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Pre-Service Teachers' Perspectives on Digital Technologies for Creative Leadership in Higher Education

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Abstract

This study aims to examine pre-service teachers' perceptions of the use of digital technologies in promoting creative leadership within higher education for sustainability. A case study design was employed, and data were collected from pre-service teachers studying at Manisa Celal Bayar University through semi-structured interviews. Content analysis was used to analyze the data. Participants conceptualized creative leadership as an innovation-oriented and collaborative process characterized by developing innovative approaches, integrating diverse ideas, maximizing team potential, and adapting to change. Digital technologies were perceived as facilitating communication, improving access to information, supporting evidence-based decision-making, strengthening team management, and enabling the implementation of innovative ideas. However, participants also identified several barriers to the effective use of digital technologies, including technological inadequacies, insufficient infrastructure, inappropriate technology use, and resistance to change. To strengthen creative leadership in higher education, participants emphasized the importance of expanding professional development activities, increasing technology-based projects, improving technological infra-structure, promoting digital literacy, and establishing interdisciplinary learning environments. The findings suggest that pre-service teachers perceive digital technologies as strategic tools that support, rather than define, creative leadership.

Keywords: creative leadership; pre-service teachers; qualitative research; digital technologies

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1. Introduction

The rapid evolution of digital technologies has profoundly reshaped higher education by transforming teaching, learning, research, and institutional governance. Beyond the mere integration of technological tools, digital transformation has become a comprehensive strategic process that requires higher education institutions to rethink their pedagogical practices, organizational structures, and leadership models [1–3]. Emerging technologies have created new opportunities for innovation, interdisciplinary collaboration, and evidence-based decision-making. However, the success of digital transformation depends on the ability of institutions and educational leaders to foster organizational cultures that embrace continuous learning, innovation, and change [3,4].

The growing integration of digital technologies into education has also increased expectations for collaborative learning, problem-solving, and authentic learning experiences [5–7]. Teacher education institutions play a critical role in equipping pre-service teachers with the knowledge, skills, and competencies required to effectively integrate digital technologies into future teaching and learning environments. This responsibility has become increasingly significant in the aftermath of the COVID-19 pandemic, which accelerated the digitalization of education and fundamentally reshaped teaching and learning practices across the globe [8]. Although digital technologies offer substantial opportunities to personalize learning, improve access to educational resources, and streamline instructional and administrative processes [9], meaningful educational transformation depends largely on teachers' ability to combine technological competence with pedagogical knowledge [10–13]. Therefore, developing digitally competent future teachers has become a central objective of contemporary teacher education [14,15].

Alongside digital transformation, leadership has emerged as a critical factor influencing the successful implementation of educational innovation. In rapidly changing higher education environments, leaders are expected not only to manage institutional processes but also to inspire innovation, encourage collaboration, and support creative problem-solving. Within this context, creative leadership has gained increasing attention as a leadership approach capable of responding to uncertainty and fostering organizational innovation. Ref. [16] conceptualizes creative leadership as leaders' capacity to apply their own creativity while fostering an environment that encourages followers to develop, express, and utilize their creative potential. Similarly, ref. [17] emphasizes that creative leadership involves orchestrating expertise and collaborative relationships to generate innovative and valuable solutions. Accordingly, creative leadership has become increasingly important in higher education institutions seeking to adapt to digital transformation and promote sustainable innovation. Although creative leadership is related to several contemporary leadership approaches, it should be distinguished from digital, transformational, and distributed leadership. Digital leadership primarily emphasizes the strategic use of digital technologies to facilitate organizational processes, communication, and institutional transformation [18,19]. Transformational leadership focuses on inspiring and motivating followers toward shared organizational goals and change, whereas distributed leadership emphasizes the sharing of leadership responsibilities and practices among multiple organizational members [20,21]. In contrast, creative leadership specifically centers on generating, encouraging, and implementing novel and valuable ideas through individual and collective creativity [16,17]. Although these approaches may overlap in practice, their primary emphases differ. Therefore, in the context of this study, creative leadership is conceptualized as a human-centered leadership process in which digital technologies serve as enabling resources rather than defining characteristics of leadership.

To establish a conceptual foundation for the present study, creative leadership is examined through an integrated framework drawing on creative leadership theory, the Technological Pedagogical Content Knowledge (TPACK) framework, and the European Framework for the Digital Competence of Educators (DigCompEdu). Creative leadership theory provides the primary perspective for understanding how individuals generate, encourage, and implement innovative ideas through collaborative processes [16,17]. TPACK, in turn, explains how technological knowledge interacts with pedagogical and content knowledge to support meaningful technology integration in educational settings [13,22]. Similarly, DigCompEdu emphasizes educators' professional engagement, digital resources, digitally supported teaching and learning, assessment, and the development of learners' digital competencies [23]. These frameworks offer complementary perspectives

for examining the relationship between human-centered creative leadership and the purposeful use of digital technologies in higher education. Accordingly, creative leadership theory provides the main conceptual lens, while TPACK and DigCompEdu inform the interpretation of participants' perceptions of technological competencies, pedagogical integration, collaboration, and innovation. Together, these perspectives guide the interpretation of the interview data without treating technology use as equivalent to creative leadership.

Digital technologies are widely recognized as strategic enablers of creative leadership because they facilitate communication, collaboration, information sharing, and data-informed decision-making [24,25]. By supporting interdisciplinary collaboration, accelerating knowledge exchange, and enabling innovative practices, digital technologies provide educational leaders with opportunities to enhance creativity and organizational agility [2]. Nevertheless, technology alone does not guarantee creative leadership. Contemporary research consistently argues that technological resources contribute to innovation only when combined with appropriate leadership competencies, supportive institutional cultures, and effective pedagogical practices [25,26]. Thus, creative leadership should be understood as a socio-technical process in which human capabilities and digital technologies interact to facilitate organizational learning and innovation.

Despite these opportunities, several barriers continue to hinder the effective integration of digital technologies into educational leadership. Previous studies have identified inadequate technological infrastructure, insufficient digital competence, financial constraints, data security concerns, and resistance to change as major challenges affecting digital transformation [1,3,4]. In addition, research has shown that teachers' limited professional knowledge, lack of technological resources, and low levels of technology acceptance restrict the pedagogically meaningful use of digital technologies [27–29]. Evidence also indicates that many teachers continue to demonstrate unfavorable attitudes toward learning with digital technologies [30]. Consequently, fostering positive attitudes toward technology and strengthening digital competencies during teacher education have become essential priorities, although intervention studies addressing pre-service teachers' technology acceptance remain relatively limited [31].

