It is clear that the scale, including its sub-dimensions, is highly reliable. The internal consistency coefficients calculated for each item and factor in the DCS for manager are significantly high.

4.3.2. Reliability Analysis of the Transformational Leadership Scale

The reliability coefficient of the TLS was determined by Cronbach alpha analysis. The alpha coefficient for the scale, comprising one single dimension and eight separate items, was

calculated as $\alpha = .981$, indicating extremely high reliability with $\alpha > 0.70$ (Field, 2013; Cevahir, 2020). The internal reliability coefficients for the items comprising the transformational leadership scale have been calculated and can be found in Table 4.7.

Table 4.7. Reliability statistics of the transformational leadership scale

Dimensions	Number of items	Internal Consistency Coefficient (Cronbach's Alpha)	Reliability Level
Transformational Leadership Scale	8	.981	High

As Table 4.7 shows, the transformational leadership scale alpha is .982, which meets the acceptable standard.

4.4. Analysis of Managers' Digital Competence Scores By Variables

A normality test was performed to determine whether to use parametric or nonparametric analysis methods for analyzing the data. It is commonly recommended in literature that the Shapiro-Wilks test should be used for sample sizes less than 50 ($n < 50$) and the Kolmogorov-Smirnov test should be used for sample sizes greater than 50 ($n > 50$) (Büyüköztürk, Kılıççakmak, Akgün, Karadeniz, & Demirel, 2018; George & Mallery, 2016) to test for the normality. In this study, the Kolmogorov-Smirnov test was employed since the sample size was 391, i.e. $n > 50$. The total items of the digital competence scale and its four sub-dimensions, as well as the transformational leadership scale, underwent analysis through the Kolmogorov-Smirnov test. According to the results, the p-value was found to be $p = .00 < 0.05$ for the digital competence scale and its sub-dimensions.

Table 4.8. Tests of normality for digital competence scale

Scale	Kolmogorov-Smirnov			
	N	p	Skewness	Kurtosis
Digital Competence	391	.000	-.939	.416
Safety	391	.000	-.847	-.032
IDL-PS	391	.000	-1.134	.805
DCC-CC	391	.000	-.306	-.603
Ethics	391	.000	-1.113	.477

*. Correlation is significant at the 0.05 level (2-tailed).

Upon examining Table 4.8, it becomes evident that the $p = 0.00$ which is less than the $p < 0.05$ for both the total digital competence scale and its four sub-dimensions. Consequently, this necessitates the use of non-parametric tests for testing the hypotheses.

Furthermore, the variances fail to demonstrate a normal distribution. Notably, the Kolmogorov-Smirnov test carried out on the transformational leadership scale displays a p -value of 0.00 which is less than the significance level of 0.05, and the data illustrates non-normal distribution. In certain sources, it has been suggested that Skewness and Kurtosis scores within ± 1 can be deemed optimal for certain psychometric objectives if $p < 0.05$. Moreover, values between ± 2 can be deemed acceptable for normality distribution.

Table 4.9. Test of normality for transformational leadership

Scale	Kolmogorov-Smirnov			
	N	p	Skewness	Kurtosis
Transformational Leadership	391	.000	-1.692	2.846

When Table 4.9 is analysed, the result of the Kolmogorov-Smirnov test performed on the transformational leadership scale showed that the data did not have a normal distribution since $p < 0.05$, $p = .00$. Therefore, nonparametric analysis was chosen as the data analysis method.

4.4.1. Analysis of Digital Competence Scale Scores Based on Gender

Nonparametric tests were used to examine the relationships between the digital competence test and transformational leadership tests and the variables, as a result of Kolmogorov-Smirnov tests. Mann-Whitney U tests were used for the gender variable and educational status, while Kruskal-Wallis tests were used for variables such as age, managerial role, managerial time, and branch. The study conducted a Mann-Whitney U test to determine if there were any differences in digital competence levels between the groups based on gender.

The Mann-Whitney U test revealed that male managers had lower levels of digital competence than their female counterparts (Mean Rank_{male} = 193.68, n = 281; Mean Rank_{female} = 202.07, n = 110) and had a moderate effect size¹ ($r = 0.36$) ($r = Z/\sqrt{n} = 0.719/\sqrt{391}=0.036$).

Table 4.10. Indicators of difference between school managers' gender and the level of digital competence

	Gender	N	Mean Rank	U	p	z
Digital Competence	Male	281	193.62	14787	0.472	-.719
	Female	110	202.07			
Safety	Male	281	196.11	15425	0.975	-.032
	Female	110	195.73			
IDL-PS	Male	281	192.13	1468,5	0.240	-1.174
	Female	110	205.88			
DCC-CC	Male	281	192.52	1478	0.313	-1.008
	Female	110	204.88			
Ethics	Male	281	190.79	13991	0.122	-1.546
	Female	110	209.31			

Upon analysis of Table 4.10, it is evident that H1 is not accepted. The digital competence test results show there isn't statistically significant difference between male and female managers.

