Building a Training Model to Enhance Digital Competencies Among Learning Support Teachers in Jordan: Examining the Role of Gender, Academic Qualifications, and Teaching Experience

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Manuscript received August 25, 2025; revised September 11, 2025; accepted November 19, 2025; published April 22, 2026

***Abstract*—This study assesses the digital competencies of Learning Support Teachers (LSTs) in Jordan and examines the effects of gender, academic qualifications, and teaching experience. Using a descriptive survey design, data were collected from 187 randomly selected LSTs in public schools in Amman. A validated 32-item electronic questionnaire covering four domains was employed. Results indicated that teachers demonstrated a moderate level of digital competence. Significant differences were observed based on academic qualification and teaching experience, with higher competence among those holding university degrees and with less than ten years of experience, while no significant differences were found by gender. These findings highlight the influence of professional background and experience on digital readiness. In response to these findings, the researchers developed the Digital Integration for Competency Enhancement (DICE) model, which targets identified competency gaps and provides context-specific professional development for language teachers. The DICE model helps teachers effectively integrate digital tools into inclusive classroom practices, thereby enhancing both teaching quality and learner engagement. In addition, this study offers original insights into LSTs' digital competencies in Jordan and proposes a practical, theoretically grounded training model that underscores the role of qualifications and experience in promoting digital readiness within inclusive education.**

***Keywords*—digital competencies, learning support teachers, teacher training model, educational technology, inclusive education, teaching experience, professional development**

I. Introduction

In the current era of Learning Support Teachers (LSTs) are expected to effectively integrate technology into inclusive classroom practices to meet diverse learners' needs. However, many still face challenges in applying digital tools with pedagogical purpose and confidence. This study is grounded in established frameworks of digital competence and pedagogical-technology integration, which emphasize the interconnection between technological, pedagogical, and professional knowledge. These foundations guided the assessment of LSTs' digital competencies and informed the design of the Digital Integration for DICE model a targeted professional development approach aimed at addressing competency gaps and supporting effective digital integration in inclusive education.

The rapid evolution of educational paradigms by technological advancements and contemporary pedagogical trends has profoundly reshaped the role of teachers. The main argument is that educators are no longer mere transmitters of knowledge; they have become facilitators, mentors, and designers of dynamic learning experiences. These experiences nurture critical thinking, creativity, and lifelong learning skills [1]. This transformation requires a comprehensive redefinition of teachers' competencies. The focus is now on integrating educational strategies with modern digital technologies to create self-directed, personalized, student-centered learning environments. These tools also develop students' critical and technical thinking skills, improving educational effectiveness [2].

In the contemporary educational landscape, designing and implementing digital educational content have become indispensable, especially for educators of students with disabilities. Effective digital education not only enhances academic achievement and performance but also fosters student engagement, including students with disabilities, and supports the development of 21st-century skills through interactive and adaptive learning experiences. Among the various emerging digital tools, Digital Learning Units (DLUs)—modular, reusable, and customizable learning components have gained increasing importance. These modules can facilitate a variety of delivery methods and flexibility in instructional design, proving to be valuable resources in both synchronous and asynchronous learning environments [3, 4].

DLUs offer numerous advantages. They promote cost-efficiency, enable real-time updates, and foster inclusive education by accommodating learners' varying needs and preferences. They encourage differentiated instruction, self-paced learning, and teacher collaboration, mirroring the ethos of open-source educational innovation [5, 6]. The success of DLUs, however, hinges on teachers' competencies in digital design, content management, interactive communication, and problem-solving with educational technologies [7–9].

LSTs, who work directly with students with disabilities, bear a distinct responsibility within inclusive educational

systems. They develop and implement Individualized Education Plans (IEPs), monitor progress, and adapt instruction to meet the diverse academic, cognitive, and emotional needs of their students [10, 11]. Given their central role, LSTs must possess advanced professional competencies, including proficiency in adaptive technologies, inclusive instructional methods, and educational planning [12, 13].

The global shift toward inclusive technology-enhanced education has been echoed in policy frameworks such as UNESCO's Education 2030 agenda, underscoring the need for continuous professional development tailored to the demands of digital teaching. Educational systems worldwide have prioritized digital readiness among teachers, aiming to embed DLUs and similar innovations into everyday classroom practices [2, 14]. Such technologies offer students with disabilities multimodal, accessible, and customizable learning solutions, enhancing autonomy, motivation, and academic success [15].

In Jordan, efforts to integrate digital education into special education have gained attention. Yet challenges remain, particularly in training and supporting LSTs to manage and deliver DLUs effectively. Preliminary interviews conducted by the current researchers with ten LSTs in Amman Governorate revealed inconsistent levels of competency in digital content mastery, system management, social media use for interaction, and digital problem-solving. These findings highlight the need for a systematic evaluation and capacity-building initiatives.

In Jordan, integrating digital education within special education has gained increasing attention. Nevertheless, significant challenges persist, particularly in supporting LSTs to manage and deliver DLUs effectively. Preliminary interviews with ten LSTs in Amman Governorate revealed inconsistent levels of competency in digital content creation, system management, social media-based student interaction, and problem-solving in digital contexts. These inconsistencies underscore the need for targeted assessment of digital competencies and the development of practical training models to enhance LSTs' capabilities. Addressing this gap is essential to improve inclusive education, optimize technology integration, and align instructional practices with contemporary educational innovations.

This study aims to assess the digital competencies of LSTs in Jordan and examine the influence of gender, academic qualification, and years of teaching experience. The specific objectives are to:

- Determine the current level of digital competencies among LSTs in Jordan.
- Identify whether there are statistically significant differences in digital competencies based on gender, academic qualification, and teaching experience ($\alpha = 0.05$).
- Propose a training model to enhance the digital competencies of LSTs based on the study findings.