Although previous research has extensively examined digital transformation, digital competence, educational technology integration, and digital leadership, relatively little attention has been given to how pre-service teachers conceptualize creative leadership within digitally enriched higher education environments. Existing studies have predominantly focused on technological competence or leadership as separate constructs, providing limited insight into how future teachers perceive the role of digital technologies in fostering creative leadership. Understanding these perceptions is particularly important because today's pre-service teachers will become tomorrow's educational leaders responsible for promoting innovation, collaboration, and digital transformation.

To address this gap, the present study aims to explore pre-service teachers' perspectives on digital technologies for creative leadership in higher education. Specifically, the study seeks to examine how pre-service teachers define creative leadership, perceive the contributions and limitations of digital technologies in creative leadership processes, and identify recommendations for strengthening creative leadership in higher education. By providing an in-depth qualitative understanding of these issues, the study contributes to the growing literature on digital transformation, teacher education, and creative leadership while offering practical implications for the design of technology-rich teacher education programs. Furthermore, the study contributes to discussions on educational sustainability by highlighting how creative leadership, collaborative practices, and purposeful technology integration can support the long-term adaptability and innovation capacity of higher education institutions.

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1.1. Literature Background

1.1.1. The Digital Transformation of Higher Education

Digital transformation is a comprehensive process that extends beyond the integration of digital technologies into educational practices. With the widespread adoption of artificial intelligence, big data, learning analytics, cloud computing, and online collaboration platforms, universities have increasingly embraced strategic transformation initiatives aimed at enhancing their digital maturity, giving rise to the concept of the "digital university". Recent studies suggest that the success of digital transformation depends on the coordinated development of institutional strategies, leadership capabilities, human capital, and an organizational culture that embraces change. Furthermore, digital transformation offers significant opportunities to create innovative learning environments, facilitate data-driven decision-making, strengthen interdisciplinary collaboration, and improve the overall quality of higher education. However, inadequate technological infrastructure, limited digital competencies, financial constraints, and resistance to change remain among the major barriers to successful digital transformation in higher education. Therefore, contemporary literature emphasizes that digital transformation should be viewed not merely as a technology-driven initiative but as a strategic process in which people, technology, and organizational change are managed in an integrated manner [1–3].

1.1.2. Creative Leadership in Higher Education

Creative leadership is a leadership approach that develops innovative solutions to emerging educational needs, integrates diverse perspectives, and fosters a learning culture that supports creativity within institutions. Unlike traditional leadership approaches, creative leadership emphasizes problem-solving, risk-taking, flexibility, collaboration, and continuous learning. In higher education institutions undergoing rapid digital transformation, creative leaders are expected to promote innovative practices, encourage interdisciplinary collaboration, and lead institutional adaptation to change. Recent studies have demonstrated that creative leadership enhances organizational innovation, supports employees' creative performance, and contributes to the sustainable competitiveness of higher education institutions [17,26]. In higher education, creative leadership goes beyond the strategic management of technology or the distribution of leadership responsibilities. It involves creating institutional conditions in which individuals can generate new ideas, collaboratively address emerging challenges, and translate innovative thinking into meaningful educational practices. Accordingly, while digital leadership concerns how technology is strategically integrated into institutional processes, creative leadership concerns how human creativity and collaborative innovation are cultivated through leadership practices.

1.1.3. Digital Technologies as Enablers of Creative Leadership

Digital technologies are widely recognized as strategic enablers that support the development of creative leadership. Technologies facilitate knowledge sharing, strengthen interaction among team members, and enable leaders to make more informed decisions. These technologies also contribute to the creation of learning environments that foster creativity, promote interdisciplinary collaboration, and facilitate the rapid implementation of innovative ideas. Recent research suggests that digital technologies alone do not create creative leadership; rather, when combined with effective leadership competencies and organizational support, they significantly enhance creativity, innovation, and organizational agility [2,24,25]. This distinction is particularly important in the present study, as the focus is not on digital leadership as a technology-oriented leadership model, but on

how digital technologies can facilitate the human-centered processes of creativity, collaboration, and innovation that characterize creative leadership.

1.1.4. Challenges of Using Digital Technologies for Creative Leadership

Although digital technologies offer significant opportunities to foster creative leadership, several individual and organizational barriers may limit their effective use. The literature identifies inadequate technological infrastructure, insufficient digital competencies, financial constraints, data security concerns, and resistance to change as major obstacles to successful digital transformation. Moreover, the unconscious use of technology without clear pedagogical purposes may reduce efficiency rather than support creative processes. Accordingly, the literature suggests that the successful implementation of creative leadership depends not only on investments in digital technologies but also on fostering digital literacy, supporting continuous professional development, and cultivating an organizational culture that encourages innovation and embraces change [1,3,4].

1.1.5. Creative Leadership Development in Teacher Education

The development of creative leadership competencies in teacher education programs has become increasingly important for ensuring the sustainability of innovative practices in future educational environments. In contemporary educational settings, teachers are expected not only to use digital technologies effectively but also to serve as leaders who can facilitate change, encourage collaboration, and nurture creativity among their students. Consequently, teacher education programs should adopt a comprehensive approach that integrates the development of digital competence with essential twenty-first-century skills, including creative problem-solving, critical thinking, communication, and collaboration. Research indicates that technology-supported project-based learning, interdisciplinary practices, and practice-oriented professional development activities significantly enhance both the digital competencies and creative leadership skills of pre-service teachers [23,32,33].

1.1.6. Research Gap Addressed by the Study

Although digital transformation has substantially reshaped teaching, learning, and leadership practices in higher education, the intersection of digital technologies and creative leadership remains underexplored, particularly from the perspective of pre-service teachers. Existing research has largely examined digital leadership, technology integration, digital competence, or educational leadership as separate constructs [1,24,26]. Similarly, studies on creative leadership have predominantly focused on organizational settings, leadership styles, innovation management, and business environments [17], while relatively little attention has been given to how future teachers conceptualize creative leadership within digitally enriched higher education environments.

Another important gap concerns the dominant methodological approaches in the literature. Previous studies have primarily employed quantitative methods to examine the relationships between digital competence, leadership, innovation, and technology acceptance [1]. The present study addresses this gap by adopting a qualitative approach to explore pre-service teachers' perceptions of digital technologies for creative leadership in higher education. The findings also contribute to the ongoing discussion regarding the relationship between technology and leadership. Much of the recent literature highlights digital technologies as drivers of organizational transformation and innovation [4,25]. In the context of creative leadership, digital technologies can serve as enabling tools that facilitate communication, collaboration, innovation, and informed decision-making. However, their effectiveness depends not merely on technological availability but also on how they are integrated into human-centered leadership practices [26].