¹ According to Cohen , $r=0,10$ small effect, $r= 0.30$ medium effect and $r=0.50$ large effect (Cevahir, 2020)

So it is clear that there is no significant difference between the genders ($p > 0.05$; $p = 0.472$). However, it appears that female managers have higher mean ranks than male managers (Mean Rank_{female} = 202.07, $n = 110$; Mean Rank_{male} = 193.62, $n = 281$) when examining the mean rank by gender. When analysing the mean rank scores by gender for the sub-dimensions, the largest difference was found in the Ethics sub-dimension (Mean Rank_{female} = 209.31; Mean Rank_{male} = 190.79), while the smallest difference was in the Safety dimension (Mean Rank_{female} = 195.73; Mean Rank_{male} = 196.11).

4.4.2. Analysis of Digital Competence Scale Scores Based on Age

The Kruskal-Wallis test was used to determine if there was a statistically significant difference between the scores of three or more independent groups when the assumptions for conducting the Independent One Way ANOVA could not be met (Allen, Bennett, & Heritage, 2014; Cevahir, 2020; Denis, 2018). As normality assumptions were not met in the digital leadership scale, the Kruskal-Wallis test was used in this study.

When analysing the managers' digital competence scores by age, a statistically significant difference was observed in the total test ($p < 0.05$; $p = 0.00$). Therefore, H_{2is} is accepted. The analysis of the Safety, IDL-PS, and DCC-CC sub-dimensions yielded similar results.

Table 4.11. Indicators of difference between school managers' digital competence levels and age variable

Age	Between 25-35		Between 36-42		Between 43-57		57 and older		Chi Square (X ²)	p
	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank		
Digital Competence	77	209.37	121	222.65	185	173.50	8	184.56	17.790	0.00*
Safety	77	210.84	121	217.20	185	177.46	8	161.06	12.713	0.005*
IDL-PS	77	214.12	121	217.80	185	174.11	8	198.13	15.839	0.001*
DCC-CC	77	210.03	121	220.62	185	174.11	8	194.75	14.912	0.002*
Ethics	77	201.65	121	213.16	185	182.12	8	202.94	6.529	0.089

*Correlation is significant at the 0.05 level (2-tailed).

Upon analysis of Table 4.11, it was observed that school managers in the 36-42 age group had the highest mean rank average (Mean Rank = 222.65, $n = 121$). To determine the percentage of variance explained by the age variable in the digital competence dependent variable, the

formula $\eta^2 = X^2 / N - 1$ (Cevahir, 2020) was utilised. The Eta square value was found to be 0.045, indicating that age explains 4.5% of the variance. The results reveal that the age variable explains only 4% of the total variance, suggesting a small effect. The differentiation was caused by the mean ranks of the 25-35 and 43-57 age groups, as well as the 36-42 and 43-57 age groups ($p < 0.01$).

4.4.3. Analysis of Digital Competence Scale Scores Based on District of Managers Work

The scores obtained from the digital competence scale were analysed based on the district where the managers work. To test H3, the Kruskal Wallis H test was applied, and the results are presented in Table 4.12.

Table 4.12. Indicators of difference between school managers' districts and the level of digital competence

Districts	Çukurova		Seyhan		Sarıçam		Yüreğir		Rural Districts		Chi-Square (X ²)	p
	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank		
Digital Competence	62	202	80	207	51	206.2	133	190.6	65	179.9	3.465	0.483
Safety	62	198.5	80	205.3	51	210.6	133	191.7	65	179.6	3.351	0.501
IDL-PS	62	201.2	80	209.7	51	202.1	133	191.1	65	179.5	3.642	0.457
DCC-CC	62	207.2	80	214.1	51	200.9	133	190.8	65	170.2	6.896	0.141
Ethics	62	208	80	201.7	51	220.7	133	185.5	65	179.7	6.568	0.161

Table 4.12 shows that H3 is not accepted, as there is no significant statistical difference in the overall Digital Competence test and in all sub-dimensions ($p > 0.05$; $p = 0.483$). Upon analysing the mean rank values, it was found that managers working in Sarıçam district had the highest mean rank (Mean Rank = 206.2, $n = 51$), while those working in rural districts (Kozan, Ceyhan, Feke, etc.) had the lowest mean rank (Mean Rank = 179.9, $n = 65$). The managers in Sarıçam district had the highest mean values in Safety (Mean Rank = 210.6, $n = 51$) and Ethics (Mean Rank = 220.7, $n = 51$) sub-dimensions. In the IDL-PS sub-dimension, managers in Seyhan district had the highest Mean Rank value (Mean rank = 209.7, $n = 80$), and

in the DCC-CC sub-dimension, managers in Çukurova district had the highest Mean Rank values (Mean rank= 207.2, n=62).

4.4.4. Analysis of Digital Competence Scale Scores Based on School Type of Managers

The digital competence scale scores were analysed based on the type of school where the managers work. To test H₄, the Kruskal Wallis H test was applied. The results of the analysis are presented in Table 4.13.

