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Teachers' digital competencies for effective AI integration in higher education in Oman

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Abstract

This study explores the competencies required by digital teachers to effectively leverage AI in fostering a future-ready classroom environment. It delves into competencies essential for teachers to harness the potential of AI. A descriptive analytical approach was employed to extract the required AI competency list and determine its importance. The study involved 26 teachers from the University of Technology and Applied Science in Oman. These participants were requested to complete a questionnaire designed to gather relevant data. The findings provide a comprehensive checklist of competencies necessary for seamless AI-enhanced teaching and serve as a valuable tool for training and guiding future digital teachers. The study revealed no significant differences in the perceived importance of AI competencies between teachers with less than 10 years of practical experience and those with 10 years or more of experience. This paper concludes that continuous professional development and targeted training are essential for all teachers to develop the necessary skills for an AI-enhanced education environment. Moreover, the study emphasizes the need for educational institutions to prioritize AI competency development in teacher training. Finally, it highlights the importance of a supportive infrastructure to help teachers stay updated with rapid AI advancement in education.

Keywords: 21st –century skills, Artificial intelligence, Computer science, Digital teacher, Integration AI in education, Teacher competencies.

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Contents

Contribution of this paper to the literature

This research identifies the essential AI competencies for digital teachers, offering a practical framework for educator training. It highlights the importance of AI skills across all experience levels and emphasizes the need for continuous professional development. The findings align with global educational trends reinforcing the integration of AI in teaching practices. This study advances the conversation on preparing teachers for the future of AI-driven learning environments.

1. Introduction

Various factors are driving changes in the education system leading to a significant redefinition of the teacher's role. These include the Fourth Industrial Revolution (World Economic Forum, 2017) new teaching methods (Maldonado-Mahauad, Perez-Sanagustín, Kizilcec, Morales, & Munoz-Gama, 2018) the explosion of information due to increased internet use (Reyna, Hanham, & Meier, 2018) a focus on lifelong learning (Berry, 2018; Hinzen & Schmitt, 2016) the incorporation of artificial intelligence (Schmidt, 2017) and the shift towards open educational resources (Paskevicius & Hodgkinson-Williams, 2018).

Teachers must proactively anticipate future needs to remain relevant and contribute effectively to society. The evolving landscape driven by emerging technologies and information necessitates preparing learners for professions that don't currently exist (Kolenick, 2018; Patterson, 2018). The global demand for lifelong learning is escalating underscoring the importance of acquiring contemporary and pertinent education for meaningful employment. Consequently, there is a widespread shift towards integrating digital learning technologies into educational frameworks to equip citizens for success in the 21st century.

Education is also undergoing a profound transformation due to the increasing and wide-ranging influence of the Fourth Industrial Revolution manifested in the unprecedented advancements in the various facets of our daily lives. This transformation is clearly perceived in digitalization and in the integration of AI as well as other emerging technologies which have become at the forefront of transformation presenting both challenges and opportunities for teachers (Gaskell, 2018). In the light of these innovations, it is mandatory for teachers to be proficient in using digital tools to be able to deliver virtual education to learners in remote and nomadic settings (Dyer, 2016). The transformative impact of technology has made learners the focal point of the learning process rather than teachers. In this modern and dynamic paradigm, learners have become more active. They are expected to shape their knowledge base and to construct an understanding of the world. In addition, the accessibility and flexibility of learning opportunities associated with modern technology have made it possible to empower learners to decide when and where they engage in educational activities (Anagün, 2018; Guo, 2018; McWilliams, 2016).

Education in the digital age necessitates the presence of teachers who are highly proficient in digital skills. Mitra (2014) asserts that education will become self-organizing with technology playing an essential role in both the delivery of educational content and the provision of assistance to learners. Furthermore, advancements such as artificial intelligence, learning analytics and the Internet of Things will contribute to a shift towards individualized and learner-centric learning experiences (Chai & Kong, 2017; Mitra, 2014; Popenici & Kerr, 2017).