Furthermore, this study contributes specifically to teacher education research. While digital competence has become an increasingly important component of teacher preparation [23], relatively few studies have examined how pre-service teachers associate digital technologies with creative leadership competencies before entering the profession. By focusing on pre-service teachers, the study provides insights into future educators' expectations regarding leadership in technology-rich educational environments. These findings may inform the design of teacher education curricula by highlighting the need to integrate leadership development, creativity, digital competence, and collaborative learning experiences.

Finally, the study contributes to the literature by identifying institutional conditions that participants perceive as essential for fostering creative leadership, including professional development opportunities, technological infrastructure, interdisciplinary collaboration, and technology-based learning experiences. These findings extend previous research by demonstrating that creative leadership is viewed not solely as an individual competency but as a phenomenon shaped by organizational support, institutional culture, and opportunities for continuous learning. Consequently, the study offers both theoretical and practical contributions by providing a more comprehensive understanding of how creative leadership can be cultivated in higher education during ongoing digital transformation.

The aim of this study is to examine pre-service teachers' views on the use of digital technologies for creative leadership in higher education. The study seeks to explore pre-service teachers' perceptions of the concept of creative leadership, the effects of digital technologies on creative leadership practices, the challenges encountered in these processes, and their suggestions for improving creative leadership.

The study was guided by the following research questions:

How do pre-service teachers conceptualize creative leadership?

How do pre-service teachers perceive the role of digital technologies in fostering creative leadership within higher education institutions?

What challenges do pre-service teachers identify as barriers to the effective use of digital technologies for promoting creative leadership in higher education?

What recommendations do pre-service teachers offer to enhance creative leadership through the effective integration of digital technologies in higher education institutions?

2. Materials and Methods

A qualitative research method was used in this study. Qualitative research employs data collection methods such as interviews, observations, and document analysis to explore and understand complex phenomena. It emphasizes an interpretive and in-depth examination of participants' experiences, perspectives, and the meanings they attribute to a particular issue, enabling researchers to investigate both recognized and previously unexplored aspects of natural settings [34].

2.1. Design

A case study design was preferred over a generic qualitative descriptive approach because the study aimed to examine participants' perspectives within a specific institutional and educational context rather than merely describe their individual opinions. This design enabled the researchers to consider how the participants' educational backgrounds, teacher preparation experiences, and exposure to digital technologies shaped their understandings of creative leadership. Thus, the institutional context was treated as an integral component of the phenomenon under investigation rather than simply as a setting for data collection. Case study research enables the systematic investigation of a bounded case within its real-life context, providing a comprehensive understanding of

complex situations and generating insights that can inform future practice and development [35]. It is particularly appropriate for addressing "how" and "why" questions when researchers have limited control over the events being examined, allowing for an in-depth exploration of contextual factors influencing the phenomenon [36]. In this study, the case was defined as pre-service teachers' perceptions of the role of digital technologies in fostering creative leadership within a specific higher education context. The case was bounded by the institutional setting in which the participants pursued their higher education, their status as pre-service teachers, and the research focus on creative leadership and digital technology use. Accordingly, the study focused on understanding how individuals with different academic backgrounds, but a shared orientation toward the teaching profession, interpreted the relationship between digital technologies and creative leadership.

2.2. Study Group

Participants were recruited using snowball sampling, one of the purposive sampling techniques commonly employed in qualitative research. The process began by identifying a small number of individuals who possessed relevant knowledge and experience related to the research topic. These initial participants were subsequently asked to recommend other individuals with similar characteristics or experiences who met the study criteria. Through this referral process, the sample was gradually expanded until sufficient participants were recruited to address the research objectives [37]. Snowball sampling was preferred because the target participants were distributed across different academic departments and included pre-service teachers with diverse disciplinary backgrounds who were preparing for the teaching profession. Although the university student population was generally accessible, identifying individuals who met the specific research criteria across different departments required an appropriate recruitment strategy. Referrals from initial participants facilitated access to eligible individuals and helped expand the sample across different academic backgrounds. Thus, the method was selected primarily as a practical network-based recruitment strategy rather than because the target population was inherently difficult to reach. Before initiating the snowball sampling process, initial participants were selected based on the following inclusion criteria: (1) being enrolled in a pre-service teacher education program at the university, (2) having experience with or familiarity with digital technologies in educational contexts, and (3) being willing to participate voluntarily and share their perspectives on creative leadership and the use of digital technologies in higher education. These criteria ensured that the initial participants had relevant educational backgrounds and experiences to contribute meaningfully to the research objectives. Subsequent participants were recruited through referrals from these initial participants. The recruitment process began with 6 initial participants who were identified through the predefined inclusion criteria. These participants were asked to recommend other pre-service teachers who met the same eligibility requirements and were willing to participate in the study. Referred individuals were contacted by the researchers, informed about the purpose of the study, and independently assessed against the inclusion criteria before being invited to participate. This referral process continued until the final sample of twenty participants was reached. To reduce potential recruitment bias associated with snowball sampling, referrals were not treated as automatic grounds for inclusion. All referred individuals were evaluated according to the same eligibility criteria. In addition, recruitment was extended across different academic departments and class levels to incorporate diverse educational backgrounds and perspectives. Participation was voluntary, and individuals were not required to participate based on recommendations from their peers.

As shown in Table 1, of the participants, 55% (n = 11) were female and 45% (n = 9) were male. Regarding departmental distribution, the largest proportion of participants was from Physical Education and Sports (35%, n = 7), followed by Music (25%, n = 5) and Coaching Education (15%, n = 3). Participants from Theology and Sports Management each represented 10% (n = 2) of the sample, while Political Science and Public Administration accounted for 5% (n = 1). In terms of academic year, 40% (n = 8) of the participants were third-year pre-service teachers, 35% (n = 7) were fourth-year pre-service teachers, and 25% (n = 5) were second-year pre-service teachers. These findings indicate that the sample was predominantly composed of pre-service teachers from the field of Physical Education and Sports and mainly included pre-service teachers in their third and fourth years of study. Although participants were enrolled in non-education disciplines, they were included in the sample because they were undertaking pedagogical formation training to qualify for the teaching profession. Therefore, despite their different disciplinary backgrounds, these participants were considered pre-service teachers, as they were receiving the pedagogical preparation required for teaching.