By accomplishing these objectives, the study contributes to both theoretical and practical knowledge, offering insights for improving teacher training, supporting inclusive education, and aligning instructional competencies with technological advancements

Accordingly, this study aims to assess the digital competencies of LSTs in Jordan and examine the impact of gender, academic qualification, and years of experience. By doing so, it contributes to both the theoretical literature and practical frameworks to improve teacher training, support inclusive education, and align instructional competencies with technological innovations [16–18]. Accordingly, the study aims to answer the following research questions:

1) What is the current level of digital competencies among LSTs in Jordan?
2) Are there statistically significant differences at the ($\alpha = 0.05$) in the digital competencies of LSTs in Jordan based on gender, academic qualification, and years of teaching experience?
3) What is the proposed training model to enhance digital competencies among LSTs based on the study findings?

II. Literature Review

A. Study Methodology

This study used a descriptive survey design to assess the level of competencies of LSTs in dealing with DLUs.

B. Study Population and Sample

The study population included (310) male and female LSTs working in public schools in Amman, Jordan, during the second semester of the 2024–2025 academic year, according to statistics from the Amman Education Directorates. Amman Governorate was chosen for being the capital and largest urban center in Jordan, home to a wide range of public schools and a diverse community of LSTs. This context enabled access to a representative sample of teachers with diverse academic qualifications, teaching experience, and exposure to digital learning initiatives, thus enhancing the generalizability and reliability of the study findings. The sample of (187) participants was selected using a stratified random sampling method to ensure proportional representation across the educational directorates and school levels. Conducting the study in Amman also facilitated logistical coordination and ensured efficient data collection across multiple educational districts. For data collection, the study tool was distributed to LSTs in coordination with educational supervisors, after obtaining all necessary official approvals. The questionnaire was administered electronically via Google Forms and shared across social media platforms commonly used by LSTs. The survey link remained active for two weeks, from April 12 to 26, 2025, and 187 teachers completed and submitted the survey. Table 1 shows the distribution of the study sample according to the demographic variables under study.

Table 1. Characteristics of the study sample by variables

Variable	Category	Frequency	Percentage (%)
Gender	Male	95	50.8
	Female	92	49.2
Years of Experience	10−	85	45.5
	10+	102	54.5
Academic Qualification	Bachelor's Degree	119	63.6
	Graduate Studies	68	36.4
Total		187	100.0

As shown in Table 1, the study sample consisted of 187 LSTs. Regarding gender, 95 participants (50.8%) were male, while 92 participants (49.2%) were female, indicating a relatively balanced gender distribution within the sample. In teaching experience, 102 participants (54.5%) had 10 years

of experience or more, whereas 85 participants (45.5%) had less than 10 years of experience, indicating that the majority of respondents were highly experienced. In academic qualifications, the majority held a bachelor's degree (n = 119; 63.6%), while 68 participants (36.4%) had a postgraduate degree.

C. Study Instrument

The development of the study instrument was grounded in a comprehensive review of recent and relevant literature on teacher competencies, professional development, and educational technology. Key references that informed the design include [16], providing insights on effective professional development; Ertmer and Ottenbreit-Leftwich [7] examining the interplay of knowledge, confidence, and beliefs in teacher technology adoption; Schleicher [17] offering broad perspectives on educational indicators and policy implications; and Voogt *et al.* [18] discussing technological pedagogical content knowledge frameworks. These sources collectively ensured that the instrument captures critical aspects of LSTs' competencies in managing DLUs. The final version of the instrument consisted of 32 items across four core competency domains: 1) demonstrating proficiency in foundational competencies essential for digital learning, 2) effectively managing digital learning systems and processing digital content, 3) utilizing social media applications to enhance interaction and engagement within digital learning environments, and 4) applying digital learning tools to improve instructional processes and facilitate problem-solving.

Participants were asked to indicate their level of proficiency in handling DLUs by placing a check mark (√) next to each item. A five-point Likert scale was used with the following response options: very high, high, medium, low, and very low. The assessment followed the approach proposed by Hamadneh and Almogbel [19], assigning values of 5, 4, 3, 2, and 1, respectively. The following interpretation scale was applied to evaluate individual items and overall scores: 1.00–1.80 = very low, 1.81–2.60 = low, 2.61–3.40 = medium, 3.41–4.20 = high, and 4.21–5.00 = very high.

D. Instrument Validity and Reliability

The initial version of the instrument was reviewed by ten expert academic experts specializing in Educational Technology and Special Education from various Jordanian universities to ensure content validity. The goal was to assess the instrument's appropriateness for measuring the intended competencies. Based on their feedback, with an 80% agreement rate, the experts recommended several modifications to improve the clarity and measurability of the items. All recommended changes were implemented, and the instrument was finalized accordingly. Both the test-retest method and internal consistency analysis were employed to ensure the reliability of the research instrument. First, the test-retest method was applied after administering the questionnaire to a pilot sample of 30 LSTs drawn from the study population but excluded from the final study sample later. The instrument was administered twice, with a two-week interval. Pearson correlation coefficients were then calculated to assess the validity of the responses over time. In addition, internal consistency reliability was examined using Cronbach's Alpha coefficients. These coefficients were calculated for each of the four domains of the instrument and the whole instrument. The resulting values provided evidence of the instrument's internal consistency and reliability in measuring the targeted digital competencies among LSTs. Table 2 illustrates the results.