Table 4.13. Indicators of difference between school managers' school type and the level of digital competence

School Type	Preschool		Primary School		Secondary School		High School		Other Educational Institutions		Chi Square (X ²)	p
	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank		
Digital Competence	27	258.17	79	205.42	108	195.05	153	182.4	24	185.85	13.004	0.011*
Safety	27	251.57	79	212.31	108	185.86	153	188.4	24	173.79	11.964	0.018*
IDL-PS	27	260.8	79	207.98	108	191.63	153	182.4	24	189.92	14.396	0.006*
DCC-CC	27	267.43	79	196.82	108	207.03	153	176.2	24	189.4	17.827	0.001*
Ethics	27	284.44	79	200.2	108	193.5	153	189.2	24	177.75	8.053	0.090

*Correlation is significant at the 0.05 level (2-tailed).

As seen in Table 4.13, H₄ is accepted. There is a significant difference in the safety, IDL-PS, and DCC-CC sub-dimensions of the Digital Competence test ($p < 0.05$; $p = 0.011$). It is observed that there isn't a significant difference only in the ethic dimension. In this context, the highest mean rank averages under the sub-dimensions of Safety, IDL-PS, and DCC-CC were observed in Pre-School (Mean Rank=251.57, $n=27$; 260.8, $n=27$; 267). Among the working managers ($n=27$), those who have degrees from educational institutions such as Public Education Centers, Guidance and Research Centers, and Special Education Schools have the lowest mean rank values in all sub-dimensions compared to those who have degrees from other educational institutions (Mean Rank=185.85, $n=24$). This situation is similarly observed in the IDL-PS and DCC-CC dimensions. In the digital competence test, the highest values are also observed among preschool managers, while the lowest values belong to managers from other educational institutions. The value of eta squared was calculated using

the formula ($\eta^2 = X^2 / N-1$) and found to be 0.43 ($\eta^2 = 13.004^2 / 390$). This value indicates a large effect size and that the variable of school type explains 43% of the total variance.

4.4.5. Analysis of Digital Competence Scale Scores of School Managers Based on Management Duration

The scores obtained from the digital competence scale were analysed according to the participants' managerial duration and Kruskal Wallis H test was applied to test H5. The results of the analysis are given in Table 4.14.

Table 4.14. Indicators of difference between school managers' management period and the level of digital competence

Management Period	0-1 years		1-5 years		6-10 years		11-15 years		16 years and above		Chi-Square (X ²)	p
	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank		
Digital Competence	52	193.45	114	204.48	117	188.55	57	196.64	51	196.02	1.377	0.848
Safety	52	201.68	114	202.3	117	185.57	57	196.41	51	199.59	1.723	0.787
IDL-PS	52	198.2	114	198.25	117	194.68	57	194.84	51	193.05	0.144	0.998
DCC-CC	52	212.19	114	198.54	117	190.3	57	185.06	51	199.11	2.145	0.709
Ethics	52	195.32	114	199.54	117	192.97	57	202.71	51	188.25	0.719	0.949

Upon examining Table 4.14, it is evident that H5 is rejected. No significant statistical difference was observed in the Digital Competence test across all sub-dimensions ($p > 0.05$; $p = 0.848$). When examining the digital competence test scores of school managers, those with 1-5 years of work experience had the highest mean rank average (Mean Rank = 204, $n = 114$). The results show that managers with 6-10 years of work experience have the lowest mean rank (Mean Rank = 188.55, $n = 117$) compared to those with less or more experience. Upon analysing the sub-dimensions, it was observed that managers with 1-5 years of managerial experience (Mean rank_{1-5 years} = 202.3, $n = 114$) had the highest mean rank in the Safety sub-dimension. Additionally, managers in this group (Mean rank_{1-5 years} = 198.25, $n = 114$) had the highest mean rank in the IDL-PS sub-dimension. The DCC-CC sub-dimension showed that managers with one year of experience had the highest mean rank (Mean rank_{0-1 year} = 212.1, $n = 52$). In the Ethics sub-dimension, managers with 11-15 years of experience had the highest mean rank (Mean rank_{11-15 years} = 202.71, $n = 57$).

4.4.6. Analysis of School Managers' Digital Competence Scale Scores Based on Their Managerial Roles

The scores obtained from the digital competence scale were analysed according to managerial roles, and Kruskal Wallis H test was applied to test H6. The results of the analysis are given in Table 4.15.

Table 4.15. Indicators of difference between school managers'roles and the level of digital competence

Managerial Roles	Principal		Chief Assistant		Assistant Principal		Chi Square (X ²)	p
	N	Mean Rank	N	Mean Rank	N	Mean Rank		
Digital Competence	141	186.69	14	144.86	236	204.6	6,066	0.048*
Safety	141	195.26	14	129.71	236	200.37	5,808	0.055
IDL-PS	141	193.54	14	125.63	236	201.63	7,131	0.028*
DCC-CC	141	185.08	14	161.61	236	204.56	4,265	0.119
Ethics	141	190.14	14	149.93	236	202.23	3,853	0.146

*Correlation is significant at the 0.05 level (2-tailed).