One of the primary duties of a teacher is to establish a purposeful learning environment to enhance students' learning experiences and develop their abilities. However, teachers may lack the necessary digital skills to effectively use AI-powered educational applications for instructional and learning goals (Ally, 2019; Seo, Tang, Roll, Fels, & Yoon, 2021). They may have insufficient technological expertise to perform data analysis or establish rules for automated assignments using AI-driven solutions (Akgun & Greenhow, 2022; Seo et al., 2021; Sijing & Lan, 2018). Artificial intelligence (AI) is widely used by teachers to efficiently handle and analyze large amounts of data for remote learners. This technology has become highly used in educational environments (Aljarrah, Ababneh, Karagozlu, & Ozdamli, 2021; European Commission, 2022). However, recent research efforts to enhance students 'AI competencies. There is a lack of studies that identify the specific digital competencies teachers need to be prepared for AI- driven learning environment. As a result, this paper highlights the critical need for teachers to acquire and enhance their competencies to effectively navigate and harness the potential of emerging technologies in the learning environment. As we move further into the digital age and the Fourth Industrial Revolution, education is becoming increasingly adaptive and individualized catering to the diverse needs of learners. This paradigm shift requires teachers to develop a new set of skills and knowledge, not only in their academic specialties but also in technology integration, data analysis, and interactive teaching methodologies. In this study, we delve into the influences molding the field of education and aim to pinpoint the essential skills required for the digital teachers of the future. This contribution significantly enriches the ongoing conversation about preparing teachers to navigate the ever-changing landscape at the intersection of teaching and technology addressing both challenges and opportunities. The competency framework outlined in this paper serves as a valuable resource for training and guiding future teachers empowering them to effectively navigate the complexities of education in the context of the Fourth Industrial Revolution. This research was guided by two key research questions:

- What AI competencies are required by digital teachers in the future classroom?
- Does the digital teachers' assessment for the importance of AI competencies vary based on work experience (less than 10 years/or more)?

2. Literature Review

2.1. Teachers' Digital Competencies

Recently, defining the significance of digital competence in higher education has gained the attention of researchers and teachers. Digital competencies encompass the skills required for living, learning and working in a digitally-driven society. These skills include communication and accessing information through the internet, social media and mobile devices (Falloon, 2020; Ng, Leung, Su, Ng, & Chu, 2023). Ferrari (2012) described digital competence as a combination of knowledge, skills, attitudes, strategies and awareness necessary for using ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content and build knowledge in an effective, efficient, critical, creative, autonomous, flexible, ethical and sensible

manner for work, entertainment, participation, learning, socialization, consumption, and empowerment. Long and Magerko (2020) argue that AI competency is now essential in the 21st century because it allows individuals to critically evaluate AI technologies, collaborate efficiently and apply AI tools in various contexts.

Rafael, Novoa-Hernandez, and Rodriguez (2023) state that from a policy standpoint, the definition of teachers' digital competencies (TDCs) often depends on frameworks such as DigCompEdu which was proposed by the European Commission. It is a framework specifically designed for teachers to outline and interpret the essential competencies and proficiency levels for teachers. This framework is regarded as a general reference point that can be used to facilitate the development of digital competencies to meet the needs of teachers. According to this model, there are 22 competencies organized in six areas: Professional engagement, digital resources, teaching and learning, assessment empowering learners and facilitating learners' digital competence (Caena & Redecker, 2019). Long and Magerko (2020) proposed 16 key competencies that individuals should develop, including recognizing and understanding AI, interdisciplinary skills, distinguishing between general and narrow AI, identifying AI's strengths and weaknesses, envisioning future AI applications and their societal impacts, understanding knowledge representation, decision-making and machine learning. They also emphasized recognizing the roles humans play in AI, developing data competency, learning from data, critically interpreting data, applying higher-level reasoning in AI, understanding sensors, and addressing ethical concerns related to AI.

Literature on digital competencies in higher education is extensive. Several studies have begun by highlighting the significance of digital skills training for university instructors. A prime example is the work of Savin-Baden (2015) which analyzed the arguments advocating the integration of virtual worlds in education and its impact on university instructors. One of the major results of this study is the significance of some models of digital literacy and pedagogically informed frameworks in resolving the problems and challenges that emerge in the process of using virtual worlds in learning. Sandí Delgado and Sanz (2020) demonstrated that serious games result in behavioral and attitudinal changes among teachers regarding Information and Communication Technologies (ICTs), teaching innovation, and digital competencies in their extensive review on the role of serious games in the development of Teachers' Digital Competencies (TDCs).