Table 2. Reliability coefficients of the study instrument

No of Domain	Competency Domain	Test-Retest Reliability	Cronbach's Alpha
1	Demonstrating proficiency in foundational competencies essential for digital learning	0.84	0.82
2	Effectively managing digital learning systems and processing digital content	0.87	0.77
3	Utilizing social media applications to enhance interaction and engagement within digital learning environments	0.82	0.71
4	Applying digital learning tools to improve instructional processes and facilitate problem-solving	0.86	0.80
	Overall Instrument	0.90	0.85

As Table 2 shows, the study instrument demonstrated good reliability indicators. The test-retest reliability coefficients for the subscales ranged from 0.82 to 0.90, with an overall reliability coefficient of 0.90. The internal consistency coefficients (Cronbach's alpha) ranged from 0.71 to 0.85 across the subscales and reached 0.85 for the total scale. These results indicate a high level of reliability for the instrument.

E. Statistical Analysis Methods

To answer the research questions, both descriptive and inferential statistics were used. Descriptive statistics, including means, standard deviations, and rankings, were calculated to assess the current digital competencies of LSTs in Jordan across different domains. Inferential analyses, including three-way MANOVA and ANOVA, were conducted to examine the effects of gender, academic qualification, and years of teaching experience on digital competencies. Effect sizes (η^2) were calculated to interpret the practical significance of these demographic variables. The results of these analyses also informed the development of a targeted training model aimed at enhancing LSTs' digital skills.

III. Results

A. Current Level of Digital Competencies

Means, standard deviations, rankings, and levels were calculated for the participants' responses regarding the competencies of LSTs in using DLUs to answer the first research question. Table 3 shows the results.

Table 3 provides descriptive statistics on the current level of digital competencies among LSTs in Jordan. The overall proficiency level is average, with a mean score of 2.82 (standard deviation = 0.66). This result reveals that while teachers possess a reasonable degree of digital skills, there is still a significant room for improvement. The area with the highest mean score is the use of social media applications to enhance interaction in digital learning (mean = 2.95, standard deviation = 0.73). This result indicates that teachers are moderately comfortable leveraging popular social media

platforms to facilitate learner engagement and communication. This result reflects the increasing role of familiar and user-friendly digital tools in educational practices. Managing digital learning systems and effectively handling digital content comes second (mean = 2.86, standard deviation = 0.69). This average level suggests that teachers possess a basic ability to organize and deliver digital learning materials; though, they may benefit from further training to improve these skills.

Table 3. Descriptive statistics of the current level of digital competencies among LSTs in Jordan

No Domain	Competency Domain	Mean	SD	Rank	Level
3	Utilizing social media applications to enhance interaction and engagement within digital learning environments	2.95	0.73	1	Moderate
2	Effectively managing digital learning systems and processing digital content	2.86	0.69	2	Moderate
4	Applying digital learning tools to improve instructional processes and facilitate problem-solving	2.80	0.71	3	Moderate
1	Demonstrating proficiency in foundational competencies essential for digital learning	2.67	0.73	4	Moderate
	Overall Score	2.82	0.66		Moderate

B. Digital Competencies of LSTS in Jordan Based on Gender, Academic Qualification, and Years of Teaching Experience

The means and standard deviations of the digital competencies level of support education teachers in Jordan were extracted according to the variables of gender, years of experience, and academic qualification to answer this research question. Table 4 depicts the results.

The results in Table 4 reveal that female support education teachers in Jordan exhibited slightly higher levels of digital competencies across all domains compared to their male counterparts. Teachers with less than 10 years of experience outperformed their more experienced peers, suggesting that newer teachers may be more adept at using digital tools, possibly due to recent training or greater exposure. In addition, teachers with graduate degrees showed notably higher competency levels than those with only a bachelor's degree, particularly in managing digital systems and using digital learning for problem-solving. Overall, the findings suggest that gender, years of experience, and academic qualification influence digital competency levels, highlighting the importance of ongoing professional development tailored to the needs of specific teacher groups. Moreover, a three-way Multivariate Analysis of Variance (MANOVA) was conducted on the digital competency domains, as shown in Table 5, to examine the statistical significance of the differences between the means. Table 6 presents the effect sizes (η^2) and practical implications of teacher demographics across the digital competency domains. Additionally, a three-way Analysis of Variance (ANOVA) was performed on the overall tool score, as presented in Table 7.

Table 4. Means and standard deviations of the digital competencies level of support education teachers in Jordan according to the variables of gender, years of experience, and academic qualification

Variable	Category	Mean SD	Demonstrating proficiency in foundational competencies essential for digital learning	Effectively managing digital learning systems and processing digital content	Utilizing social media applications to enhance interaction and engagement within digital learning environments	Applying digital learning tools to improve instructional processes and facilitate problem-solving	Total
Gender	Male	Mean	2.64	2.79	2.93	2.74	2.78
		SD	0.780	0.710	0.80	0.750	0.710
	Female	Mean	2.70	2.93	2.98	2.86	2.86
		SD	0.660	0.66	0.630	0.65	0.600
Years of Experience	Less than 10 years	Mean	2.84	3.02	3.15	2.95	2.99
		SD	0.740	0.650	0.730	0.720	0.650
	10 years or more	Mean	2.52	2.73	2.79	2.67	2.67
		SD	0.680	0.690	0.670	0.670	0.630
Academic Qualification	Bachelor's Degree	Mean	2.55	2.74	2.85	2.67	2.70
		SD	0.800	0.740	0.760	0.720	0.700
	Graduate Studies	Mean	2.87	3.07	3.13	3.02	3.02
		SD	0.520	0.520	0.610	0.620	0.530