Upon analysing Table 4.15, a statistically significant difference was found in the total test ($p < 0.05$; $p = 0.048$) for the digital competence test of the managers. Therefore, H6 is accepted. When considering the sub-dimensions, a statistically significant difference was observed in the IDLPS factor based on managerial roles. However, no significant difference was observed in the Safety, DCC-CC, and Ethics factors based on managerial roles. Upon analysis of the mean rank scores of participants based on their managerial roles, it was observed that assistant principals had a higher mean rank than principals in both the total digital competence test and all sub-dimensions (Mean Rank_{Principal} = 186.69, $n = 141$; Mean Rank_{Assistant Principal} = 204.06, $n = 236$). However, it should be noted that Chief Assistant Principals, with a limited number of participants (Mean Rank_{Chief Assistant} = 144.86, $n = 14$), had the lowest mean rank. The Eta square value ($\eta^2 = X^2 / N - 1$) was calculated to determine the difference across the test. The value of η^2 was 0.09, indicating a moderate effect. The variable of managerial role explained 9% of the total variance.

4.4.7. Analysis of Digital Competence Scale Scores of School Managers Based on Graduation Status

The scores obtained from the digital competence scale were analysed according to the educational status of the managers, and Mann Whithney U test was applied to test H7. The results of the analysis are given in Table 4.16.

Table 4.16. Indicators of difference between school managers' graduation status and the level of digital competence

	Graduation Status	N	Mean Rank	U	p	Z
Digital Competence	Bachelor's degree	227	185.61	16649.000	0.080	-1.926
	Postgraduate degree	164	204.18			
Safety	Bachelor's degree	227	187.36	17050.000	0.182	-1.502
	Postgraduate degree	164	201.81			
IDL-PS	Bachelor's degree	227	185.75	16650.500	0.084	-1.934
	Postgraduate degree	164	203.99			
DCC-CC	Bachelor's degree	227	187.40	17077.000	0.195	-1.445
	Postgraduate degree	164	201.76			
Ethics	Bachelor's degree	227	186.43	16945.500	0.124	-1.605
	Postgraduate degree	164	203.06			

Upon analysing Table 4.16, it becomes apparent that there isn't any statistically significant difference between the scores of the digital competence test and the educational status of the managers. Therefore, H7 cannot be accepted. The mean scores of managers with postgraduate education (Mean Rank_{Postgraduate} =204.18; n=164) are higher than those of managers with a bachelor's degree (Mean Rank_{Bachelor} =185.61, n=164) in both the overall test and sub-dimensions.

4.4.8. Analysis of School Managers' Digital Competence Scale Scores Based on Their Branches

Kruskal Wallis H test was applied to test H8 and the scores obtained from the digital competence scale were analysed according to the branch variable. The results of the analysis are given in Table 4.17.

Table 4.17. Indicators of difference between school managers'branches and the level of digital competence

		Digital Competence	Safety	IDL-PS	DCC-CC	Ethics
	p (X²)	0.026*	0.011*	0.068	0.122	0.555
		27.361	30.309	23.821	21.495	13.607
Branches	N	Mean Rank	Mean Rank	Mean Rank	Mean Rank	Mean Rank
Physical Education and Sports	16	191.94	222.31	170.31	170.25	190.84
Information Technologies	12	266.04	290.08	247.58	247.67	220.29
Religious Culture and Moral Knowledge	12	179.63	187.50	167.75	184.29	169.92
Philosophy	3	157.33	152.17	138.17	149.83	175.17
Science (Physics-Chemistry-Biology)	29	193.47	180.78	200.21	212.16	201.74
Visual Arts	5	192.10	196.50	168.40	158.30	207.10
Imam Hatip Vocational Courses(IHVT)	3	77.17	83.67	159.17	124.83	101.17
Maths	37	164.57	166.66	172.93	170.51	184,95
Pre-Schooling Teaching	30	250.93	244.13	254.77	260.33	241.80
School Counseling	9	213.78	207.67	180.56	193.83	196.78
Primary School Teaching	76	206.89	212.32	205.53	199.03	201.92
Social Studies (History-Geography)	43	179.09	174.63	190.02	192.94	177.74
Turkish- Turkish Language and Literature	50	172.56	170.21	167.90	179.31	180.75
Foreign Languages (German, English, Arabic...)	29	196,14	198.55	216.72	187.53	209.19
Vocational High School Field Teaching	21	218.43	190.98	201.69	210.48	207.88
Other branches	16	192.09	195.75	188.38	178.16	178.66

*Correlation is significant at the 0.05 level (2-tailed).