2.2. Teacher competencies for Effective AI Integration

Recent studies have emphasized teachers' need to update their competencies to be able to integrate AI into pedagogical practices. It is recommended that this ongoing process of updating should extend beyond mere acquisition of knowledge of AI concepts and principles into understanding how to use AI-based tools to enhance students' competencies (Kong & Abelson, 2022; Ng, Leung, Chu, & Qiao, 2021; Su, Zhong, & Ng, 2022).As a result, it is critical to investigate and analyse the knowledge, abilities, and attitudes required by teachers for effective AI integration. For example, Kim and Kwon (2023) highlight the importance of identifying current gaps in teaching competencies within AI education. For them, analyzing the essential components of knowledge, skill, and attitude to enhance teaching can significantly improve teacher performance. Prior research investigating teacher-focused competencies in integrating AI curriculum has mainly focused on the following three main aspects: 1) identifying AI knowledge, 2) utilizing AI technology and smoothly incorporating it into pedagogical practices. It is worth mentioning that the Technological Pedagogical Content Knowledge (TPACK) framework introduced by Mishra and Koehler (2006) has been extensively used to organize the competencies needed by teachers for the effective implementation of AI tools. This framework offers a classification of these competencies in three categories: Content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK).

Based on this framework, Edwards, Morgan, and Hagger (2018) highlighted the importance of such skills as choosing and designing machine-oriented instructions, close monitoring of students' progress and providing emotional and cognitive support through the utilization of AI-based robotics. In a study analyzing the AI curriculum, Kim, Grieco, Bombelli, Hickman, and Sanz-Cobena (2021) stated that for effective preparation of learning environments and teaching AI, there are ten competencies that should be catered for including understanding the fundamentals of AI, Computer Science (CS)with programming and algorithms, and using Information and Communication Technology (ICT) tools and educational software.

One of the major issues related to teachers' competencies in AI integration is the need to foster a balanced and thoughtful approach. Todorova (2023) states that the increasingly intensifying influence of digital technologies on human lives would oblige teachers to enhance their technological teaching capabilities and more importantly to establish boundaries that safeguard a distinctly human learning environment. Therefore, teachers should keep pace with technological advancements and introduce integration seamlessly within a "balanced approach". According to Markauskaite et al. (2022) seamless integration of new digital technologies into teaching practices involves engaging in professional learning to build competencies and to gain experience with AI-enabled tools. It entails teachers learning to utilize appropriate AI-driven technologies such as adaptive learning systems and intelligent agents. Cavalcanti et al. (2021) state that these tools aid in daily teaching management, collaboration with various stakeholders (e.g., parents, colleagues), enhancing personalized learning to comprehend students' progress and needs, and performing various tasks such as providing automatic feedback, self-diagnosing and fostering online collaboration among learners. Applying these tools would help teachers seamlessly integrate AI tools in teaching.

This approach of seamless and balanced integration of AI tools was also advocated by Ng et al. (2023) who stated that teachers have a crucial role in obtaining the maximum benefit from the potential of technology in enriching students' learning experience. Their study stresses teachers' need for developing their digital competencies with a view to navigating this paradigm smoothly so as to become empowered and well-equipped to integrate AI tools into learning environments effectively.

Pujeda (2023) expressed a similar point in an in-depth literature review that explores the digital competencies essential for teachers to effectively navigate AI-driven learning environments. In this study, the concept of "strategic integration of AI tools" is introduced. According to Pujeda (2023) strategic integration of AI tools requires teachers not only to have technological proficiency but also to develop a deep sense or understanding of the implications associated with implementing them. The study also highlights the massive potentials of AI-driven environments such as fostering individualized learning, catering for diversity of learning styles, adeptly and addressing the unique learning characteristics of each student. The benefits of strategic integration of AI tools for

teachers include enhancing the repertoire of their teaching skills, and achieving higher levels of interaction and personalized learning as well as enriching their methods. Strategic integration of AI tools into learning environments is seen as an important agent in enhancing the overall learning experience and promoting inclusive and equitable learning experiences for all. It is worth mentioning that despite the numerous research conducted on AI integration into learning, there is still a need for investigating this area among teachers in higher education who need to be highly proficient in various professional aspects beyond just teaching such as academic instruction, educational aptitude, and technological expertise. There are also conflicting results regarding how personal and contextual factors affect teachers' competence in artificial intelligence (AI). Therefore, this study aims to fill some of these gaps by exploring a wide range of faculty members' AI competencies including academic instruction, educational proficiency, and technological skills. It also seeks to investigate how personal factors like years of experience affect teachers' digital competence in higher education.