As shown in Table 6, the results of a Multiple Analysis of Variance (MANOVA) showed that gender does not significantly influence any of the four digital competency domains among LSTs in the Amman Governorate (p-value > 0.05 for all domains; Hoteling effect = 0.029). In contrast, academic qualification had a statistically significant effect in all domains: core competencies (F = 10.189, Sig. = 0.002), managing digital learning systems and content (F = 10.795, Sig. = 0.001), using social media for interaction (F = 13.271, Sig. = 0.000), and improving learning and problem-solving processes (F = 9.169, Sig. = 0.003), with a medium effect size (Hoteling effect = 0.075). Similarly, years of experience significantly influenced all domains, indicating that least experienced teachers demonstrated higher digital competencies: basic competencies (F = 9.493, Sig. = 0.002), managing digital learning systems and content (F = 11.222, Sig. = 0.001), using social media (F = 7.147, Sig. = 0.008), and improving learning processes (F = 11.467, Sig. = 0.001), with a medium effect size (Hoteling's κ = 0.071), indicating a medium-strength effect according to Cohen's effect size interpretation criteria. Overall, these results suggest that academic qualifications and teaching experience are the main determinants of digital competency, while the effect of gender is insignificant.

Table 6 shows the effect sizes (η^2) for teacher demographics across the four digital proficiency domains, highlighting their statistical and practical significance. The results indicate that gender has small to negligible practical effects on teachers' digital proficiencies, suggesting that differences between male and female teachers are minimal in practice. In contrast, academic qualifications and years of experience show small to moderate effects, with higher

qualifications and less experience being associated with stronger foundational skills, more effective management of digital learning systems, and better application of digital tools in teaching and problem-solving contexts. These findings confirm that while demographic factors can influence digital proficiency, professional development initiatives should target all teachers to ensure broad improvement, rather than focusing exclusively on specific subgroups. Overall, the η^2 values provide a useful context for interpreting the practical impact of demographic variables, complementing significance tests and offering practical insights for training and policy planning.

Table 5. Three-way Multivariate Analysis of Variance (MANOVA) for the effect of gender, years of experience, and academic qualification on the digital competencies of support education teachers

Source of Variance	Domain	Sum of Squares	df	Mean Square	F Value	Sig.
Gender Hotelling's Trace = 0.029	Demonstrating proficiency in foundational competencies essential for digital learning	0.473	1	0.473	0.971	0.326
	Effectively managing digital learning systems and processing digital content	1.498	1	1.498	3.500	0.063
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	0.384	1	0.384	0.800	0.372
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	1.135	1	1.135	2.485	0.117
Academic Qualification Hotelling's Trace = 0.075	Demonstrating proficiency in foundational competencies essential for digital learning	4.959	1	4.959	10.189	0.002
	Effectively managing digital learning systems and processing digital content	4.621	1	4.621	10.795	0.001
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	6.369	1	6.369	13.271	0.000
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	4.189	1	4.189	9.169	0.003
Years of Experience Hotelling's Trace = 0.071	Demonstrating proficiency in foundational competencies essential for digital learning	4.621	1	4.621	9.493	0.002
	Effectively managing digital learning systems and processing digital content	4.804	1	4.804	11.222	0.001
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	3.430	1	3.430	7.147	0.008
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	5.239	1	5.239	11.467	0.001
Error	Demonstrating proficiency in foundational competencies essential for digital learning	89.070	183	0.487		
	Effectively managing digital learning systems and processing digital content	78.336	183	0.428		
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	87.830	183	0.480		
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	83.604	183	0.457		
Total	Demonstrating proficiency in foundational competencies essential for digital learning	98.790	186			
	Effectively managing digital learning systems and processing digital content	88.626	186			
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	97.707	186			
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	93.635	186			

Table 6. Impact of teacher demographics on digital competencies: η^2 effect sizes and interpretation

Independent Variable	Digital Competency Domain	Significance (p)	η^2 (Effect Size)	Practical Interpretation
Gender	Demonstrating proficiency in foundational competencies essential for digital learning	0.326	0.005	Minimal practical effect; gender differences are negligible
	Effectively managing digital learning systems and processing digital content	0.063	0.017	Small effect; minor influence of gender
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	0.372	0.004	Negligible practical effect
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	0.117	0.013	Small effect; limited practical impact
Academic Qualification	Demonstrating proficiency in foundational competencies essential for digital learning	0.002	0.053	Small to moderate effect; higher qualifications support stronger digital skills
	Effectively managing digital learning systems and processing digital content	0.001	0.056	Moderate effect; indicates meaningful advantage for highly qualified teachers
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	0.000	0.068	Moderate effect; qualifications affect effective use of social media for learning
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	0.003	0.048	Small to moderate effect; experience in higher education enhances practical application
Years of Experience	Demonstrating proficiency in foundational competencies essential for digital learning	0.002	0.049	Small to moderate effect; experience improves basic digital skills
	Effectively managing digital learning systems and processing digital content	0.001	0.058	Moderate effect; experience contributes meaningfully to digital system management
	Utilizing social media applications to enhance interaction and engagement within digital learning environments	0.008	0.038	Small effect; experience aids in interactive digital engagement
	Applying digital learning tools to improve instructional processes and facilitate problem-solving	0.001	0.059	Moderate effect; more experienced teachers better integrate tools in problem-solving

Table 7. Three-way Analysis of Variance (ANOVA) for the effect of gender, years of experience, and academic qualification on the digital competency levels of support education teachers in Jordan

Source of Variance	Sum of Squares (SS)	df	Mean Square	F Value	Sig.	Effect Size (η^2)	Practical Interpretation
Gender	0.796	1	0.796	2.021	0.136	0.01	Very small effect; indicates that the differences between groups have little practical effect, even if they are statistically significant.
Years of Experience	5.043	1	5.043	12.802	0.000	0.062	Moderate effect; indicates that differences between groups have a meaningful practical effect and can be important in educational and training contexts.
Academic Qualification	4.465	1	4.465	11.336	0.000	0.055	An effect approaching the average, the differences have limited practical significance, but may still be relevant in certain contexts, indicating a difference worth considering when designing interventions.
Error	72.086	183	0.394				
Total	81.937	186					

