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The Moderating Role of Digital Leadership Between Digital Transformation and Performance of Vocational Education Teachers In Public Schools

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A B S T R A C T

This paper aims to investigates the moderating role of digital leadership in the relationship between digital transformation and the performance of vocational education teachers in public schools. The research focuses on male and female vocational education teachers within government schools affiliated with the education directorates in Irbid Governorate, encompassing a total population of 447 teachers, with 199 males and the remainder females. A sample size of 105 teachers was selected through a simple random sampling method. Employing a descriptive analytical approach, data was processed using the Statistical Package for the Social Sciences (SPSS-29). The findings reveal statistically significant differences in the impact of digital transformation on the performance of vocational education teachers based on years of experience and academic qualifications. However, no significant differences were found related to the gender variable. Importantly, the study demonstrates that digital leadership enhances the positive effects of digital transformation on teachers' performance, underscoring its critical role. The study concludes that digital leadership plays a vital role in optimizing the benefits of digital transformation for vocational education teachers' performance in public schools, suggesting this area warrants further research. Additionally, the study recommends strengthening teacher support and encouragement through administrative efforts, enhancing teacher competencies, and providing a conducive classroom environment. Teachers should be motivated and provided opportunities to pursue further studies relevant to their specialization.

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1. Introduction

Digital transformation has become an integral part of modern education, revolutionizing the teaching and learning process in classrooms. With the rapid advancement of technology, teachers face the challenge of integrating digital tools and technologies into their educational practices. Consequently, this shift towards digital teaching methods has a profound impact on teachers' performance and effectiveness in the classroom. However, the successful implementation of digital transformation in education heavily relies on the presence of effective digital leadership and support (Desouqi, 2022). Digital leadership refers to the vision, guidance, and support provided by educational leaders to ensure the seamless integration of technology into teaching practices (Al-Naimi & Hattamleh, 2023). In the context of digital transformation, leaders play a vital role in empowering teachers and enabling them to adopt and use digital tools effectively (Al-Semirat, 2023). On the other hand, digital leaders provide teachers with the necessary resources, training, and professional development opportunities to enhance their digital competence. Digital leadership fosters a culture of innovation and risk-taking, encouraging teachers to experiment with new technological tools and teaching methods (Al-Naimi & Hattamleh, 2023). Furthermore, effective digital leadership promotes collaboration and communication among teachers, enabling them to share best practices and learn from each other. Strong and supportive digital leadership enhances the positive impacts of digital transformation on teachers' performance, leading to improved educational practices, student engagement, and outcomes. Conversely, the lack of digital leadership can hinder teachers' ability to use technology effectively and overcome the challenges associated with digital transformation (Shawish, 2022). However, the impact of digital transformation on teachers' performance is significant, offering numerous benefits such as access to resources, improved communication, and personalized learning experiences. However, the presence of effective digital leadership is essential to harness the full potential of digital transformation in education. Through their vision, support, and resources, digital leaders play a crucial role in enabling teachers to embrace technology and adapt their practices, ultimately enhancing the overall quality of education. The problem of this study is to identify the moderating role of digital leadership in the effect of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate. The study problem can be clarified through the following questions:

1. What is the performance level of vocational education teachers in public schools in Irbid Governorate, and what is the impact of digital transformation on it?
2. Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate attributed to variables (gender, academic qualification, number of years of experience)?
3. Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the moderating role of digital leadership in the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate?

This paper aims to identify the performance level of vocational education teachers in public schools in Irbid Governorate and the impact of digital transformation on it. Additionally, it seeks to determine whether the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate is attributed to variables such as gender, academic qualification, and number of years of experience. Furthermore, this study aims to highlight the moderating role of digital leadership in the impact of digital transformation on the performance of vocational education teachers in public schools in Irbid Governorate.

2. Literature Review

The rapid advancement of digital technology has significantly transformed various sectors, including education. The integration of digital tools and practices in teaching has introduced new dynamics in