Upon analysis of Table 4.17, it was discovered that there is a statistical difference between the branches of the managers and their digital competence scores, with $p < 0.05$; $p = 0.026$. Therefore, H_8 is accepted. A similar result was found in the Safety sub-dimension of the digital competence test, with $p < 0.05 = 0.011$. However, no differentiation was observed in the DL-PS, CC-CC, and Ethics dimensions. Upon comparison of mean ranks, managers in the Information and Technology branch had the highest mean rank (Mean Rank_{DigComp-ICT} = 266.04, $n = 12$), while managers in the Imam Hatip Vocational Course branch had the lowest mean rank (Mean Rank_{DigComp-IHVT} = 77.17, $n = 3$). When the mean ranks were analysed in terms of sub-dimensions, it was found that Information Technology managers had the highest mean rank in the Safety dimension (Mean Rank_{ICT-Safety} = 290.08, $n = 12$), while in the other three dimensions the mean ranks of managers whose branch was pre-school teaching (Mean Rank_{Pre-IDL-PS} = 254.77, $n = 30$; Mean Rank_{Pre-DCC-CC} = 260.33, $n = 30$; Mean Rank_{Pre-Ethics} = 241.80, $n = 30$) were higher than those of managers in other branches.

4.4.9. Analysis of The Relationship Between School Managers' Digital Competence and Transformational Leadership Scores

Simple correlation tests should be used to determine the relationship between managers' digital competence and transformational leadership characteristics. Simple correlation tests are used to determine whether there is a linear relationship between two quantitative variables from the same source and, if there is a relationship, to provide numerical information about the direction and strength of that relationship. The correlation coefficient (r) takes a value between -1 and +1, and the + or - sign before the coefficient indicates the direction of the relationship. The correlation coefficient is independent of the sign and according to the widely used Cohen classification, 0.10-0.29 is small, 0.30-0.49 is medium and 0.50 and above has a large effect. The Pearson correlation test is used when the data are normally distributed and the Spearman correlation test is used when the data are not normally distributed (Cevahir, 2020).

In this study, H_9 was tested using the Spearman correlation test to examine the relationship between the two variables. This is because the data obtained from managers on digital competence and transformational leadership were not normally distributed.

Table 4.18. Analysis of the relationship between managers' digital competence and transformational leadership scores

		Transformational Leadership
	Spearman r	.489
Digital Competence	p	0.000*
	N	391

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

Analysis of Table 4.18 shows that H9 is accepted. It was found that there was a moderate positive ($r=0.489$) and statistically significant ($p<0.05=0.00<0.05$) relationship between digital competence and administrators' transformational leadership scores.

5. CONCLUSIONS AND DISCUSSIONS

This section of the study presents the findings of the research and suggestions for future research.

The aim of this study was to assess the digital competence and transformational leadership of school managers. In this context, a study was conducted using the Teacher Digital Competence scale developed by Gümüş (2021) and the short transformational leadership scale developed by Berger et al. (2012) with the participation of 391 official school managers working at different levels in Adana province in the 2022-2023 academic year. Validity and reliability analyses were conducted for both scales, and it was found that the scales were valid and had high reliability. As a result of exploratory factor analysis, due to the presence of overlapping items in the factor loads of the digital competence scale, the overlapping items were removed from the scale and as a result, the digital competence scale consisted of four subdimensions (information and data literacy-problem solving, security, content creation, communication and collaboration, ethics) and 38 items. The transformational leadership scale was applied as a unidimensional scale with 8 items.

Prior to hypothesis testing, the Kolmogorov-Smirnov normality test was applied to the scales and it was found that the data did not have a normal distribution. Since non-parametric tests should be used in the analysis of non-normally distributed data, Mann Whithney U and Kruskall Wallis tests were applied to test whether the digital competence levels of managers differed according to variables, and Spearman correlation test was applied to determine the direction and strength of the relationship between transformational leadership and digital competence;

It was found that the digital competence levels of managers differed according to age variable (H2), school type variable (H4), manager roles (H6) and branches (H8). However, no differentiation was found in managers' digital competence scores according to the gender variable (H1), the district they work in (H3), the duration of their administration (H5), and their educational status (H7). There was a moderately significant relationship between managers' digital competence levels and transformational leadership characteristics (H9). The results of the hypothesis testing are summarized in Table 5.1.

Table 5.1. A short summary of the hypothesis testing

	Difference	Accepted/Rejected
Gender	NO	Rejected
Age	YES	Accepted
District	NO	Rejected
School Type	YES	Accepted
Management Duration	NO	Rejected
Management Role	YES	Accepted
Educational Status	NO	Rejected
Branch	YES	Accepted
Relationship between the digital competence and the transformational leadership	YES	Accepted

Table 5.1 provides a brief summary of the hypothesis test results. Hypothesis results by variables are given below:

When the digital competence scores of the managers were analysed according to the gender variable, it wasn't found any significant difference in the digital competence levels of the managers. However, it was observed that the mean ranks of female managers were higher than those of male managers. Özalp (2022) found that there was no significant difference in the digital competence scores of teachers according to the gender variable in his dissertation study to examine the digital competence of teachers. (Vural et al. 2023) also found that there was no gender difference in their study to measure teachers' perceptions of digital leadership. However, in the studies conducted by Gümüş (2021) and Aydın (2022), it was found that the digital competence characteristics of teachers and managers differed according to gender.