As shown in Table 7, there were no statistically significant differences at the 0.05 level in the digital competency levels of special education teachers in Jordan attributable to gender, as indicated by an F-value of 2.021 and a *p*-value of 0.136. The effect size for gender was very small ($\eta^2 = 0.01$), suggesting minimal practical impact. In contrast, years of experience had a statistically significant effect ($F = 12.802$, $p < 0.001$), with teachers having less than 10 years of experience exhibiting higher digital competencies. The corresponding effect size was moderate ($\eta^2 = 0.062$), indicating a meaningful practical impact. Similarly, academic qualification significantly influenced digital competencies ($F = 11.336$, $p < 0.001$), with teachers holding graduate degrees demonstrating higher competency levels. The effect size was near-moderate ($\eta^2 = 0.055$), reflecting limited but notable practical significance. These findings highlight that experience and academic qualification play a more substantial role in shaping digital competencies than gender, emphasizing the importance of targeted professional development strategies that consider these demographic factors.

C. Proposed Training Model to Enhance Digital Competencies

This study is anchored in the Technological Pedagogical Content Knowledge (TPACK) and Digital Competence Framework for Educators (DigCompEdu) frameworks, providing a robust theoretical basis for examining digital competency in inclusive education. TPACK emphasizes the integration of content, pedagogy, and technology, guiding the assessment of how teachers combine these domains in practice, while DigCompEdu offers structured competence areas, including professional engagement, digital resources, teaching and learning, assessment, and learner empowerment.

Applying these frameworks revealed that LSTs, particularly those with bachelor's degrees and extensive teaching experience, often possess content knowledge but lack integrated pedagogical and technological skills. These insights informed the design of a professional development model that emphasizes project-based learning, mentoring, collaborative communities, and differentiated training, ensuring that teachers acquire both technical skills and pedagogical application in inclusive classrooms.

Consequently, the study recommends that policy makers, teacher education programs, and in-service training initiatives align with these frameworks to systematically enhance digital competencies. Moreover, engaging parents and students in evaluating digital tools can promote inclusion and meaningful technology use. By grounding the research in TPACK and DigCompEdu, the study strengthens its rigor, situates its contributions within established scholarly discourse, and provides actionable guidance for sustainable professional growth in inclusive digital education.

1) Practical proposal: A training model to enhance digital competencies of LSTs

Considering the study's findings, which revealed a moderate level of digital competencies among LSTs—particularly in managing digital systems, designing electronic content, and solving problems using educational technology—there is an urgent need for a structured training model that addresses these practical gaps through a progressive and applied approach. The researcher proposes a four-phase training model to develop LSTs' ability to effectively employ DLUs within inclusive educational settings.

To ensure the scientific rigor and practical feasibility of the proposed model, the Delphi method was adopted for expert validation. This iterative methodology involved a panel of specialists in educational technology, digital learning, and special education. Multiple rounds of structured feedback enabled the refinement of the model's relevance, structure, objectives, clarity, and applicability. Based on expert consensus, the model was adjusted to better align with the contextual needs of LSTs in inclusive environments, ensuring that the final version is evidence-based, contextually grounded, and professionally validated.

Importantly, Fig. 1 (The Proposed Training Model: DICE) is not merely illustrative but represents the conceptual and operational backbone of the training program. The figure visually maps the four phases Diagnostic, Interactive Foundation, Contextual Integration, and Evaluation and Reflection showing how each phase systematically addresses the gaps identified in the empirical data. The inclusion of the figure provides a clear framework for interpreting how the training components are sequenced and integrated, thereby strengthening the practical coherence of the model.

2) Proposed training model: DICE model

Table 8 illustrates the proposed training model titled DICE, and Fig. 1 further visualizes its structure and implementation flow, reinforcing its operational relevance.

Fig. 1 illustrates the complete structure of the DICE model, presenting its four interconnected cyclical phases: Diagnostic, Interactive Foundation, Contextual Integration, and Evaluation & Reflection. This visual representation aligns

with the empirical findings, showing how each phase directly addresses the digital competency domains outlined in the study's analytical tables, particularly Table 8. The figure also emphasizes the logical flow of steps through the use of arrows, highlighting the model's iterative and continuous improvement nature. It enables readers to understand how a learning support teacher progresses from diagnosis to contextual application and then to evaluation, thereby supporting the interpretation of the study's results and demonstrating the practical operationalization of the model in inclusive educational environments.

Table 8. The proposed training model: DICE among LSTs

Digital Competency Domain	Key Empirical Findings	Corresponding DICE Phase	Mode of Addressing
Domain 1: Basic Digital Skills and Competencies	Variance in mastering device use, Office applications, browsers, and online search	Diagnostic	Use of digital diagnostic tools to assess baseline skill levels and design individualized training plans.
Domain 2: Managing Digital Learning Systems and Content Development	Weakness in designing digital content, online assessments, and activating learning platforms	Interactive Foundation	Hands-on training on LMS platforms, cybersecurity basics, content adaptation, and structured practice activities.
Domain 3: Using Social Media Applications	Limited use of forums, Twitter, YouTube, and educational videos for academic interaction	Contextual Integration	Applying digital communication tools in real instructional settings to enhance engagement and interaction.
Domain 4: Digital Learning for Enhancing Learning and Problem-Solving	Limited application of flipped learning, web quests, and interactive textbooks in supporting learners	Contextual Integration	Designing differentiated digital modules to support problem-solving and meet diverse learner needs, including students with disabilities.
All Domains (General Competency Level)	Limited self-review, reflective practices, and professional feedback	Evaluation & Reflection	Activating professional learning communities, using collaborative platforms, and implementing reflective reports for continuous improvement.