Table 1. Demographic Characteristics of Participants.

Variable	Category	n	%
Gender	Female	11	55
	Male	9	45
Department	Physical Education and Sports	7	35
	Music	5	25
	Coaching Education	3	15
	Theology	2	10
	Sports Management	2	10
	Political Science and Public Administration	1	5
Class Level	2nd Year	5	25
	3rd Year	8	40
	4th Year	7	35

2.3. Data Collection

In qualitative research, interviews are commonly categorized according to their level of structure as structured, semi-structured, or unstructured, depending on the degree of standardization in question design, sequencing, and administration. They may also be classified based on the interview format, such as individual or focus group interviews, or according to the mode of data collection, including face-to-face, telephone, and online interviews. This flexibility enables researchers to select the most appropriate interview approach for addressing the objectives and context of the study [38–40]. Semi-structured interviews are among the most widely used data collection methods in qualitative research [41]. This interview format is characterized by a flexible structure in which a limited number of guiding questions are prepared in advance, while additional probing and follow-up questions are asked during the interview to obtain richer and more detailed insights into participants' experiences and perspectives [42,43]. The interviews were conducted face-to-face in a quiet and convenient setting at the university. To enhance the credibility and trustworthiness of the findings, member checking was conducted. The interview data and the researchers' interpretations were shared with the participants to verify whether their views and statements had been accurately represented. Feedback provided by the participants was considered, and necessary revisions were made accordingly. Each interview lasted approximately 10–15 min. All interviews were conducted in Turkish, the participants' native language. The interview questions were developed based on a review of the relevant literature and aligned with the research objectives. The interview guide was

reviewed by two experts in educational sciences to ensure the clarity, relevance, and appropriateness of the questions. Following the expert feedback, minor revisions were made to the interview questions. Additionally, a pilot interview was conducted to assess the clarity and comprehensibility of the questions, and necessary adjustments were made accordingly. During the interviews, follow-up and probing questions were used when necessary to obtain more detailed information and clarify participants' responses. The adequacy of the sample was considered in relation to the information power principle proposed by [44]. Given the focused research aim, the participants' shared orientation toward the teaching profession, the relevance of their educational backgrounds to the research questions, and the depth of the semi-structured interviews, the twenty participants were considered to provide sufficient information to address the objectives of the study. Furthermore, the inclusion of participants from different academic departments offered diverse perspectives on the role of digital technologies in creative leadership. Accordingly, sample adequacy was evaluated based on the relevance, richness, and analytical contribution of the collected data rather than on numerical representativeness.

2.4. Data Analysis

Content analysis was employed in this study. As a widely used analytical approach in the social sciences, content analysis provides a systematic, objective, and rigorous framework for identifying, organizing, and interpreting patterns within textual data. It enables researchers to classify meaningful units into categories and themes, thereby facilitating the interpretation of participants' experiences and perspectives [45].

The analysis followed a systematic multi-stage procedure. Initially, all interview recordings were transcribed verbatim. The transcripts were subsequently anonymized, and each participant was assigned a unique identifier (P1–P20, including information on the study year and gender) to ensure confidentiality by removing all personally identifiable information. The transcripts were then carefully reviewed to identify meaningful units of text, which were subjected to open coding. The coding, organization, and management of qualitative data were supported using MAXQDA 2020 qualitative data analysis software. The hierarchical coding structure illustrates the primary categories and their associated subcategories identified through the content analysis. In Figures 1–4, the frequency (f) represents the number of coded references identified during the content analysis, rather than the number of participants. Multiple references from the same participant may therefore contribute to the frequency of a particular code. The main coding categories included pre-service teachers' perceptions of creative leadership, the perceived contributions of digital technologies to creative leadership, challenges associated with technology integration, and recommendations for fostering creative leadership in higher education. Each category was further organized into subcategories representing the recurring patterns and perspectives identified in the interview data. To enhance the reliability of the analysis, two researchers independently coded the interview transcripts and subsequently compared their coding results. Discrepancies were discussed and resolved through mutual agreement to ensure consistency in the coding process.

To ensure the trustworthiness of the qualitative inquiry, the study was guided by the framework proposed by [46]. Credibility was supported through expert consultation during the development and review of the interview protocol, ensuring that the questions were relevant to the research objectives and clearly formulated. Confirmability was addressed by presenting the findings with direct quotations from participants, allowing readers to evaluate the consistency between participants' statements and the researchers' interpretations. Transferability was supported by providing detailed descriptions of the research context, participant characteristics, and data collection procedures, enabling readers to assess the applicability of the findings to similar contexts. Dependability was

addressed by clearly describing the research design, data collection process, and data analysis procedures. These practices were adopted to enhance the transparency, methodological consistency, and overall trustworthiness of the study.

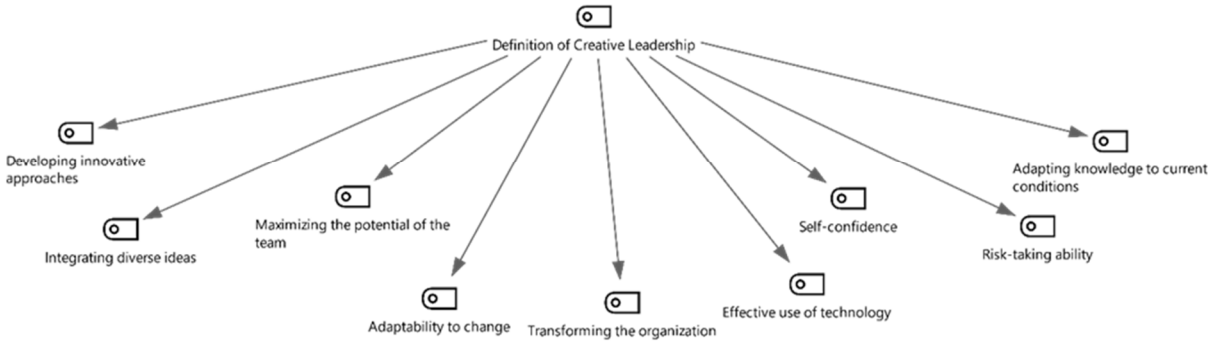


Figure 1. Definition of Creative Leadership.