When the managers' digital competence scores were analysed in relation to the age variable, it was found that there was a significant differentiation according to age. It was found that the managers in the 36-43 age group had higher mean rank scores than the managers in the other age groups in terms of both the overall test and the sub-dimensions, and it was determined that the differentiation was due to the scores of the managers in the 25-42 and 43-57 age groups. In his study, Gümüş (2021) found that the digital competence scores of teachers differed according to their age and that the digital competence scores of teachers in the 21-40

age group were higher than those of teachers over 40. Özalp's (2022) study found that teachers' digital competence scores differed according to the age variable. Vural et al. (2023) found results that support our findings in their study and stated that the level of digital competence differs according to age. As a result of the research, the fact that there is a difference in favor of the 36- 43 age group can be attributed to the fact that individuals in this age range are in the productive period in terms of psychosocial development level, and accordingly, they have interest, curiosity, learning efforts and are open to innovations.

When the managers' digital competence scores were analysed according to the districts in which they worked, no significant difference was found in the managers' digital competence scores. While the managers working in Sarıçam district have the highest mean rank on the scale, the managers working in the districts considered as provincial have the lowest mean rank. Gümüş (2021) reached similar results in his study on the digital competence of teachers and found that the digital competence scores did not differ according to the institutional location. Aydın (2022), in his study on the relationship between digital leadership and organisational wisdom in educational organisations, found that the digital leadership scores of school principals did not differ according to the region in which they worked.

When the managers' digital competence scores were analysed according to the type of school in which the managers worked, a significant difference was observed in the managers' digital competence scores. It was found that pre-school managers had the highest mean rank in the digital competence test and in all sub-dimensions. Therefore, it was seen that there was a difference in favour of preschool managers. In his study, Gümüş (2021) found that there was a differentiation in the digital competence levels of teachers according to the type of school they worked in and stated that teachers working in secondary schools had higher mean scores than teachers working in other types of schools. Similarly, Vural et al. (2023), in their study on teachers' digital leadership, concluded that there was a difference in digital leadership levels according to school type (level). The differentiation of digital competence levels between managers in kindergartens and other institutions is believed to be due to the recent increase in the number of preschool institutions and appointments made to kindergartens. This is a result of the growing importance of preschool education in our country. Additionally, many preschool educators are appointed at a young age and eventually become managers.

When managers' digital competence scores were analysed according to their management duration, there was no significant difference between the duration of their management and

their digital competence levels. It was observed that the highest mean score was obtained by managers with 1-5 years of experience, while the lowest mean score was obtained by managers with 6-10 years of experience. When analysing the sub-dimensions, it was found that in the dimensions of information and data literacy, problem solving and safety, and digital content creation, communication and collaboration, those with up to 5 years of administrative experience scored higher than those with 6 years or more of administrative experience. In the ethics dimension, it was observed that those with 11-15 years of experience had a higher average than the others. Aydın (2022) found that the general digital leadership scores of the principals in his study differed significantly according to their managerial tenure.

When managers' digital competence scores were analysed according to their administration roles, a statistical difference was found in managers' digital competence scores. It was observed that the mean rank of assistant principals was higher than that of principals and vice-principals in the overall digital leadership test and in all sub-dimensions. There is a low-level significant difference in favour of the managers working as assistant principals. Digital proficiency levels vary according to the roles of managers. This differentiation may be due to the fact that assistant principals are the ones who mostly carry out the digital activities in the school, they are generally younger, or they have the aim of promotion (principalship).

When the digital competence scores of the managers were analysed according to their educational status, no significant difference was observed in the digital competence levels of the managers. However, it was observed that the mean scores of managers with postgraduate degrees were higher than those with undergraduate degrees in the overall test and in all sub-dimensions. In a similar study conducted by Fidan & Yeleğen (2022), the digital competence levels of teachers were examined and it was concluded that there was no significant difference in the digital competence levels of teachers according to their educational status.

When the digital competence scores of the managers were analysed according to the branches of the managers, a significant difference was observed in the digital competence scores of the managers. While the managers with information technologies branch had the highest average in digital competence, the group with the lowest average was the managers whose branch was Imam Hatip Vocational courses. When the sub-dimensions were examined, it was seen that the highest average in the safety sub-dimension was the information technologies teachers, while the highest average in the dimensions of information data literacy-problem solving,

digital content creation- communication and collaboration and ethics was found to be the managers in the branch of pre-school teaching. Gümüş (2021) revealed results that support this study in his study. It was concluded that Information Technologies teachers have higher digital competence levels than teachers working in other branches and that there is a difference on the basis of branch. In the study conducted by Özalp (2022), it was found that digital competence scores differed significantly according to the branches, and when the averages on the basis of branch were examined, it was seen that while a result in favour of Information Technologies teachers emerged, Preschool teachers had the lowest digital competence levels. Fidan & Yeleğen (2022) also explained that there is a difference between branches in their study. The differing levels of digital proficiency among managers according to their respective fields, and the advantage this gives to managers in the field of information technology, may be due to the close relationship between digital proficiency and information technology. The inclusion of digital competence in the field of information technology and the need for teachers in this field to possess a high level of expertise may be the reason.