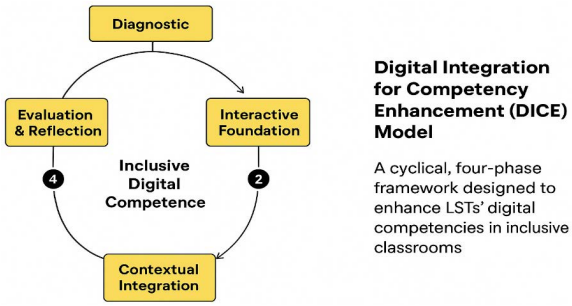

Fig. 1. Proposed training model: DICE among LSTs.

3) Key features of the model

- Anchored in the study's findings, which highlighted the superiority of novice teachers and those with postgraduate qualifications, necessitating customized training tracks based on teacher profiles.
- Promotes a shift from "passive technology use" to pedagogically grounded digital integration.
- Merges technical skills and pedagogical knowledge following the TPACK framework and Digital Pedagogical Competencies models.
- The visual model (Fig. 1) supports these features by providing a structured depiction of how competencies develop across the four phases.

4) Implementation recommendations

1) Adopt the model by educational directorates as part of national in-service teacher training programs.
2) Align the model with national digital transformation strategies, such as Jordan's Vision 2030.
3) Integrate it into teacher education programs at universities through applied academic modules.
4) Evaluate the model's effectiveness through follow-up experimental studies assessing improvements in teaching performance and digital engagement.
5) Explicitly use Fig. 1 as a guiding framework during implementation to ensure proper sequencing and fidelity to the model's phases.

IV. Discussion

The overall level of digital competencies among LSTs in dealing with digital learning units was found to be moderate. Among the assessed domains, teachers demonstrated the strongest proficiency in using social media applications to enhance student interaction within digital environments. In contrast, the mastery of foundational competencies necessary for effective digital learning was their weakest. This discrepancy highlights a critical gap, where LSTs appear relatively comfortable with informal and accessible technologies such as social media but often struggle with the pedagogically grounded and curriculum-aligned use of digital tools, particularly in inclusive educational settings. Such findings suggest that the integration of digital learning units remains hindered by multiple challenges. These challenges include limited foundational digital skills, insufficient training in instructional technology for students with disabilities, a lack of clear instructional models, and inadequate preparation during teacher education programs [3]. Recent research also highlights that special education teachers often struggle to adapt digital environments to the diverse needs of students with learning disabilities [15]. Moreover, the rigidity of some digital platforms, combined with limited adaptive features or culturally responsive content, may unintentionally reinforce exclusion. While these findings echo previous studies, the present research contributes by situating the issue within the Jordanian and Arab context while drawing parallels with global patterns. This comparison clarifies why younger teachers, though more digitally fluent, tend to rely on informal tools such as social media, whereas more experienced teachers show caution shaped by structural and institutional constraints. The results also reveal that gender parity in training does not necessarily translate into equitable classroom practices, suggesting the influence of deeper cultural factors. Importantly, identifying rigid digital platforms as barriers to inclusion offers an original theoretical contribution that enriches debates on digital

pedagogy in inclusive education. Based on these insights, the study underscores the need for specific recommendations, such as prioritizing adaptive and assistive technologies, adopting mentoring and peer-coaching models, and redesigning teacher education curricula to embed inclusive digital pedagogy as a core component.

LSTs often demonstrate familiarity with informal digital tools but face challenges in applying them pedagogically, particularly in inclusive classrooms. To address this gap, professional development must prioritize hands-on engagement with assistive and adaptive technologies, enabling teachers to integrate digital tools effectively into instruction for students with diverse learning needs. Grounded in the TPACK framework, such initiatives should emphasize the intersection of technological, pedagogical, and content knowledge, ensuring that teachers can translate technical skills into meaningful instructional strategies. Complementarily, the DigCompEdu framework provides a structured approach to developing digital competencies across professional engagement, resource utilization, assessment, and learner empowerment. These programs should also incorporate ongoing mentoring, peer collaboration, and reflective practice, allowing teachers to consolidate skills and build pedagogical confidence. By embedding these strategies into both pre-service and in-service training, educational systems can foster sustainable professional growth, enhance teacher efficacy, and improve learning outcomes for students with disabilities and special educational needs [20]. Improving LSTs' digital competencies thus requires a dual emphasis (enhancing their technical fluency while simultaneously strengthening their pedagogical understanding of how to employ digital tools meaningfully for learners with special needs). Without this balance, technology risks remaining underutilized or misaligned with students' individual learning profiles, ultimately reducing its intended benefits in inclusive education contexts.

In addition, the analysis revealed no statistically significant differences in LSTs' digital competencies based on gender. This finding suggests a relative parity between male and female teachers regarding digital readiness and technological capability. Such an outcome reflects broader educational commitments to gender equity, particularly in the provision of professional development opportunities and access to digital learning resources. Equal opportunities to participate in ICT-related training programs—frequently designed in a gender-neutral manner by ministries of education in countries such as Jordan—likely contribute to this result. However, future investigations could extend beyond mere access to training and examine whether gender parity in professional development translates into equitable application of digital tools and strategies in classroom practices, thereby ensuring that digital competence is effectively reflected in teaching outcomes [21].