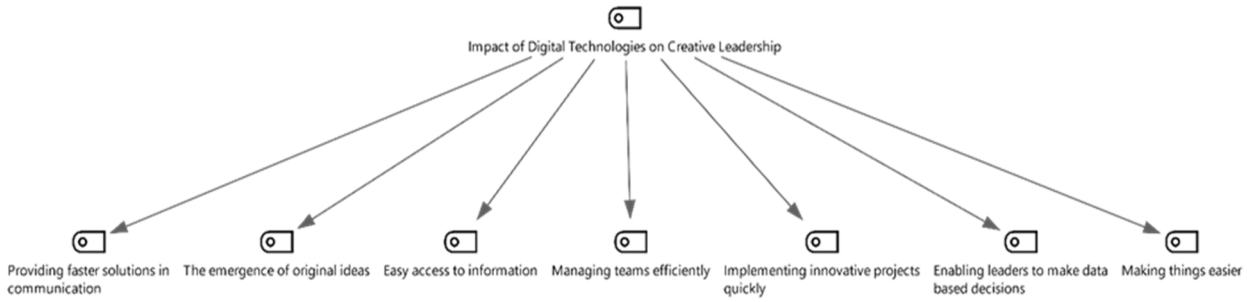


Figure 2. Impact of Digital Technologies on Creative Leadership.

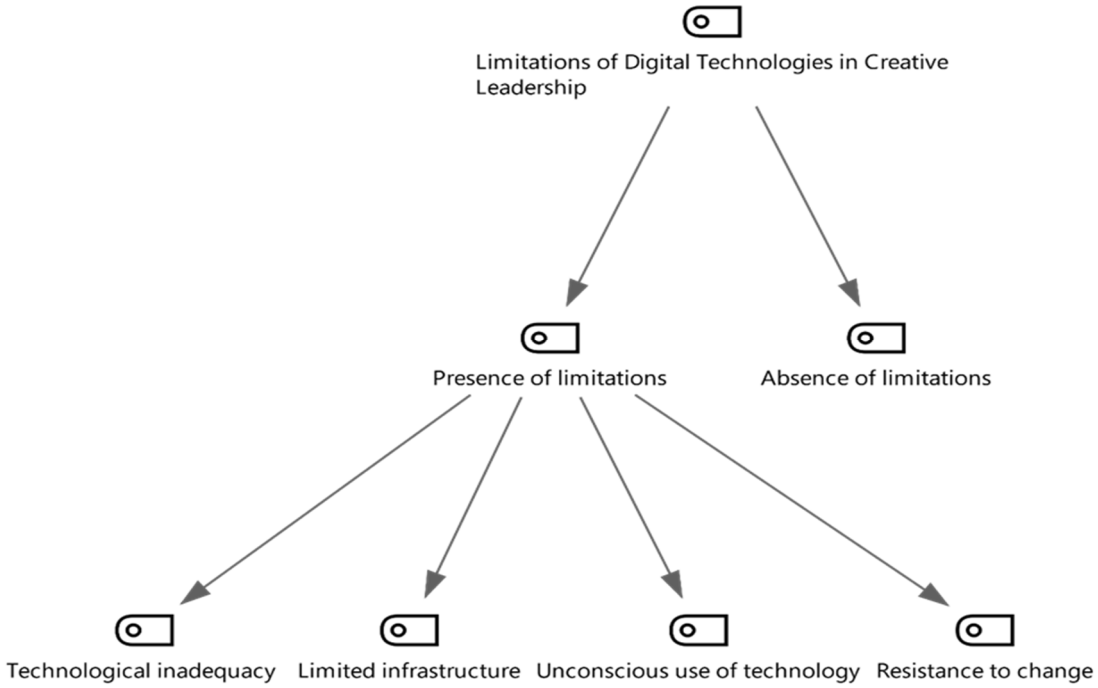


Figure 3. Limitations of Digital Technologies in Creative Leadership.

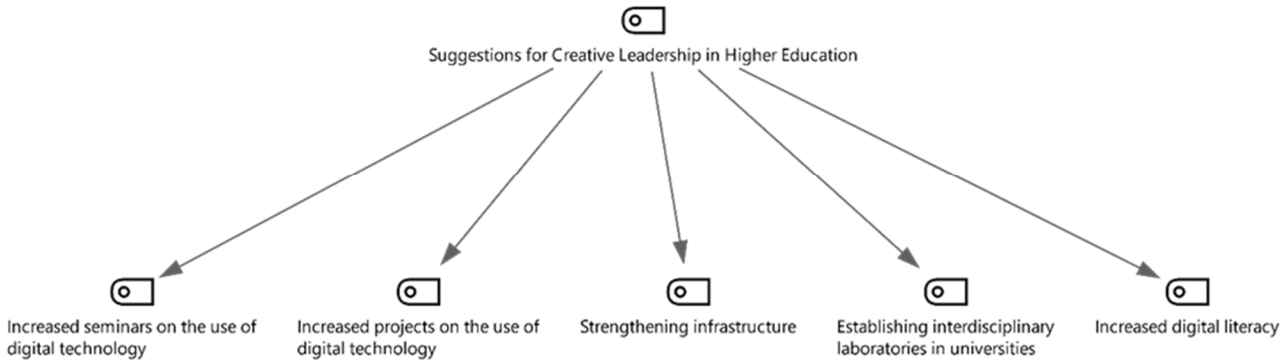


Figure 4. Suggestions for Creative Leadership in Higher Education.

3. Results

The findings regarding pre-service teachers' definitions of creative leadership reveal that developing innovative approaches (f = 13) and maximizing the potential of the team (f = 10) were the most frequently emphasized dimensions. This suggests that participants primarily associated creative leadership with generating original ideas, developing alternative solutions, and mobilizing the collective capabilities of team members. These perceptions indicate that creative leadership was understood as both an innovation-oriented and collaborative process rather than merely the maintenance of existing organizational practices.

Integrating diverse ideas (f = 7) also emerged as a prominent dimension of participants' definitions. This finding highlights the importance attached to bringing together different perspectives and combining individual contributions in the development of creative solutions. Furthermore, adaptability to change (f = 3) suggests that participants recognized the importance of responding flexibly to changing circumstances. The identification of adapting knowledge to current conditions (f = 1) further indicates an awareness of the need to reconsider and apply existing knowledge in accordance with contemporary educational needs.

Other dimensions, including transforming the organization, effective use of technology, self-confidence, and risk-taking ability, were each mentioned once (f = 1). Although these dimensions appeared less frequently in the participants' accounts, their inclusion indicates that creative leadership was not understood exclusively in terms of idea generation and teamwork. Rather, some participants also associated it with organizational development, technological engagement, personal attributes, and willingness to undertake risks. In particular, the limited references to effective technology use suggest that technology was not a central element in most participants' definitions of creative leadership. Overall, the findings portray creative leadership primarily through innovation, collective potential, and the integration of diverse perspectives, while also acknowledging its organizational, technological, and individual dimensions.