educational environments, fundamentally altering the ways in which educators deliver instruction and interact with students. This literature review aims to explore the existing research on digital transformation in education, focusing on its impact on teachers' performance, the role of digital leadership, and the specific challenges and opportunities faced by vocational education teachers in public schools. Firstly, the review will examine the concept of digital transformation in education, highlighting its key components and the theoretical frameworks that underpin its implementation. This section will provide a comprehensive understanding of how digital transformation reshapes educational practices and outcomes. Secondly, the review will delve into the impact of digital transformation on teachers' performance. Various studies have indicated that the adoption of digital tools can enhance teaching effectiveness, improve student engagement, and facilitate personalized learning experiences. However, the extent of these benefits can vary based on several factors, including the teachers' proficiency with technology, the availability of resources, and the overall support from the educational leadership. Thirdly, the review will explore the critical role of digital leadership in facilitating successful digital transformation. Effective digital leadership involves providing vision, guidance, and support to ensure the seamless integration of technology into teaching practices. Leaders in education play a pivotal role in fostering a culture of innovation, encouraging professional development, and creating an environment conducive to digital learning. Additionally, the review will address the specific context of vocational education teachers in public schools. Vocational education, with its focus on practical and skills-based learning, presents unique challenges and opportunities for digital transformation. The literature will be examined to identify how digital tools can enhance vocational training and how teachers can be supported in adopting these technologies. Finally, the review will consider the moderating effects of digital leadership on the relationship between digital transformation and teachers' performance. Understanding these dynamics is crucial for developing strategies that maximize the positive impacts of digital transformation on educational outcomes. However, this literature review aims to synthesize the current research on digital transformation in education, with a particular focus on the performance of vocational education teachers and the role of digital leadership. By examining these areas, the review seeks to provide a comprehensive foundation for understanding the complexities and implications of digital transformation in the educational context.

Digital transformation presents a broad spectrum of benefits for teachers, enabling access to an extensive range of resources and educational materials that facilitate the development of engaging and interactive lessons. Teachers can utilize online platforms, educational apps, and digital content to supplement traditional teaching methods and provide personalized learning experiences for their students. Digital tools also enhance effective communication between teachers, students, and parents. It is crucial to study the impact of digital leadership, which oversees learning management systems, collaborative platforms, and communication applications for teachers. These tools enable interaction with students beyond classroom walls, provide instant feedback, track progress, and meet individual needs, thereby enhancing the overall learning experience and fostering a more productive and inclusive educational environment. Furthermore, Na'imi and Hattamleh (2023) examined the role of digital leadership in improving teacher performance in the Bani Ubaid District Education Directorate. Using a descriptive survey method and a sample of 385 teachers, the study found a significant role of digital leadership in enhancing teacher performance, particularly in professional practice, digital culture and learning, and digital citizenship. Razak et al. (2023) aimed to provide a theoretical understanding of digital learning transformation among public school teachers. Analyzing 42 articles from Scopus databases, the study identified significant themes and barriers to digital transformation, highlighting the importance of strategic policy-making for sustainable education and effective teaching performance. Moreover, Abuajwa et al. (2023) focused on digital leadership and readiness for change in Palestinian higher education institutions. Using a descriptive-analytical method and a sample of supervisory staff, the study revealed a positive impact of digital leadership on change readiness, emphasizing the importance of digital skills and continuous professional development.

Mohamed (2023) explored digital transformation requirements and challenges in Egyptian educational institutions. The study identified key requirements, such as updated regulations, re-engineered structures,

robust IT infrastructure, and continuous learning programs. Major challenges included administrative resistance, lack of financial resources, and limited awareness of digital transformation's importance. Al-Semirat (2023) investigated digital leadership drivers among school leaders in Karak Governorate during remote learning. Using a descriptive method and a sample of 127 administrators and teachers, the study found significant effects of administrative and digital support, leadership skills, and digital culture on digital leadership, with recommendations for incentivizing leaders who implement digital practices. Carvalho et al. (2022) also analyzed the relationship between leadership styles, digital transformation, and performance in higher education institutions. A systematic literature review revealed that transformational leadership was most commonly associated with digital transformation, which is essential for enhancing educational activities and adopting online learning technologies. In addition, Shawish (2022) examined the role of digital leadership in promoting digital literacy among teachers from the perspective of school principals in the Qasaba Amman District. Using a descriptive survey method, the study found a high degree of digital leadership's impact on developing computational thinking, critical thinking, and content creation, with no significant differences based on gender or experience. However, this review synthesizes the current research on digital transformation, teacher performance, and digital leadership, highlighting their interconnectedness and the critical role of effective leadership in fostering a conducive environment for digital innovation in education.

2.1 Digital Transformation

Digital transformation in education refers to the use of digital technologies to enhance the learning experience for students, teachers, and administrators. It can help streamline administrative tasks, improve the quality and relevance of learning, and promote inclusion (Truong & Diep, 2023). However, digital transformation is a phenomenon driven by a suite of modern digital technologies operating synchronously, such as computers, artificial intelligence, and cloud computing. This transformation generates vast amounts of new information that can aid in decision-making and strategic planning (Lanzolla et al., 2020). Implementing digital transformation across various sectors enhances efficiency and improves organizational performance in multiple dimensions. It is also linked to increased innovation, productivity, financial performance, company growth, reputation, and competitive advantage (Vial, 2019). Educational systems must adapt to equip students with the skills necessary to build a more just and productive society. Schools should provide hard skills like technology design and resource management, as well as soft skills like communication, empathy, and social awareness, enabling students to shape inclusive and fair communities. These skills are essential for enabling people to thrive in a more complex, interconnected, and rapidly changing world (Truong & Diep, 2023).