Moreover, the standardization of teacher education programs across Jordanian universities ensures that both male and female teachers receive comparable exposure to educational technologies and digital pedagogical strategies [22, 23]. The ubiquity of digital devices and increasing digital literacy across the population have also narrowed historical gender gaps in technology use [24]. Notably, many female educators in the Arab region are now actively participating and even leading technology integration initiatives, engaging in research, training, and innovation in digital learning [25]. Shared work environments in public schools of similar infrastructure, student populations, and administrative conditions further explain the uniformity in digital competency levels across genders.

These findings have important implications for practice and policy. Rather than focusing on gender-based interventions, capacity-building programs should consider variables with more substantial influence, such as years of teaching experience, academic qualification, and subject specialization. Tailoring professional development to these factors can maximize impact and ensure all educators are equipped to deliver effective, inclusive digital instruction [26].

Recent evidence underscores that teachers with less than 10 years of experience often demonstrate significantly higher digital fluency compared to their more experienced colleagues. This generational divide stems not only from early and sustained exposure to digital technologies but also from the fact that younger educators have typically developed their technological skills organically through everyday use, thus resulting in more intuitive and confident integration of digital tools. A systematic review found that younger university instructors consistently self-report higher digital competence, while their senior counterparts often show moderate to low confidence in areas such as technology-enhanced assessment [27]. Similarly, a Turkish study applying the DigCompEdu framework revealed that chronological age and teaching tenure are not, by themselves, reliable predictors of digital competency, highlighting the importance of continuous, need-based professional development [28]. Furthermore, a mixed-methods study demonstrated that even teachers with natural digital fluency require structured pedagogical support to effectively translate technical skills into impactful digital teaching practices [29]. This advantage is further amplified by the fact that recent graduates are more likely to have completed teacher preparation programs incorporating digital pedagogy, instructional design, and e-learning strategies [23]. The post-pandemic acceleration of digital education has also benefited early-career teachers, who entered the profession during a period of rapid technological integration [30]. As a result, they tend to display higher adaptability, greater openness to innovation, and more frequent use of digital platforms in both personal and professional contexts [24]. While this finding aligns with previous research highlighting younger teachers' relative advantage in digital skills, the study introduces a novel perspective by indicating that rigid digital platforms can act as barriers for certain educators, particularly those supporting students with diverse learning needs. This underscores that efforts to enhance digital competence should extend beyond training programs to include the design and implementation of flexible, adaptable digital tools that facilitate inclusive education. Together, these factors help explain observed competency gaps and emphasize the importance of differentiated, targeted professional development initiatives aimed at equipping more experienced teachers with up-to-date digital

pedagogical skills, thereby enabling effective integration of technology in diverse classroom contexts.

Recent studies indicate that teachers with less than ten years of experience often demonstrate higher levels of digital fluency than their more experienced counterparts [19, 23]. This advantage stems not only from early and prolonged exposure to technology but also from comprehensive academic and professional training. In particular, graduate programs in Jordan integrate extensive coursework and research in educational technology, digital pedagogy, and instructional design. They provide graduates with the theoretical knowledge and practical skills necessary to effectively integrate digital learning. Those graduates develop advanced skills in critical thinking, analytical evaluation, and content synthesis, enabling them to design, adapt, and implement pedagogically robust digital learning modules.

Teachers with advanced degrees tend to demonstrate greater competence in reflective practice, regularly evaluating and improving the effectiveness of digital tools to meet the needs of diverse learners, including those with special educational needs. Their participation in professional development activities (e.g., specialized conferences, workshops, and research networks) ensures they keep pace with emerging trends in educational technology [23]. Evidence from a systematic review suggests that younger teachers and those with postgraduate qualifications report higher self-assessed digital competence, while more experienced teachers often demonstrate moderate to low confidence in technology-enhanced assessment [27]. A study in Turkey using the Digital Pedagogical Competencies Framework highlighted that age or years of experience alone do not reliably predict digital competence, underscoring the need for individualized professional support [28]. Similarly, a mixed-methods study found that even early-career teachers with strong technical skills benefited from structured pedagogical guidance to effectively translate their digital proficiency into instructional practice [29]. Recent higher education research confirms that teachers participating in postgraduate studies and continuing professional development are better equipped to implement blended and online learning, supported by enhanced digital pedagogical content knowledge frameworks developed in response to the pandemic [30]. Together, these findings suggest that postgraduate academic training coupled with targeted and differentiated professional development is essential to close competency gaps and enable all teachers, not just young teachers, to effectively integrate digital learning modules.

Recent studies underscore the significant role of advanced academic qualifications and continuous professional development in enhancing teachers' digital competence. Educators holding postgraduate degrees often exhibit a higher level of reflective practice, regularly evaluating and improving the effectiveness of digital tools to meet the diverse needs of learners, including those with special educational needs. Their engagement in professional development activities—such as specialized conferences, workshops, and research networks—ensures they remain abreast of emerging trends in educational technology.

A systematic review by Luo *et al.* [31] synthesizes 25 empirical studies conducted between 2015 and 2025, revealing that teachers' digital competence positively influences students' academic self-efficacy and learning engagement. The review indicates that younger teachers and those with postgraduate qualifications report higher self-assessed digital competence, while more experienced teachers often demonstrate moderate to low confidence in technology-enhanced assessment.

In Turkey, a study utilizing the Digital Pedagogical Competencies Framework highlights that age or years of experience alone do not reliably predict digital competence. This finding underscores the necessity for individualized professional support to address specific developmental needs [32].

Similarly, a mixed-methods study by Yulin and Danquah [29] found that even early-career teachers with strong technical skills benefited from structured pedagogical guidance. This support enabled them to effectively translate their digital proficiency into instructional practice, emphasizing the importance of pedagogical training alongside technical expertise.

Recent higher education research further corroborates these findings. A study by Cid-Martínez *et al.* [33] indicates that teachers participating in postgraduate studies and continuing professional development are better equipped to implement blended and online learning. This is supported by enhanced digital pedagogical content knowledge frameworks developed in response to the pandemic.