3. Methodology

3.1. Research Design

This study employed a combination of descriptive and analytical methodologies to investigate and tackle the research queries concerning the identification of the necessary skills for digital teachers. The descriptive technique was employed to thoroughly observe and document the present condition of digital teaching competencies offering a comprehensive and realistic representation of the phenomenon. In addition, the analytical approach was used to thoroughly analyze the data, enabling identification of patterns, linkages, and underlying aspects that are crucial for constructing a competency framework for future digital teachers.

3.2. Research Sample

The research sample consisted of 26 teachers from the University of Technology and Applied Science (UTAS) especially from Rustaq College of Education located in the sultanate of Oman. These teachers were chosen due to their active involvement in using technology to enhance teaching and learning processes. The selection criteria focused on teachers who regularly employ digital tools, resources, and platforms to create engaging and effective learning environments. The participants were categorized based on their years of practical teaching experience as summarized in Table 1. This categorization was important to ensure a comprehensive analysis of how experience levels might influence the perception and use of AI competencies in teaching.

Table 1. The distribution of sample participants according to their years of practical experience.

Variable	Variable levels	Frequency	Percent
Experience years	Less than 10 years	10	38.46%
	10 years and more	16	61.53%

3.3. Research Instrument

A compilation of digital competencies with AI was derived from theoretical frameworks and previous research. These competencies were incorporated into a questionnaire designed to evaluate their significance from the perspective of digital teachers at universities of technology and applied science. Responses to the questionnaire items were based on a three-point scale (important, neutral and not important) with corresponding scores assigned (3/2/1) upon correction. The questionnaire used for data collection is provided in Appendix.

3.4. Instrument Validity and Reliability

The input of nine teachers in university technology and applied science was sought to ensure the questionnaire's content validity. Their feedback was utilized to assess the appropriateness of the questionnaire items, the linguistic formulation and the inclusion of any additional relevant items. Following the arbitrators' recommendations, necessary amendments and additions were made. The revised questionnaire was then reviewed by three of the initial arbitrators and their approval was obtained for the revisions. The finalized questionnaire comprised 41 items delineating the digital competencies deemed essential for digital teachers in higher education.

The reliability of the questionnaire was gauged by calculating Cronbach's alpha coefficient before deleting the item degree and after deleting it on a sample of nine teachers in a university of technology and applied science. The Cronbach's alpha value reliability coefficient was .79 and the values after item deletion ranged from .75 to .79. These results suggest that the Cronbach's alpha values obtained upon deletion of items didn't enhance the questionnaire reliability and that the reliability coefficient value by the Cronbach's alpha method was acceptable.

3.5. Research Procedures

The research procedure consisted of several steps. Initially, relevant studies and literature pertaining to the research topic were reviewed. Subsequently, a questionnaire was developed based on this literature review. The validity and reliability of the questionnaire were then assessed. Following this, the questionnaire was administered to the research sample and the data obtained were subjected to statistical analysis. Finally, the research findings were discussed based on the results obtained from the data analysis.

4. Results

4.1. Results of the First Question

The first question states "What AI competencies are required by digital teachers of the future classroom?"

"To address this inquiry, the researchers computed the frequency, percentage, mean, and standard deviation of respondents' answers for each aspect of AI competencies necessary for teachers. Given that each aspect is rated on a scale of 1 to 3 with a range of 2 and a category length of 0.67, the interpretation is as follows: a mean value falling between 1 and less than 1.68 indicates a low level between 1.68 and less than 2.35 indicates a medium level, and between 2.35 and 3 indicates a high level. The findings are summarized in Table 2.

Table 2. Frequencies, percentages, means, and standard deviations of the AI competency items required for digital teachers.