Illustrative participant quotations are presented below:

P4 (F,4): "Creative leadership, unlike conventional leadership, offers a broad perspective, adapts to all kinds of developments, keeps up with and effectively utilizes today's technological age, and successfully fosters teamwork in all areas."

P5(M,2): "Creative leadership is a vision that can transform the organizational structure, maximize the potential of individuals within the team, and aim for continuous improvement. It not only achieves current goals but also shapes the future by fostering innovative ideas."

P13(F,3): "It is the ability to come up with new and original ideas within a process that either already exists through technology or has the potential to be realized."

P1(M,2): "A leader is someone who adapts certain theoretical knowledge to fit contemporary circumstances and conditions."

The findings regarding the impact of digital technologies on creative leadership indicate that pre-service teachers primarily associated digital technologies with facilitating communication, generating original ideas, and improving access to information. Providing faster solutions in communication (f = 7) emerged as the most frequently emphasized dimension, suggesting that participants considered digital technologies important tools for accelerating information exchange, facilitating interaction, and supporting communication processes in leadership practices.

The emergence of original ideas (f = 6) and easy access to information (f = 5) were also prominent dimensions. These findings suggest that participants perceived digital technologies as resources that expand access to knowledge, support creative thinking, and facilitate the development of innovative approaches. In this respect, digital technologies were viewed not merely as instruments for performing routine tasks but also as resources that contribute to idea generation and knowledge sharing.

Participants also highlighted the role of digital technologies in managing teams efficiently (f = 4), implementing innovative projects quickly (f = 3), making things easier (f = 3), and enabling leaders to make data-based decisions (f = 3). These findings indicate that participants recognized the contribution of digital technologies to organizational coordination, operational efficiency, project implementation, and decision-making processes. In particular, the emphasis on data-based decision-making suggests an awareness of the potential of digital tools to support leadership practices through more informed and evidence-based decisions.

Overall, the findings suggest that pre-service teachers perceived digital technologies as facilitating both the interpersonal and operational dimensions of creative leadership. While faster communication, original idea generation, and access to information were more frequently emphasized, efficient team management, rapid project implementation, task facilitation, and data-based decision-making also formed part of their understanding. Thus, digital technologies were primarily conceptualized as enabling resources that strengthen communication, support innovation, and facilitate the effective implementation of creative leadership practices.

Illustrative participant quotations are presented below:

P7 (F,2): "Digital technologies facilitate creative leadership; they accelerate communication and enable the emergence of new ideas."

P12 (F,4): "I believe that digital technologies have a positive impact on creative leadership in higher education. In particular, the ease with which students and academics can communicate, exchange ideas, and access different resources can support the emergence of new ideas."

P10 (F,4): "I believe that digital technologies have a positive impact on creative leadership practices within higher education institutions. In particular, online learning platforms, artificial intelligence tools, digital content creation applications, and communication technologies facilitate access to information and support the development of innovative ideas. In the field of physical education, movement analysis software, video-assisted instructional practices, and digital assessment and evaluation tools can contribute to more effective planning of teaching processes. This, in turn, can enable pre-service teachers to develop both their leadership skills and their technological competencies."

The findings regarding the limitations of digital technologies in creative leadership indicate that pre-service teachers primarily emphasized technological inadequacy (f = 13) and limited infrastructure (f = 9) as major challenges. These findings suggest that participants perceived insufficient technological knowledge, skills, and infrastructure as important barriers to the effective integration of digital technologies into creative leadership

practices. In particular, technological inadequacy highlights the potential difficulties leaders may experience when attempting to use digital tools effectively, while limited infrastructure points to constraints related to access to technological resources and facilities.

Unconscious use of technology (f = 5) also emerged as a notable concern. This finding indicates that participants recognized the importance of using digital technologies purposefully and responsibly rather than relying on them without sufficient awareness or consideration of their potential consequences. Furthermore, resistance to change (f = 4) suggests that reluctance to adopt new technologies and adapt to changing practices may hinder the integration of digital tools into leadership processes.

Interestingly, two participants expressed the view that digital technologies do not necessarily involve limitations (f = 2). This perspective provides a contrasting viewpoint within the findings and suggests that some pre-service teachers may perceive technological resources primarily in terms of the opportunities and advantages they offer. Nevertheless, the overall findings indicate that participants were aware of several practical and individual challenges associated with the use of digital technologies in creative leadership. These challenges were mainly related to technological competence, infrastructure, conscious technology use, and openness to change.

Illustrative participant quotations are presented below:

P19 (M,3): "The biggest challenges are the resistance to change shown by traditional structures within institutions and the fact that not every student has equal access to current technological infrastructure. In addition, the level of digital literacy required to integrate existing technologies with appropriate pedagogical methods may also be insufficient."

P20 (F,2): "There may be security issues, technical problems such as deficiencies in the infrastructure used, and issues related to getting used to the process."

P6 (F,2): "Naturally, certain obstacles exist. In particular, disparities in the digital literacy levels of academic staff, inadequacies in institutional infrastructure, and—most importantly—bureaucratic hurdles and the resistance of institutional culture to change can significantly slow down these processes."

The findings regarding suggestions for promoting creative leadership in higher education indicate that pre-service teachers primarily emphasized the need for increased seminars on the use of digital technology (f = 13) and more projects involving digital technology (f = 9). These findings suggest that participants considered practical opportunities for learning about and experiencing digital technologies essential for supporting creative leadership. In particular, seminars were perceived as opportunities to improve knowledge and awareness, while technology-oriented projects were associated with the practical application of digital tools and the development of innovative practices.

Strengthening infrastructure (f = 5) also emerged as an important recommendation. This finding highlights participants' awareness that the effective integration of digital technologies into higher education requires adequate technological facilities and institutional resources. Accordingly, improving infrastructure may provide a supportive environment for implementing technology-based projects and developing creative leadership practices.

Establishing interdisciplinary laboratories in universities (f = 1) and increasing digital literacy (f = 1) were also mentioned, although less frequently. These suggestions point to the potential value of interdisciplinary collaboration and the development of individuals' digital competencies in fostering creative approaches to leadership. Although these dimensions received comparatively limited attention, they represent complementary institutional and individual strategies for supporting digital transformation in higher education.