Collectively, these studies suggest that postgraduate academic training, coupled with targeted and differentiated professional development, is essential to bridge competency gaps. Such an approach enables all teachers—not just younger or early-career educators—to effectively integrate digital learning modules, thereby fostering an inclusive and adaptive educational environment.

Overall, the findings of this study align with international evidence indicating that teachers in various contexts—such as Europe, Asia, and the Middle East often demonstrate greater ease with informal digital tools than with pedagogically structured applications for inclusive learning. However, by situating these patterns within the Jordanian context, this research highlights how structural constraints, limited adaptive technologies, and variations in teacher preparation programs shape digital competence locally. The study advances global understanding by introducing the DICE model as a context-sensitive framework that bridges global best practices with local realities. DICE emphasizes adaptive technology use, reflective practice, and mentoring as key pathways to strengthen inclusive digital pedagogy, offering a practical and theoretically grounded contribution to international discussions on teacher digital competence and inclusion.

The findings of the current study, which indicated a moderate overall level of digital competencies among LSTs particularly in managing digital systems, designing digital content, and applying technology-based problem-solving strategies provide strong justification for the development of the proposed DICE training model. The identified weaknesses across the four competency domains align directly with the model's sequential phases, demonstrating its relevance and practical necessity. For example, the significant variance in basic digital skills corresponds to the

Diagnostic phase, which aims to assess individual readiness and tailor training accordingly. Similarly, the weaknesses observed in digital content development and the limited use of learning platforms are addressed through the Interactive Foundation phase, which emphasizes structured, hands-on capacity building.

Furthermore, the restricted use of social media applications and limited implementation of advanced digital strategies such as flipped learning and web quests reinforce the need for the Contextual Integration phase, where LSTs are supported in applying digital tools in authentic instructional contexts. The study also revealed limited engagement in reflective practices, a gap that is systematically targeted within the Evaluation & Reflection phase. Collectively, these alignments illustrate how the DICE model operationalizes the empirical findings by translating them into a coherent, phased framework for capacity development. Fig. 1 clearly visualizes this alignment, showing how each phase directly responds to specific competency gaps identified in the data, thereby strengthening the model's validity and its potential for enhancing digital practices in inclusive educational settings.

The findings of this study are subject to some limitations:

Subject Matter: The study is limited to examining the digital competencies of LSTs in using DLUs in Jordan, focusing specifically on inclusive education contexts.

Population: The research targeted only LSTs working in public schools within Amman Governorate, excluding teachers from private schools or other governorates, which may affect the generalizability of the results.

Time and Location: Data were collected during the second semester of the 2024–2025 academic year in Amman public schools. The results may not fully reflect competency levels at different times of the academic year or in other locations.

Instrument Validity: The study relied on a self-administered electronic questionnaire covering four competency domains. While the instrument was validated and tested for reliability, it is not a standardized tool. Therefore, the accuracy of the findings depends on the rigor of the validation process and the honesty and seriousness of participants' responses.

Context-Specific Factors: External factors such as school resources, prior training in digital technologies, and institutional support may have influenced LSTs' competencies, limiting the ability to generalize findings to all inclusive education settings in Jordan.

V. Conclusion

The study highlights an urgent need for a comprehensive national professional development strategy aimed at enhancing LSTs' competencies, particularly for those working with students with disabilities and special educational needs, to enable effective integration of digital learning tools. The data revealed significant gaps in digital proficiency, especially among teachers holding only a bachelor's degree and with over ten years of experience. This finding suggests a deficiency in ongoing professional development and a limited capacity to keep pace with rapidly evolving technological requirements.

Based on these findings, the study recommends the following:

1) Policy and Ministry-Level Initiatives: The Ministry of Education and local directorates should prioritize assistive and adaptive technologies, such as text-to-speech software, interactive learning platforms, and accessible digital content—to enhance inclusive practices. Specialized training programs and field-based initiatives should be implemented to strengthen teachers' digital pedagogical skills. Digital competency standards should be embedded into national professional frameworks to formalize performance evaluation, certification, and career progression.
2) Teacher Education Programs: Pre-service curricula should integrate advanced digital teaching methodologies and inclusive curriculum design, emphasizing project-based and experiential learning. Graduates should acquire not only technical proficiency but also the ability to apply digital tools in pedagogically sound, inclusive classroom practices.
3) In-Service Professional Development: Differentiated professional development should be offered based on teachers' experience, academic background, and digital skill levels. Effective models may include mentoring, peer coaching, collaborative professional learning communities, and blended workshops. Focus should be placed on translating technical skills into student-centered digital competencies, ensuring that teachers can design and deliver inclusive, adaptive learning experiences.
4) Parental and Student Engagement: Family-centered digital literacy initiatives should be established to empower parents and students, particularly those with disabilities, in evaluating and selecting appropriate digital tools. Such engagement promotes inclusion and enhances students' autonomy in digital learning environments.
5) Future Research Directions: Future studies should explore regional and contextual variations across Jordan, educational levels, disciplines, and age groups. Research should identify practical challenges and innovative strategies for implementing digital learning in inclusive classrooms. Comparative studies across Arab countries are also recommended to inform evidence-based reforms and sustainable professional growth.

By specifying technologies, models of professional development, and curricular reforms, these recommendations provide a clear roadmap for enhancing digital competency and inclusive teaching practices across Jordanian schools.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

B.M.H. was responsible for writing the theoretical framework. I.M.H. conducted the analysis and reported the results. M.T.J. prepared the discussion section. M.I.A. wrote the methodology. All authors reviewed and approved the final version of the manuscript.

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