2.2 Teacher Performance

Teacher performance encompasses the behaviors, attitudes, and actions within the teaching and learning environment that contribute to achieving students' educational goals (Kilag et al., 2023). Teachers must continuously enhance their skills to keep up with the latest trends, educational methods, and technologies in the education sector (Abu Khairan & Rantisi, 2023). Ensuring that content remains up-to-date and applicable is crucial for effectively meeting students' educational requirements and facilitating their optimal development. Teacher performance refers to the observable outcomes in the classroom that indicate the effectiveness or ineffectiveness of training and development. It includes actions, attitudes, and behaviors exhibited in the teaching and learning environment that contribute to achieving students' educational goals (Al-Juhani & Al-Harthi, 2023). Performance is a critical aspect of organizational management due to its significant role in achieving organizational goals with maximum efficiency and effectiveness. Teachers are expected to possess the pedagogical expertise and skills necessary for effective communication with their students. While a comprehensive understanding of content is essential, it does not guarantee efficient

teaching. Teachers must be capable of delivering educational content or experiences in ways that ensure optimal learning outcomes when students engage in learning activities. Additionally, the subject matter should be communicated and presented in a manner that captivates students and enhances their educational experience (Tjabolo, 2020). Moreover, teachers need to effectively manage a range of routine responsibilities, such as managing teaching programs, ensuring proper organization and maintenance of laboratory equipment, coordinating guest lecturers, arranging and supervising school trips, and promptly handling registration change requests, among many other tasks (Rababaah, 2022). Ensuring and retaining highly skilled teachers is critical for providing high-quality education in schools. Teacher effectiveness is evaluated based on their performance, which is influenced by factors such as salary, working conditions, and job motivation.

2.3 Digital Leadership

Digital leadership is defined as the integration of digital technologies, such as mobile devices, communication applications, and web applications, into the leadership practices of school leaders towards sustainable change in technology use in schools. In essence, digital leadership is a combination of leaders, resources, devices, and technology (Yusof et al., 2019). Digital leaders differ from other leaders in terms of skills, attitudes, knowledge, and their professional and personal experiences. Digital leaders must possess flexibility, adaptability, intellectual curiosity, and a willingness to acquire new knowledge. They should be open to continuous learning by seeking solutions globally and constantly encourage their collaborators and followers to learn (Karakose et al., 2021). In addition, the strategic importance of digital leadership is evident in its role in supporting and assisting staff in educational institutions to streamline administrative procedures and facilitate decision-making processes. It also enables leaders to plan efficiently and effectively to meet work requirements and deliver high-quality outputs according to technical and other standards that meet modern demands and achieve their intended purposes (Al-Otaibi, 2023). Digital leadership differs from traditional leadership in that it "does not focus on the characteristics or actions of leaders; instead, it emphasizes that leaders must develop, guide, manage, and apply technology to various organizational processes to enhance operational performance. Applying leadership skills is essential for leaders to help their organizations adopt technology beneficially and prepare their institutions for the 21st century" (Mehibel & Haqah, 2023).

3. Hypothesis Development

Digital transformation offers a wide range of benefits for teachers by enabling access to a vast array of resources and educational materials, which facilitates the development of engaging and interactive lessons. Teachers can leverage online platforms, educational apps, and digital content to supplement traditional teaching methods and provide personalized learning experiences for their students. Digital tools also enhance effective communication between teachers, students, and parents. It is crucial to study the impact of digital leadership overseeing learning management systems, collaborative platforms, and communication applications for teachers. These tools enable interaction with students beyond classroom walls, provide instant feedback, track progress, and meet individual needs. This level of connectivity enhances the overall learning experience and fosters a more productive and inclusive educational environment.

Digital transformation, driven by technologies such as computers, artificial intelligence, and cloud computing, generates vast amounts of new information that aid decision-making and strategic planning (Lanzolla et al., 2020). The implementation of digital transformation in education enhances efficiency, innovation, productivity, financial performance, company growth, reputation, and competitive advantage (Vial, 2019). Educational systems must adapt to equip students with the necessary skills for a just and productive society, including hard skills like technology design and resource management, and soft skills

like communication, empathy, and social awareness (Truong & Diep, 2023). This dual focus ensures that students are prepared to thrive in a complex, interconnected, and rapidly changing world. Furthermore, teachers need to continually update their skills to stay current with trends, educational methods, and technologies (Abu Khairan & Rantisi, 2023). Teacher performance encompasses behaviors, attitudes, and actions within the educational environment that achieve students' educational goals (Al-Juhani & Al-Harthi, 2023). Effective teaching requires both comprehensive content knowledge and the ability to deliver it in ways that ensure optimal learning outcomes (Tjabolo, 2020). Additionally, teachers must manage various responsibilities, including organizing teaching programs and maintaining equipment (Rababaah, 2022). Retaining highly skilled teachers is crucial for high-quality education, with their effectiveness influenced by factors such as salary, working conditions, and motivation.