In the analysis of the relationship between the transformational leadership characteristics of school managers and their digital competences, there was a moderate, positive and significant relationship between the transformational leadership characteristics of school managers and their digital competences. We can say that transformational leadership has a positive relationship with digital competences. The research suggests a positive relationship between transformational leadership and digital competence among managers. This may be due to the fact that managers with high transformational leadership qualities are open to change, technology, and innovation.

6. CONTRIBUTIONS AND RECOMMENDATIONS

A review of the literature shows that although there has been a rapid increase in the number of scholarly studies on digitalisation and digital issues in recent years, there have not been many studies on the digital competences of school managers. When the studies were examined, it was found that most of the studies were conducted on the digital skills or competencies of teachers or students, and very few studies were conducted on the digital competencies of school managers. School managers have an important role to play in transforming educational institutions and catching up with the times. Therefore, this study was conducted to measure the digital competencies and transformational leadership of school managers. In this context, this study will be a reference for future studies at the point of examining the digital competences of school managers and will contribute to the literature.

The literature has expanded and contributed by revealing the relationships between transformational leadership and digital competence in the context of school managers. It has also revealed differences among managers in terms of age, seniority, branch, and school type, which contributes to the literature. When determining the vision of their institutions in the context of transformational leadership, managers must possess digital competencies. These competencies are essential in inspiring and influencing staff and ensuring the transformation of the institution they lead.

The study found a moderate, positive and significant relationship between school managers' transformational leadership characteristics and their digital competences. Therefore, intervention programs, in-service trainings, courses or trainings to be prepared to develop transformational leadership characteristics and digital competencies of school administrators should be shaped by taking into account the factors of age, school type, administrative role and branch. In addition, in order to keep up with the rapidly developing and changing technology, it can be suggested that the training to improve managers' digital competences should be revised and repeated every year according to the needs and innovations.

According to the results of the research, it is important that the level of digital competence of managers is high and that the level of digital competence of managers differs according to branches. Therefore, the Ministry of National Education can develop digital competence frameworks and action plans for school managers and educators, increase the digital

competence levels of existing managers, and include digital competence and skills criteria in initial assignment regulations for managers.



7. LIMITATIONS AND FUTURE RESEARCH

The current research was conducted in Adana province focusing on education managers' digital competence levels and transformational leadership. Therefore, the study is limited to school managers employed in public schools located in Adana during the 2022-2023 academic year. In addition, the study is limited to the information provided by the answers given to the Digital Competency Scale used to measure the digital competency levels of educational institution managers and the transformational leadership scale used to measure the characteristics of transformational leadership.

As a result of the findings obtained from this study, the following are suggested :

- As the results of the study are limited to public school managers working in Adana province, future studies that include private school managers across the country and compare the results may provide more comprehensive findings on the digital competences of school managers.
- In the distribution of managers by branches, it was observed that some branches remained at a very low number of participants. Therefore, a study in which the distribution of managers by branch is proportionally balanced may provide more generalised results based on branches.
- This study provides an opportunity to compare the digital competency levels of managers working in different cultural and sociological environments in terms of gender, age, school type, seniority, educational status, and industry.

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APPENDICES

ANNEX – A : SURVEY

Item No	Digital Competence Scale	Totally disagree	Disagree	Neutral	Agree	Totally agree
1	I can take precautions against risks and threats in digital environments.	1	2	3	4	5
2	I can help my colleagues to ensure safety and privacy in digital environments.	1	2	3	4	5
3	I can choose appropriate ways to protect my personal data and privacy in digital environments.	1	2	3	4	5
4	I can interpret privacy policy statements about how personal data is used in digital services.	1	2	3	4	5
5	I can use information to protect myself and others from dangers in digital environments.	1	2	3	4	5
6	I can share information that can protect myself and others from dangers in digital environment.	1	2	3	4	5
7	I can protect myself and others against cyberbullying (attack) in digital environments.	1	2	3	4	5
8	I can help my colleagues to recognise threats in digital environments.	1	2	3	4	5
9	I can tell ways to protect myself from the negative effects of digital technologies.	1	2	3	4	5
10	I can help my colleagues to protect themselves from the negative effects of digital technologies.	1	2	3	4	5
11	I can find data, information and content by searching in digital environments.	1	2	3	4	5
12	I can filter what I need from the data, information and content I access in digital environments.	1	2	3	4	5
13	I can use different search strategies to find the most appropriate data, information and content in digital environments.	1	2	3	4	5
14	I can help my colleagues to browse, search and filter data, information and content.	1	2	3	4	5
15	I can interpret the data, information and content I access in digital	1	2	3	4	5