Item no.	AI competencies		Responses			Mean	Std. deviations	Importance level
			Not important	Neutral	Important			
1-	I possess profound theoretical knowledge in the academic specialization.	f	0	0	26	3	0.000	High
		%	0	0	100			
2-	I am capable of achieving high performance in the academic field.	f	0	2	24	2.92	0.272	High
		%	0	7.6	92.3			
3-	I demonstrate proficiency in the content of the course I teach.	f	0	0	26	3	0.000	High
		%	0	0	100			
4-	I develop my specialized scientific knowledge through study and continuous training.	f	0	0	26	3	0.000	High
		%	0	0	100			
5-	I have skill in creating and updating curriculum content.	f	0	4	22	2.85	0.368	High
		%	0	15.38	84.6			
6-	I have deep understanding of foundational concepts in artificial intelligence (AI) and its applications in education.	f	0	6	20	2.76	0.430	High
		%	0	23.7	76.92			
7-	Proficient in handling internet browsers, email, advanced internet searching, databases, and digital repositories.	f	0	0	26	3	0.430	High
		%	0	0	100			
8-	Proficient in handling documents, files, and folders, including creating, saving, moving, exchanging, and compressing them.	f	0	0	26	3	0.000	High
		%	0	0	100			
9-	Possess principles and skills in artificial intelligence, search algorithms, and expert systems.	f	16	8	2	1.46	0.647	Low
		%	61.5	30.7	7.6			
10-	Proficient in using visual and audio conferencing software, real-time and asynchronous communication tools, and social media communication software.	f	0	3	23	2.88	0.326	High
		%	0	11.5	88.4			
11-	Proficient in deploying intelligent adaptive learning management systems LMS like Moodle. (At least the system adopted by the institution).	f	8	4	14	2.32	0.908	Medium
		%	30.7	15.3	53.8			
12-	Proficient in designing, producing, and developing electronic content, authoring multimedia, processing audio and visual elements, photography, and digital editing.	f	0	2	24	2.92	0.272	High
		%	0	7.6	92.3			
13-	Proficient in designing websites, forums, and registering and managing social media pages.	f	10	10	6	1.84	0.784	Medium
		%	38.4	38.4	23.0			
14-	Able to troubleshoot technical issues independently.	f	13	11	2	1.57	0.643	Low
		%	50	42.3	7.6			
15-	I am keeping updated with emerging educational technologies and AI applications.	f	0	2	24	2.92	0.272	High
		%	0	7.6	92.3			
16-	Capability to incorporate multimedia elements into lessons, such as images, videos, and interactive simulations.	f	0	4	22	2.84	0.368	High
		%	0	15.3	84.6			
17-	Proficient in managing digital resources including AI-powered educational tools, and integrating them seamlessly into the teaching process.	f	18	3	5	1.5	0.812	Low
		%	69.3	11.5	19.2			
18-	Proficiency in designing and programming electronic assessments, surveys, and data collection tools used in the intelligent learning environment.	f	0	4	22	2.84	0.368	High
		%	0	15.3	84.6			
19-	Competence in managing and utilizing educational applications, including Google and Microsoft educational apps for effective online teaching.	f	0	0	26	3	0.000	High
		%	0	0	100			
20-	I have knowledge of the applications and implications of AI in educational settings.	f	8	0	18	2.38	0.941	High
		%	30.7	0	69.2			
21-	I have skills in integrating new AI technologies into teaching practices.	f	9	0	17	2.30	0.970	Medium
		%	34.6	0	65.3			
22-	I understand how AI tailors educational content to individual student needs.	f	8	0	16	2.15	0.941	Medium
		%	30.7	0	61.5			
23-	I am aware of potential risks associated with AI-powered educational tools.	f	18	8	0	1.30	0.452	Low
		%	69.2	30.7	0			
24-	I lead, participate, and direct discussions and activities towards achieving students' goals.	f	0	4	22	2.84	0.368	High
		%	0	15.3	84.6			
25-	I use teaching methods that align with diverse learning styles	f	0	6	20	2.76	0.430	High
		%	0	23.0	76.9			
26-	I propose diverse methods to achieve educational goals to suit different learners in their competencies and self-esteem.	f	5	0	21	2.61	0.402	High
		%	19.2	0				
27-	I have skills in guiding students on effective utilization of AI tools and resources.	f	20	1	5	1.42	0.809	Low
		%	76.9	3.8	19.2			
28-	I create groups for continuous interaction between the teacher and students between students and the targeted digital content.	f	0	0	26	3	0.000	High
		%	0	0	100			
29-	I ensure that interaction with students is focused on educational topics and learning, avoiding unnecessary diversions.	f	0	6	20	2.76	0.430	High
		%	0	23.0	76.9			