Digital leadership plays a pivotal role in integrating digital technologies into educational practices. Digital leaders must be flexible, adaptable, and open to continuous learning, encouraging their teams to do the same (Karakose et al., 2021). They support educational staff by streamlining administrative procedures, facilitating decision-making, and enabling effective planning and high-quality performance (Al-Otaibi, 2023). Unlike traditional leadership, digital leadership focuses on developing, guiding, managing, and applying technology to improve organizational performance (Mehibel & Haqah, 2023). Additionally, Na'imi and Hattamleh (2023) examined the role of digital leadership in improving teacher performance in the Bani Ubaid District Education Directorate. Using a descriptive survey method and a sample of 385 teachers, the study found a significant role of digital leadership in enhancing teacher performance, particularly in professional practice, digital culture and learning, and digital citizenship. This study underscores the importance of digital leadership in fostering a supportive environment for digital transformation.

Razak et al. (2023) aimed to provide a theoretical understanding of digital learning transformation among public school teachers. Analyzing 42 articles from Scopus databases, the study identified significant themes and barriers to digital transformation, highlighting the importance of strategic policy-making for sustainable education and effective teaching performance. This study emphasizes the need for a structured approach to overcome the barriers to digital transformation in education. Furthermore, Abuajwa et al. (2023) focused on digital leadership and readiness for change in Palestinian higher education institutions. Using a descriptive-analytical method and a sample of supervisory staff, the study revealed a positive impact of digital leadership on change readiness, emphasizing the importance of digital skills and continuous professional development. This research highlights the crucial role of digital leadership in preparing educational institutions for change and innovation. In addition, Mohamed (2023) explored digital transformation requirements and challenges in Egyptian educational institutions. The study identified key requirements, such as updated regulations, re-engineered structures, robust IT infrastructure, and continuous learning programs. Major challenges included administrative resistance, lack of financial resources, and limited awareness of digital transformation's importance. This study provides a comprehensive overview of the necessary conditions and obstacles for successful digital transformation. Al-Semirat (2023) investigated digital leadership drivers among school leaders in Karak Governorate during remote learning. Using a descriptive method and a sample of 127 administrators and teachers, the study found significant effects of administrative and digital support, leadership skills, and digital culture on digital leadership, with recommendations for incentivizing leaders who implement digital practices. This study offers practical insights into fostering effective digital leadership in educational settings. Furthermore, Carvalho et al. (2022) analyzed the relationship between leadership styles, digital transformation, and performance in higher education institutions. A systematic literature review revealed that transformational leadership was most commonly associated with digital transformation, which is essential for enhancing educational activities and adopting online learning technologies. This study highlights the importance of adopting appropriate leadership styles to facilitate digital transformation. Shawish (2022) examined the role of digital leadership in promoting digital literacy among teachers from the perspective of school principals in the Qasaba Amman District. Using a descriptive survey method, the study found a high degree of digital leadership's impact on developing computational

thinking, critical thinking, and content creation, with no significant differences based on gender or experience. This study demonstrates the effectiveness of digital leadership in enhancing key digital competencies among teachers. However, the above literature highlights the critical role of digital leadership in facilitating digital transformation in education. Effective digital leadership not only supports the integration of technology but also fosters a culture of continuous learning and innovation, essential for improving teacher performance and achieving educational goals as shown in ***Figure 1***. Thus, the following hypotheses can be proposed:

H1: Blockchain technology significantly enhances the accuracy of financial reporting in the UAE.

H2: Blockchain technology significantly improves the transparency of financial reporting practices in the UAE.

H3: The adoption of blockchain technology significantly reduces the risk of fraud in financial reporting in the UAE.