	environments.					
16	I can judge the reliability of data, information and content sources I access in digital environments.	1	2	3	4	5
17	I can compare the data, information and content I access in digital environments in different sources.	1	2	3	4	5
18	I can share the data, information and content I access in digital environments when necessary.	1	2	3	4	5
19	I can determine how to store data, information and content in digital environments.	1	2	3	4	5
20	I can create different information by using digital environments creatively.	1	2	3	4	5
21	I can use different tools and technologies to create innovative processes and products in the digital environment.	1	2	3	4	5
22	I can creatively use digital tools and technologies to solve complex problems.	1	2	3	4	5
23	I am aware of the ways in which my digital competence needs to be developed.	1	2	3	4	5
24	I can tell where to look for opportunities to improve my digital competence.	1	2	3	4	5
25	I can follow current developments to overcome my deficiencies in digital competence.	1	2	3	4	5
26	I can help my colleagues to meet their needs related to digital competences.	1	2	3	4	5
27	I can find solutions to the problems I will face in developing my digital competence.	1	2	3	4	5
28	I can evaluate the development of my students' digital competence	1	2	3	4	5
29	I can define copyright rules and licences of data, information and content in digital environments.	1	2	3	4	5
30	I can apply copyright rules and licences of data, information and content in digital environments.	1	2	3	4	5
31	I can produce solutions for copyright and licence applications of data, information and content in digital environments.	1	2	3	4	5
32	I can help my colleagues with copyright and licensing practices of data, information and content in digital environments.	1	2	3	4	5
33	I can design the most appropriate programme to solve a problem and perform a specific task in a digital environment.	1	2	3	4	5
34	I can develop the most appropriate programme to solve a problem and	1	2	3	4	5

	perform a specific task in a digital environment.					
35	I can help my colleagues to share information through digital technologies.	1	2	3	4	5
36	I can offer different services to other people (my students, colleagues, etc.) to participate in society through digital technologies.	1	2	3	4	5
37	I can help my colleagues with issues related to digital citizenship.	1	2	3	4	5
38	I can use appropriate tools and technologies for collaborative processes in the digital environment.	1	2	3	4	5
39	I can suggest different tools and technologies for collaborative processes to other people (my students, colleagues, etc.) in the digital environment.	1	2	3	4	5
40	I can choose the most appropriate tools and technology for creating content in the digital environment.	1	2	3	4	5
41	I can help my colleagues which tools they can use in collaborative processes in the digital environment.	1	2	3	4	5
42	I act in accordance with ethical principles when using or disseminating content belonging to others in the digital environment.	1	2	3	4	5
43	I act in accordance with ethical principles when using digital technologies.	1	2	3	4	5
44	I can act in accordance with ethical principles while interacting in the digital environment.	1	2	3	4	5
45	I pay attention to ethical principles when determining communication strategies in the digital environment.	1	2	3	4	5
46	I respect the digital etiquette of different audiences, cultures and generations.	1	2	3	4	5

Item No	Transformational Leadership Scale	Totally disagree	Disagree	Neutral	Agree	Totally agree
1	I know how to motivate my colleagues.	1	2	3	4	5
2	My colleagues are proud to work with me.	1	2	3	4	5
3	My colleagues have confidence that I can overcome any obstacle.	1	2	3	4	5
4	I am interested in the training of colleagues in need.	1	2	3	4	5
5	I give advice to my colleagues in need.	1	2	3	4	5
6	I enable my colleagues to rely on reasons and evidence to solve problems.	1	2	3	4	5
7	I encourage the use of intelligence to overcome obstacles.	1	2	3	4	5
8	I present situations in a way that encourages my colleagues.	1	2	3	4	5

PERSONAL INFORMATION FORMS

1- Gender

☐ Male

☐ Female

2- Age

☐ 25- 35

☐ 36-42

☐ 43-57

☐ 58 and above

3- County where your school is located

☐ Çukurova

☐ Sarıçam

☐ Seyhan

☐ Yüreğir

☐ Rural District

4- Type of school you work

☐ Preschool

☐ Primary school

☐ Secondary School

☐ High school

☐ Others

5- Management duration

☐ 1-5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ 20 years and above

6- Your administrator role type

☐ Principal

☐ Chief Assistant

☐ Assistant Principal

7- Your education status

☐ Bachelor

☐ Postgraduate (Master or PhD)

☐ Others

8- Your branch

☐ Physical Education and Sports

☐ Information Technologies

☐ Religious Culture and Moral Knowledge

☐ Philosophy Group Teaching

☐ Science-Physics-Chemistry-Biology

☐ Visual Arts / Music

☐ Imam Hatip Vocational Courses

☐ Maths

☐ Pre-school teaching

☐ Primary School Teaching

☐ Guidance and psychological counseling

☐ Social Studies (History-Geography)

☐ Turkish Language and Literature – Turkish

☐ Vocational High School Field Teaching

☐ Foreign Language (German- English- Arabic etc.)

☐ Other branches