Item no.	AI competencies		Responses			Mean	Std. deviations	Importance level
			Not important	Neutral	Important			
30-	I engage with students who are not actively participating, solve their problems and encourage them to participate.	f	0	4	22	2.84	0.368	High
		%	0	15.3	84.6			
31-	I provide students with feedback during interaction regarding their progress rate, messages, and answers to their questions.	f	0	6	20	2.76	0.430	High
		%	0	23.0	76.9			
32-	I have skills in providing feedback informed by AI analytics.	f	0	6	20	2.76	0.430	High
		%	0	23.0	76.9			
33-	I accept students' ideas, performances, and feelings during their learning and encourage them to express themselves.	f	0	0	26	3	0.000	High
		%	0	0	100			
34-	I create psychological, friendly and collaborative climate.	f	0	2	24	2.92	0.272	High
		%	0	7.6	92.3			
35-	I appreciate the diversity and individual differences among students.	f	0	8	18	2.69	0.471	High
		%	0	3.0	69.2			
36-	I understand the failures of students, utilizing them as starting points for excellence and success.	f	0	6	20	2.76	0.430	High
		%	0	23.0	76.9			
37-	I demonstrate genuine warmth towards students and avoid aggressive behaviors.	f	0	1	25	2.96	0.196	High
			0	3.8	96.1			
38-	I am aware of ethical considerations in using AI in education.	f	0	1	25	2.96	0.196	High
		%	0	3.8	96.1			
39	I assist students in being aware of the policy of responsible and legal use of technology and the risks of inappropriate use legally, ethically, and healthily.	f	6	7	12	2.15	0.827	Medium
		%	23.0	26.9	46.1			
40-	I clarify and practices with students the ethical use of social media and real-time and asynchronous communication tools.	f	0	8	18	2.69	0.471	High
		%	0	30.7	69.2			
41-	I have skills in promoting ethical AI use among students.	f	0	9	17	2.65	0.485	High
		%	0	34.6	65.3			
	Total degree of all AI competencies					2.61	0.817	High

Table 2 shows that teachers generally view AI competencies as highly important with exceptions for items 11. 13. 21.22, and 39 which were deemed medium important and items 9, 14, 17, 23, and 27 rated as less important. The average total degree of AI competencies divided by the number of items is 2.59 indicating an overall high level of importance attributed to AI competencies.

4.2. Results of the Second Question

The second question states that "Does the digital teachers' assessment for the importance of AI competencies vary based on work experience (less than 10 years or more)"? The Mann-Whitney test was employed to examine the significance of variances among the mean ranks of digital teachers' evaluations regarding the importance of AI competencies based on their practical experience to address this inquiry. The outcomes are summarized in Table 3. The results of the Mann-Whitney test are illustrated in Figure 1.

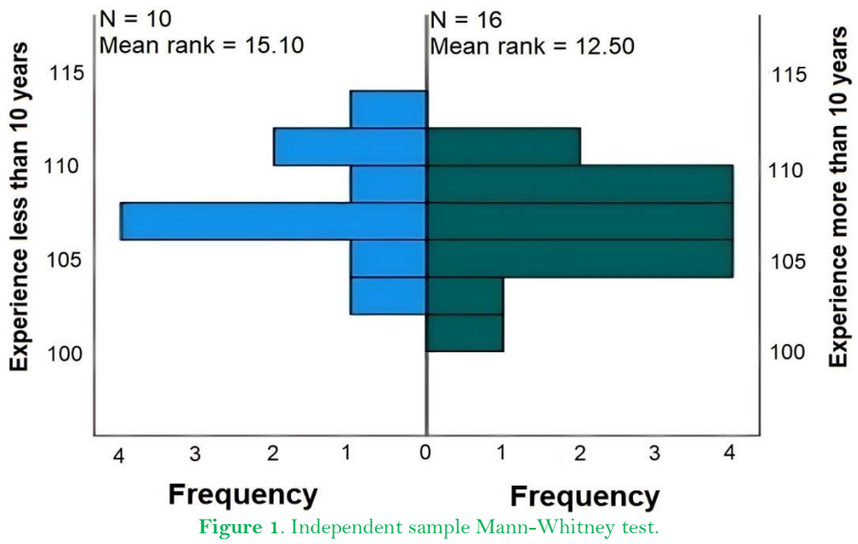

Figure 1. Independent sample Mann-Whitney test.