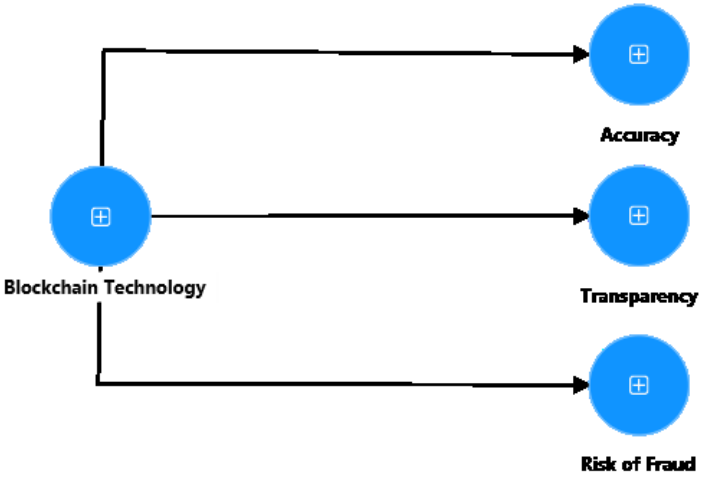

Figure 1. Research Model

4. Methodology

The methodology and procedures section provide a detailed description of the study's design, population, sample, tools, validity and reliability indicators, variables, procedures, and statistical treatments used to address the research questions. The study utilized a descriptive-analytical method to investigate the impact of digital transformation on the performance of vocational education teachers, considering the moderating role of digital leadership. To achieve the study's objectives of uncovering the effect of digital transformation on the performance of vocational education teachers, the researcher developed a measurement scale after reviewing relevant educational literature, sources, references, and related studies. The initial version of the scale consisted of 40 items, distributed across three domains: teacher performance, digital transformation, and digital leadership. The study population included all vocational education teachers in public schools under the education directorates in Irbid Governorate, totalling 447 teachers, with 199 males and the remainder females. A simple random sampling method was used to select a sample of 105 teachers, based on Morgan's table for sample size selection. The demographic breakdown of the study sample shown in *Table 1* as follows.

Table 1: Description of Study Sample by Demographic Variables

Variable	Category	Number	Percentage (%)

Gender	Male	5.00	4.80
	Female	100.00	95.20
Academic Qualification	Bachelor's Degree	63.00	60.00
	Postgraduate	42.00	40.00
Years of Experience	Less than 5 years	13.00	12.40
	5 to less than 10 years	20.00	19.00
	More than 10 years	72.00	68.60
Total		105.00	100.00

To ensure the validity and reliability of the questionnaire, the study employed rigorous procedures. The development and validation process of the instrument involved a comprehensive review of existing literature and feedback from experts in the field, ensuring that the items accurately measured the intended constructs and were consistent over time. The use of a descriptive-analytical approach allowed for a thorough examination of the variables and their interactions. This method provided insights into how digital transformation impacts vocational education teachers' performance and how digital leadership moderates this relationship. The statistical treatments applied in this study included various techniques to analyze the collected data and answer the research questions effectively.

5. Findings

The face validity of the scale was confirmed by presenting its initial version to a panel of seven experts in the field of educational administration. These experts reviewed the scale for its accuracy and content validity, assessing each item's relevance, clarity, linguistic formulation, and suitability for measuring the intended construct. Based on their feedback, modifications were made, including rephrasing some items for greater clarity and removing inappropriate ones. The criterion for accepting or excluding items was achieving 80% agreement among the experts. Following this review, the scale was refined to include 30 items divided into three domains: teacher performance (items 1-10), digital transformation (items 11-20), and digital leadership (items 21-30). To verify construct validity, the scale was administered to a pilot sample of 30 teachers who were not part of the main study sample. Pearson correlation coefficients were calculated to determine the item-total correlations within each domain. The correlation coefficients for teacher performance ranged from 0.53 to 0.71, for digital transformation from 0.48 to 0.74, and for digital leadership from 0.45 to 0.76. All these values were statistically significant at the 0.05 level, indicating acceptable levels of construct validity according to Audeh (2010). These results supported the retention of all items in the scale. However, to estimate the internal consistency reliability of the scale, Cronbach's alpha was calculated using the data from the initial pilot sample of 30 teachers. The Cronbach's alpha values were 0.74 for the domain of teacher performance, 0.76 for the domain of digital transformation, and similarly high for digital leadership, indicating good internal consistency. Additionally, test-retest reliability was assessed by re-administering the scale to the same pilot sample with a two-week interval between the first and second administrations. Pearson correlation coefficients between the two administrations were 0.83 for teacher performance and 0.80 for digital leadership, suggesting strong test-retest reliability. These reliability coefficients indicate that the scale is stable over time and consistently measures the intended constructs. However, this are shown in *Table 2* as follows.

Table 2: Means and Standard Deviations of Vocational Education Teachers' Performance

Importance Level	Rank	Standard Deviation	Mean	Item
High	1	0.96	3.87	Focus on developing teachers' performance using modern teaching methods
High	2	1.06	3.76	Teachers are adequately provided with professional studies

Moderate	3	0.85	3.60	Encouraging teachers to teach different curricula through IT
Moderate	4	0.99	3.53	Teacher performance is evaluated using advanced assessment models
Moderate	5	0.89	3.51	The school provides teachers with clear strategies to develop their abilities
Moderate	6	0.88	3.40	Focus on teachers' self-motivation as a modern approach
Moderate	7	1.04	3.32	Raising the cultural level of primary education teachers by providing diverse educational cultures
Moderate	8	0.99	3.31	Enhancing teachers' efforts and encouraging them through administration
Moderate	9	0.92	3.25	Developing teachers' competencies and providing a conducive classroom environment
Moderate	10	0.93	3.05	Encouraging teachers and providing opportunities for academic advancement in their specialization
Moderate	-	0.94	3.46	Overall mean