Overall, participants' suggestions focused primarily on expanding educational and practical opportunities related to digital technologies, alongside improving institutional infrastructure. These findings indicate that pre-service teachers viewed the development of creative leadership in higher education as requiring not only individual willingness and competence but also institutional support, continuous learning opportunities, and practical engagement with digital technologies.

Illustrative participant quotations are presented below:

P14 (F,3): "To foster creative leadership through digital tools in higher education, leaders should first undergo training in using technology, just as they should at the beginning of any endeavor, through a training and supervision process. A strong infrastructure and budget should also be provided to bring ideas to life. Furthermore, employees who make a difference with technology should be rewarded for their efforts to encourage further development and inspire others. Finally, data from the system should be monitored to support leaders in continuously updating their skills."

P4 (F,4): "Interdisciplinary innovation laboratories should be established at universities. Furthermore, "reverse mentoring" programs—in which the younger generation provides guidance to those in leadership positions—should be initiated, and creative projects should be encouraged through financial and academic support."

4. Discussion

The present study explored pre-service teachers' perspectives on digital technologies for creative leadership in higher education. The findings indicate that participants conceptualized creative leadership primarily as an innovation-oriented, collaborative, and adaptive leadership approach rather than as a technology-centered construct. While digital technologies were considered valuable enablers of creative leadership, participants consistently emphasized that creativity originates from human interaction, collaboration, and innovative thinking, with technology serving as a supportive mechanism. This finding aligns with contemporary leadership theories suggesting that technology facilitates leadership practices but does not replace the cognitive, social, and relational competencies required for effective leadership [17,19].

One of the most prominent findings was that participants associated creative leadership with developing innovative approaches, integrating diverse ideas, and maximizing the potential of team members. This suggests that pre-service teachers perceive creativity as a collective rather than an individual process. Such a perspective is consistent with distributed and collaborative leadership theories, which argue that innovation emerges through interaction, knowledge sharing, and collective problem-solving rather than through the actions of a single leader [20,47]. The emphasis on collaboration also reflects current perspectives on higher education leadership, where creative leaders are expected to cultivate inclusive environments that encourage participation, knowledge exchange, and interdisciplinary cooperation. The relatively limited emphasis on risk-taking and organizational transformation also deserves consideration. One possible explanation is that pre-service teachers tend to associate leadership with practices that are more visible and familiar within educational settings, such as teamwork, generating ideas, and collaborative problem-solving. In contrast, risk-taking and organizational transformation may be perceived as responsibilities that require greater institutional authority and direct leadership experience. This pattern may therefore reflect an emerging understanding of leadership shaped primarily by pedagogical and interpersonal experiences rather than by engagement in formal organizational decision-making. Such a perspective suggests that pre-service teachers' conceptualization of creative leadership is currently more practice-oriented and collaborative than strategically or institutionally oriented.

The findings can also be interpreted in relation to the Technological Pedagogical Content Knowledge (TPACK) framework and the European Framework for the Digital Competence of Educators (DigCompEdu). The participants' emphasis on communication, access to information, data-informed decision-making, and the development of innovative projects reflects the integration of technological knowledge with pedagogical practices, as emphasized in the TPACK framework [13]. Similarly, the findings concerning the use of digital technologies to facilitate collaboration, support teaching and learning processes, and develop innovative educational activities are consistent with the competence areas outlined in DigCompEdu [23]. In particular, participants' recommendations for additional seminars, technology-based projects, and improved technological infrastructure highlight the importance of continuous professional development and institutional support for educators' digital competence. Although these frameworks were not used as predefined coding categories, they provide complementary theoretical perspectives for interpreting how pre-service teachers understand the relationship between digital technologies, pedagogical practices, and creative leadership.

Another important finding concerns the perceived contribution of digital technologies to creative leadership. Participants viewed digital technologies as enhancing communication, facilitating access to information, supporting evidence-based decision-making, and enabling the implementation of innovative ideas. These findings support previous studies demonstrating that digital technologies increase organizational flexibility, improve communication networks, and create opportunities for in-novation by facilitating collaboration and knowledge sharing [24,25]. Rather than attributing creativity directly to technology, participants viewed digital tools as resources that strengthen leaders' ability to organize, communicate, and innovate. This finding reinforces the notion that digital transformation should be understood as a socio-technical process in which technological resources and human competencies interact to enhance organizational creativity. However, these findings should be interpreted as reflecting participants' perceptions of the potential benefits of digital technologies rather than evidence of their actual effectiveness in leadership practice. Since the study examined pre-service teachers' views and did not measure the impact of digital technology use on leadership performance or institutional outcomes, it cannot establish whether these perceived benefits translate into more effective leadership. This distinction is particularly important because positive expectations regarding technological tools do not necessarily indicate that these tools will produce the anticipated outcomes in real organizational contexts. From a sustainability perspective, these findings suggest that the strategic use of digital technologies, combined with collaborative and innovative leadership practices, can contribute to the long-term sustainability of higher education by supporting inclusive learning environments, continuous knowledge sharing, and institutional adaptability.

Despite recognizing the benefits of digital technologies, participants also identified several challenges that may limit their contribution to creative leadership. Technological inadequacies, insufficient infrastructure, unconscious technology use, and resistance to change were perceived as major barriers. These findings are consistent with previous research indicating that successful digital transformation depends not only on technological availability but also on institutional readiness, digital competence, and organizational culture [1,4]. The identification of resistance to change further highlights the importance of fostering adaptive organizational cultures that encourage continuous learning and openness to innovation. Therefore, creative leadership in higher education requires more than access to digital tools; it also depends on developing the organizational conditions necessary for meaningful technology integration.

The participants' recommendations further reinforce this interpretation. Their suggestions focused primarily on expanding professional development opportunities, increasing technology-based projects, strengthening technological infrastructure, and creating collaborative learning environments. These recommendations indicate that participants perceive creative leadership as a competency that can be systematically developed through institutional investment, continuous professional learning, and experiential opportunities rather than as an innate personal characteristic. This perspective is consistent with contemporary models of leadership development, which emphasise that leadership competencies evolve through practice, reflection, and participation in authentic learning experiences [48].