Figure 1 presents the results of an independent sample Mann-Whitney test indicating that there are no significant differences in the mean ranking of scores between digital teachers' evaluations of the importance of AI competencies based on their work experience (less than 10 years or more).

Table 3. Findings from the Mann-Whitney test concerning variations among specialists in evaluating the importance of AI competencies necessary for digital teachers based on their level of experience variable.

	Groups	N	Mean rank	U	Z	Sig.
Academic competencies	Less than 10 years	10	15.10	64.000	0.421	0.253
	More than 10 years	16	12.50			

Table 3 indicates that there are no notable variations in the average ranks of scores among digital teachers in two distinct categories concerning their experience in evaluating the importance of AI competencies for digital teachers. This suggests that specialists attributed similar levels of importance to all the digital competencies examined in this study underscoring the significance of these competencies across varying levels of experience among teachers regardless of practical experience.

5. Discussion

The analysis results for the first research question clearly illustrate the significance of Al competencies essential for digital teachers and the order of these competencies reveals a hierarchical importance structure guiding the capabilities of digital teachers. At the apex of significance lie foundational theoretical knowledge and the ability to translate it into high academic performance closely followed by proficiency in course content delivery and continuous specialization development. This expertise extends to curriculum design and updating demonstrating deep comprehension of AI fundamentals and adept handling of digital tools and resources crucial for effective teaching. This result aligns with findings from numerous studies focusing on the realm of AI (Amhag, Hellström, & Stigmar, 2019; Blayone et al., 2018; Guillen & Mayorga, 2019; Montoro, Hinojo-Lucena, & Sánchez, 2015; Romero-Rodríguez, Contreras-Pulido, & Pérez-Rodríguez, 2019).

On the other hand, results for the second question reveal that there are no statistically significant differences in the average rankings of scores among specialists in both groups when assessing the importance of AI competencies regardless of their experience levels. Specialists across different practical experience categories attributed similar levels of importance to all the AI competencies evaluated in this study. These findings could stem from the alignment in the proficiency and capabilities of teachers in a university of technology and applied science. The contemporary technological advancements have compelled all academics and professionals to hone essential skills demanded by the job market catering to the needs of stakeholders and adjusting to the evolving digital landscape. Additionally, efforts within the college of technology and applied science focus on advancing the profession both scientifically and technically aiming to enhance its adaptability, dynamism, and alignment with technological advancements. This result aligns with findings from studies focusing on the importance of AI competencies (Alnasib, 2023; Hazaea, 2020).

6. Conclusion

This study emphasizes the critical role of AI competencies in shaping the future of education particularly for the digital teachers in higher education. The findings reveal that AI competencies are generally considered highly important by teachers; there are variations in how specific competencies are valued. These insights underline the necessity for teachers to develop a robust set of AI skills including foundational knowledge, effective use of digital tools and the ability to integrate AI into pedagogical practices. The study also highlights that the significance of these competencies is recognized consistently across teachers with varying levels of experience suggesting a universal need for these skills in the rapidly evolving educational settings. The results align with the global trends and suggest that the development of SI competencies is crucial for teachers to effectively prepare learners for the challenges and opportunities of the 21st century.

This research provides valuable guidance for the development of comprehensive training programs that can equip teachers with the skills necessary to thrive in a digitally- driven world by identifying and analyzing these competencies. As the educational system continues to evolve, the integration of AI and digital technologies will be essential in creating an adaptive and effective learning environment.

7. Recommendation

Possessing AI competence has become an essential talent for individuals to succeed and prosper (Romero-Rodríguez et al., 2019). It is imperative for teachers to possess digital proficiency given the backdrop of the fourth industrial revolution. Educational institutions should develop and implement robust training programs focused on AI competencies for teachers. These programs should be tailored to address the specific needs of teachers at different experience levels ensuring that all teachers can effectively integrate AI into their teaching practices. Moreover, institutions should prioritize the integration of AI-related content within teacher education programs. This will help future teachers to become proficient in the use of AI tools and technologies preparing them to meet the demands of modern educational environments. In addition, it is crucial to offer ongoing professional development opportunities for teachers to keep them updated on the latest advancements in AI and digital teaching tools. This will enable teachers to continuously refine their skills and stay competitive in an ever-evolving educational process. Finally, additional studies should be conducted to assess the current status of digital teachers and explore effective methods for their development.