Table 2 above, presents the means and standard deviations for the performance of vocational education teachers. The mean values ranged from 3.87 to 3.05, with the overall mean for the scale being 3.46 and a standard deviation of 0.94, indicating a moderate level of performance overall. The scores varied between high and moderate, reflecting different aspects of teacher performance as influenced by digital transformation and digital leadership. However, the highest mean score (3.87) was for the item "Focus on developing teachers' performance using modern teaching methods," with a standard deviation of 0.96, indicating a high level of importance. This suggests that the use of modern teaching methods is seen as a crucial factor in enhancing teacher performance. The lowest mean score (3.05) was for the item "Encouraging teachers and providing opportunities for academic advancement in their specialization," with a standard deviation of 0.93, indicating a moderate level of importance. This reflects that while academic advancement is important, it is perceived to be less critical compared to other aspects such as using modern teaching methods. In addition, the overall mean score of 3.46 with a standard deviation of 0.94 suggests that the general performance of vocational education teachers is moderate. This indicates that while there are areas of strength, such as the adoption of modern teaching methods, there are also areas that require improvement, such as providing opportunities for teachers' academic advancement. The range of mean values between high and moderate levels underscores the varying impact of digital transformation and digital leadership on different facets of teacher performance. The detailed analysis of mean scores and standard deviations provides valuable insights into specific areas where digital transformation and leadership can be leveraged to improve teacher performance. The high importance placed on modern teaching methods highlights the need for continuous professional development and support in integrating technology into teaching practices. Conversely, the lower scores in areas related to academic advancement suggest a need for more structured support and opportunities for teachers to further their education and specialization. However, this comprehensive analysis not only identifies key areas of strength and improvement but also provides a roadmap for targeted interventions to enhance the overall effectiveness of vocational education teachers in Irbid Governorate. By focusing on the areas identified as having the greatest impact, educational leaders can develop strategies to support teachers in adopting digital tools and methodologies, ultimately leading to improved educational outcomes.

To determine if there are statistically significant differences at the level ($\alpha \leq 0.05$) in the impact of digital transformation on the performance of vocational education teachers in public schools due to variables (gender, academic qualification, years of experience), a multivariate analysis of variance (MANOVA) was conducted. The results are presented in *Table 3,* and *Table 4* as follows.

Table 3: MANOVA Results for Differences in Mean Scores of Study Sample Responses Based on Study Variables

Variable	Level	Impact of Digital Transformation on Teacher Performance	Overall Scale Mean
Gender	Male	Mean = 3.85	Mean = 3.38
		SD = 0.58	SD = 0.42
	Female	Mean = 3.15	Mean = 3.19

		SD = 0.83	SD = 0.71
Academic Qualification	Bachelor's Degree	Mean = 3.43	Mean = 3.59
		SD = 0.84	SD = 0.78
	Postgraduate	Mean = 3.38	Mean = 3.31
		SD = 0.71	SD = 0.66
Years of Experience	Less than 5 years	Mean = 3.33	Mean = 3.68
		SD = 0.92	SD = 0.90
	5 to 10 years	Mean = 3.44	Mean = 3.73
		SD = 0.63	SD = 0.58
	More than 10 years	Mean = 3.18	Mean = 3.23
		SD = 0.92	SD = 0.65

Table 4: MANOVA Results for Differences in Mean Scores of Study Sample Responses Based on Study Variables

Source of Variance	Dimension	Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance Level
Gender	Impact of Digital Transformation on Teacher Performance	1.352	1	1.354	2.159	0.136
Academic Qualification	Impact of Digital Transformation on Teacher Performance	3.614	1	3.728	6.256	0.014*
Years of Experience	Impact of Digital Transformation on Teacher Performance	2.21	2	1.008	1.0304	0.006*
Error	Impact of Digital Transformation on Teacher Performance	144.012	105	0.521		
Total	Impact of Digital Transformation on Teacher Performance	3365.161	105			
Total	Overall Scale Mean	3192.121	105			
***Statistically significant at the level ($\alpha \leq 0.05$).**						

The multivariate analysis of variance (MANOVA) results provide significant insights into the differential impact of digital transformation on the performance of vocational education teachers based on various demographic variables. The analysis revealed that gender did not show statistically significant differences in the impact of digital transformation on teacher performance. The F value was 2.159 with a significance level of 0.136, indicating that male and female teachers are similarly affected by digital transformation initiatives in terms of their performance. This finding aligns with previous studies suggesting that gender does not play a pivotal role in the effectiveness of digital integration in educational settings (Vial, 2019). In contrast, academic qualification was found to have a statistically significant impact on teacher performance in the context of digital transformation. The F value for academic qualification was 6.256, with a significance level of 0.014. This indicates that teachers with different academic qualifications respond differently to digital transformation efforts. Teachers with higher academic qualifications, such as postgraduate degrees, may have more exposure to advanced pedagogical techniques and a better understanding of integrating technology into their teaching practices. This result underscores the importance of advanced education and continuous professional development in enhancing teachers' ability to effectively utilize digital tools (Truong and Diep, 2023). Similarly, years of experience also showed statistically significant differences in the impact of digital transformation on teacher performance, with an F value of 1.0304 and a significance level of 0.006. This finding suggests that more experienced teachers might either benefit more from digital transformation due to their familiarity with various teaching methods or struggle more due to potential resistance to changing long-established practices. It highlights the complex relationship between experience and adaptability to new technologies. Experienced teachers might have developed extensive pedagogical strategies that they can enhance with digital tools, but they may also require targeted support to overcome any resistance to adopting new technologies (Abu Khairan and Rantisi, 2023). While gender did not significantly affect the impact of digital transformation on the performance of vocational education teachers, both academic qualification and years of experience did show significant