An interesting finding emerging across all themes is that digital technologies were rarely described as defining characteristics of creative leadership. Instead, participants consistently positioned technology as an enabling resource that supports communication, innovation, collaboration, and decision-making. This distinction is theoretically important because it suggests that pre-service teachers do not equate digital competence with creative leadership. Rather, they perceive creative leadership as a human-centered process in which technology enhances, but does not determine, leader-ship effectiveness. This finding contributes to the growing literature arguing that successful digital leadership requires balancing technological competence with creativity, interpersonal communication, and collaborative problem-solving [26]. The professional status of the participants also provides an important context for interpreting these findings. As pre-service teachers, participants may have had limited direct experience with formal leadership responsibilities, institutional decision-making, resource allocation, and organizational change in higher education. Consequently, their perspectives may be shaped more by their educational experiences, observations of leadership practices, and expectations about their future professional roles than by direct involvement in leadership positions. This context may partly explain why they emphasized collaboration, innovation, and communication while giving comparatively less attention to risk-taking and organizational transformation. Nevertheless, their views remain valuable because they provide insight into how future educators are beginning to understand and conceptualize creative leadership. The findings should therefore be interpreted as reflecting emerging professional perceptions rather than comprehensive evaluations of leadership practices in higher education.

Overall, the findings suggest that pre-service teachers adopt a holistic under-standing of creative leadership that integrates innovation, collaboration, adaptability, and strategic technology use. Their perspectives imply that the development of creative leadership in higher education should extend beyond the provision of digital technologies to include institutional support, continuous professional development, opportunities for collaborative innovation, and organizational cultures that embrace change. Accordingly, higher education institutions seeking to prepare future educators for digitally enriched learning environments should prioritize not only technological investments but also the cultivation of creative, collaborative, and adaptive leadership capacities. In this regard, fostering creative, collaborative, and adaptive leadership capacities can be considered an important investment in the educational sustainability of higher education institutions, as these capacities support their ability to respond to changing educational needs and maintain innovation over time.

5. Conclusions

This study reveals that pre-service teachers conceptualize creative leadership in higher education primarily as an innovation-driven, collaborative, and adaptive process, where digital technologies function as supportive tools rather than defining elements. Par-

ticipants emphasized the role of creativity in developing innovative approaches, integrating diverse ideas, and maximizing team potential, highlighting a strongly collective understanding of leadership. It is important to note that these findings represent pre-service teachers' perceptions and interpretations rather than evidence of actual leadership performance or the measurable effects of digital technologies on creative leadership. Accordingly, the relationships identified in this study should be understood as perceived associations and potential contributions, not as established causal effects. The study did not examine the implementation of leadership practices or evaluate the outcomes of specific educational interventions. From an educational sustainability perspective, these findings highlight the importance of human-centered creative leadership in fostering inclusive, adaptable, and innovative higher education environments over time.

Digital technologies were perceived as potentially supporting creative leadership by improving communication, facilitating access to information, supporting decision-making, and creating opportunities for innovation. However, participants' accounts suggested that these potential contributions depend on infrastructure quality, user competence, and purposeful use. Limitations such as technological inadequacy, insufficient infrastructure, and resistance to change were identified as perceived barriers to the effective integration of digital technologies.

Overall, the findings suggest that strengthening creative leadership in higher education requires not only technological investment but also continuous professional development, improved digital literacy, and institutional support for collaborative and innovative practices. In this respect, investing in creative leadership development and sustainable digital practices may help higher education institutions maintain their capacity for continuous innovation and respond effectively to evolving educational needs.

The findings offer several implications for teacher education and higher education institutions. However, these implications should be interpreted as recommendations informed by pre-service teachers' perceptions rather than as evidence of the effectiveness of specific interventions.

Curriculum-Level Implications. At the curriculum level, teacher education programs may consider incorporating activities that encourage creative thinking, collaborative problem-solving, interdisciplinary learning, and the purposeful use of digital technologies. Courses focusing on digital literacy and educational technologies could provide opportunities for pre-service teachers to explore how digital tools may support communication, information sharing, and collaborative learning. These suggestions are based on participants' emphasis on creativity, collaboration, and technological support.

Institutional-Level Implications. At the institutional level, higher education institutions may consider improving digital infrastructure, ensuring equitable access to technological resources, and developing institutional environments that encourage collaboration and innovation. Institutional guidelines addressing responsible technology use, data security, and digital ethics may also help respond to the concerns expressed by participants. These recommendations reflect the perceived technological barriers and institutional needs identified in the study.

Professional Development Implications. Regarding professional development, universities and teacher education institutions may consider offering training opportunities focused on digital literacy, creative problem-solving, collaborative leadership, and the responsible use of digital tools. Such programs could be designed to help pre-service teachers become more familiar with the potential uses and limitations of digital technologies in educational settings. However, the effectiveness of these training initiatives requires further empirical investigation.

Limitations and Suggestions for Future Research

This study has several limitations that should be considered when interpreting the findings. First, the research was conducted using a qualitative design, which provides in-depth insights into participants' perceptions but limits the generalizability of the results. The findings reflect the subjective views of pre-service teachers and cannot be statistically generalized to all teacher education contexts.

Second, the study was carried out with pre-service teachers from a single institution, Manisa Celal Bayar University. This context-specific sample may have influenced the results, as institutional culture, access to digital resources, and educational practices can shape participants' perceptions of creative leadership and digital technologies. Therefore, the findings should be interpreted within this contextual framework.

Third, the data were collected through self-reported responses, which may be influenced by participants' personal experiences, interpretations, and awareness levels regarding digital technologies and creative leadership. This may result in variations in depth and detail across responses. Furthermore, the sample was not intended to be statistically representative, and the findings reflect the perspectives of pre-service teachers as students rather than those of individuals holding formal leadership positions. Participants' responses may also have been influenced by the wording and scope of the interview questions, while the interpretation of qualitative data and the development of codes and themes may involve a degree of researcher subjectivity despite the use of systematic coding procedures.

Future research may address these limitations by including larger and more diverse samples from different universities and educational contexts. Comparative studies across institutions or countries could provide a broader understanding of how creative leadership is perceived in relation to digital technologies. Additionally, mixed-methods or quantitative studies could be conducted to test and generalize the relationships identified in this qualitative study.

Moreover, future studies may focus on longitudinal designs to examine how perceptions of creative leadership evolve over time, particularly as digital transformation in higher education continues to progress. Experimental or intervention-based research could also be conducted to evaluate the impact of targeted digital literacy or leadership training programs on the development of creative leadership competencies among pre-service teachers.

Finally, the study focused on pre-service teachers' perceptions and did not examine their actual creative leadership behaviors, digital technology practices, or leadership performance in authentic educational settings. Furthermore, no educational intervention or professional development program was implemented or evaluated. Therefore, the findings do not establish whether the proposed uses of digital technologies or the recommended educational practices lead to measurable improvements in creative leadership competencies. Future research could address this limitation through observational studies, longitudinal designs, and intervention-based research.

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