differences. This suggests that teachers' academic backgrounds and professional experience levels are crucial factors in determining how effectively digital transformation impacts their performance. These findings emphasize the need for tailored professional development programs that address the specific needs of teachers based on their academic qualifications and experience levels to maximize the benefits of digital transformation in education (Lanzolla et al., 2020).

The results indicate statistically significant differences in the impact of digital transformation on the performance of vocational education teachers based on years of experience and academic qualifications, with significance values of 0.006 and 0.014, respectively. However, there were no statistically significant differences attributed to gender, with a significance value of 0.136. This finding suggests that while gender does not influence how digital transformation affects teacher performance, the level of academic qualification and years of experience do play crucial roles. Supporting this, Razak et al. (2023) emphasize the importance of digital transformation and educational technology communities, particularly for policymakers who need to devise strategies and reconsider existing practices to achieve sustainable education and effective teacher performance. This perspective aligns with the study's findings, highlighting the necessity for tailored approaches in implementing digital transformation that consider teachers' educational backgrounds and professional experience. Additionally, Mohamed (2023) identifies key requirements for the successful application of digital transformation in educational institutions. These include updating educational laws and regulations to align with digital transformation, re-engineering institutional structures and processes to meet the demands of digital integration, providing robust ICT infrastructure, preparing and qualifying educational human resources, and offering continuous learning and self-learning programs in digital technology. Furthermore, fostering the exchange of experiences and enhancing partnerships with the local community are essential. These recommendations underscore the multifaceted approach needed to support teachers effectively during digital transformation, ensuring they have the necessary tools and environment to succeed.

Carvalho et al. (2022) also contribute to this discussion by pointing out that the most discussed aspects of digital transformation involve online learning systems and various types of technology. This focus reflects the practical challenges and opportunities that come with integrating digital tools into educational practices. The findings from Carvalho et al. suggest that for digital transformation to be effective, it must be supported by comprehensive and well-implemented technological systems that teachers can utilize to enhance their instructional methods. Thus, the significant differences based on academic qualifications and years of experience highlight the need for differentiated support and professional development tailored to these factors. While gender does not appear to influence the effectiveness of digital transformation, the varying impacts based on experience and education level indicate that a one-size-fits-all approach is insufficient. Effective digital transformation in education requires strategic planning, robust infrastructure, continuous professional development, and community engagement, as supported by the findings of Razak et al. (2023), Mohamed (2023), and Carvalho et al. (2022). In addition, to test the hypothesis, hierarchical regression analysis was conducted to understand the role digital leadership plays in enhancing the impact of digital transformation on the performance of vocational education teachers. This analysis was performed in two stages. In the first stage, the independent variable (digital transformation) was introduced to control for and adjust it in the regression model. In the second stage, the variable of digital leadership was added to the model to determine its capacity to improve the effect. In *Table 5* below are the summary of the results.

Table 5: Hierarchical Regression Analysis

Independent Variable	Model 1			Model 2		
	Beta	T	sig	Beta	T	sig
Digital Transformation	0.188	2.714	0.017	0.017	0.215	0.002
Digital Leadership				0.787	2.849	0.018
R		7.84		0.910		

R square		0.660		0.870		
Change R				0.063		
F change		152.234		211.825		
Sig		0.000		0.000		

The hierarchical regression analysis involved two models. In the first model, the independent variable (digital transformation) was introduced to control its influence on the dependent variable (teacher performance). The results of the first model showed a very high overall correlation coefficient (R) of 0.847 between digital transformation and teacher performance. This model indicated a statistically significant effect of digital transformation on the performance of vocational education teachers, supported by an F value of 152.234 with a significance level of 0.000. The R Square value of 0.66 suggests that 66% of the variance in teacher performance can be explained by the variance in digital transformation. In the second model, digital leadership was added to the regression model to determine its role in enhancing the effect of digital transformation on teacher performance. The results from the second model revealed a statistically significant impact of digital transformation on teacher performance, with the correlation coefficient increasing to 0.91, representing a 7% increase due to the inclusion of digital leadership. This indicates that digital leadership significantly enhances the relationship between digital transformation and teacher performance. The R Square change value of 0.87, which is statistically significant, shows a 21% increase compared to the first model, highlighting the substantial contribution of digital leadership to improving the positive impact of digital transformation on teacher performance. These findings are consistent with previous studies. For instance, Na'imi and Hattamleh (2023) found a high role of digital leadership in developing teacher performance in educational directorates, with significant impacts noted in areas such as excellence in professional practice and digital culture and learning. Similarly, Abuajwa et al. (2023) reported a positive effect of digital leadership on readiness for change in educational institutions, underscoring the importance of leadership in facilitating digital transformation. However, the hierarchical regression analysis demonstrates that digital leadership significantly enhances the positive impact of digital transformation on the performance of vocational education teachers. This underscores the critical role of digital leadership in educational settings, emphasizing the need for strong leadership to support and guide the integration of digital technologies in teaching practices. The results are backed by empirical evidence from previous studies, reinforcing the importance of digital leadership in achieving effective and sustainable digital transformation in education.

Digital transformation has the potential to enhance the quality of education and fundamentally change how teaching and learning are conducted. According to the current study, the digital transformation of vocational education can improve the quality of education by updating the content and outcomes of graduate training and enhancing relationships among participants in the educational environment. The study posits that the role of digital leadership in the impact of digital transformation on the performance of vocational education teachers is a fascinating area of research that warrants further exploration. Moreover, the study recommends bolstering teachers' efforts and encouraging them through effective management. It emphasizes the importance of developing teachers' competencies and providing a conducive classroom environment. Teachers should be encouraged and given opportunities to pursue academic studies that qualify them further in their field of specialization. This recommendation aligns with findings from Razak et al. (2023), which highlighted the critical role of continuous professional development and strategic policy-making in achieving sustainable education and effective teaching performance. Furthermore, the study underscores the need to activate the role of digital leadership by leveraging technology and investing in digitalization to enhance teachers' performance. This finding is supported by Mohamed (2023), who identified key requirements for successful digital transformation in educational institutions, including updating laws and regulations, re-engineering institutional structures, and providing robust ICT infrastructure. Effective digital leadership, as noted by Carvalho et al. (2022), is crucial in navigating these changes and ensuring that the integration of online learning systems and various technologies leads to improved educational outcomes. However, digital transformation holds considerable promise for improving

vocational education by modernizing educational content and fostering better relationships within the educational ecosystem. The critical role of digital leadership in this process cannot be overstated. By encouraging and supporting teachers, providing ongoing professional development, and leveraging digital technologies, educational institutions can significantly enhance teacher performance and overall educational quality. Future research should continue to explore this dynamic interplay between digital transformation and digital leadership to uncover more insights and best practices.

6. Implication

The findings of this study have several important implications for educational policy, practice, and future research. Firstly, the significant role of digital leadership in enhancing the impact of digital transformation on teacher performance underscores the need for strong and effective leadership in educational institutions. Policymakers should focus on developing and implementing leadership training programs that equip school leaders with the necessary skills to manage and promote digital transformation effectively. Secondly, the study highlights the necessity of continuous professional development for teachers, particularly in the context of digital transformation. Educational institutions should provide ongoing training and support to help teachers integrate digital tools into their teaching practices. This support should be tailored to teachers' academic qualifications and years of experience to address their specific needs and challenges. Thirdly, the substantial increase in the positive impact of digital transformation on teacher performance, facilitated by digital leadership, suggests that schools should prioritize investments in digital infrastructure and leadership development. This can include upgrading ICT infrastructure, providing access to advanced digital tools, and fostering a culture of innovation and continuous learning among teachers. Finally, future research should explore the specific mechanisms through which digital leadership influences the effectiveness of digital transformation. Understanding these mechanisms can help in designing more targeted interventions and strategies to maximize the benefits of digital transformation in education.

7. Conclusion

This paper demonstrates that digital leadership plays a crucial role in enhancing the impact of digital transformation on the performance of vocational education teachers. While gender did not significantly affect this relationship, both academic qualifications and years of experience were found to be significant factors. The hierarchical regression analysis revealed that the inclusion of digital leadership significantly improved the positive effects of digital transformation on teacher performance, highlighting the importance of strong leadership in educational settings. However, the results of this study are consistent with previous research, reinforcing the idea that effective digital leadership is essential for successful digital transformation in education. The findings emphasize the need for comprehensive professional development programs, robust digital infrastructure, and strategic leadership to support teachers in integrating digital technologies into their teaching practices. Thus, this study contributes to the growing body of literature on digital transformation and leadership in education, providing valuable insights for policymakers, educators, and researchers. By fostering effective digital leadership and supporting continuous professional development, educational institutions can enhance teacher performance and ultimately improve educational outcomes.

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