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Appendix

The appendix: Questionnaire
Title: AI Competencies Required for digital teachers
Instructions: Please indicate the importance of each digital competency listed below by selecting the option that best represents your opinion. Your responses will be used to assess the significance of these competencies from the perspective of digital educators.
Scale:

- 3 = Important
- 2 = Neutral
- 1 = Not Important

Section 1: General information

1. **What is your teaching experience?**
   - Less than 10 years
   - 10 years or more

Section 2: Digital competencies

Item no	AI competencies	Important	Neutral	Not important
1.	I possess profound theoretical knowledge in the academic specialization.	○	○	○
2.	I am capable of achieving high performance in the academic field.	○	○	○
3.	I demonstrate proficiency in the content of the course i teach	○	○	○
4.	I develop my specialized scientific knowledge through study and continuous training.	○	○	○
5.	I have Skill in creating and updating curriculum content.	○	○	○
6.	I have deep understanding of foundational concepts in artificial intelligence (AI) and its applications in education.	○	○	○
7.	I am professional in handling internet browsers, email, advanced internet searching, databases, and digital repositories.	○	○	○
8.	I am professional in handling documents, files, and folders, including creating, saving, moving, exchanging, and compressing them.	○	○	○
9.	I possess principles and skills in artificial intelligence, search algorithms, and expert systems.	○	○	○
10.	I am professional in using visual and audio conferencing software, real-time and asynchronous communication tools, and social media communication software.	○	○	○
11.	I am professional in deploying intelligent adaptive learning management systems LMS like moodle. (At least the system adopted by the institution)	○	○	○
12.	I am professional in designing, producing, and developing electronic content, authoring multimedia, processing audio and visual elements, photography, and digital editing.	○	○	○
13.	I am professional in designing websites, forums, and registering and managing social media pages.	○	○	○
14.	Able to troubleshoot technical issues independently.	○	○	○
15.	I am keeping up-to-date with emerging educational technologies, and AI applications	○	○	○
16.	Capability to incorporate multimedia elements into lessons, such as images, videos, and interactive simulations.	○	○	○
17.	I am professional in managing digital resources, including AI-powered educational tools, and integrating them seamlessly into the teaching process.	○	○	○
18.	I am professional in designing and programming electronic assessments, surveys, and data collection tools used in the intelligent learning environment.	○	○	○
19.	Competence in managing and utilizing educational applications, including Google and Microsoft educational apps, for effective online teaching.	○	○	○
20.	I have knowledge of the applications and implications of AI in educational settings.	○	○	○
21.	I have skills in integrating new AI technologies into teaching	○	○	○

Item no	AI competencies	Important	Neutral	Not important
	practices.			
22.	I understand how AI tailors educational content to individual student needs.	○	○	○
23.	I am awareness of potential risks associated with AI-powered educational tools.	○	○	○
24.	I lead, participates , and direct discussions and activities towards achieving students' goals.	○	○	○
25.	I use teaching methods that align with diverse learning styles	○	○	○
26.	I propose diverse methods to achieve educational goals to suit different learners in their competencies and self-esteem.	○	○	○
27.	I have skills in guiding students on effective utilization of AI tools and resources.	○	○	○
28.	I create groups for continuous interaction between the teacher and students, among students, and between students and the targeted digital content.	○	○	○
29.	I ensure that interaction with students is focused on educational topics and learning, avoiding unnecessary diversions.	○	○	○
30.	I engage with students who are not actively participating, solves their problems, and encourages them to participate.	○	○	○
31.	I provides students with feedback during interaction regarding their progress rate, messages, and answers to their questions.	○	○	○
32.	I have skills in providing feedback informed by AI analytics.	○	○	○
33.	I accept students' ideas, performances, and feelings during their learning and encourages them to express themselves.	○	○	○
34.	I create psychological, friendly, and collaborative climate	○	○	○
35.	I appreciate the diversity and individual differences among students	○	○	○
36.	I understand the failures of students, utilizing them as starting points for excellence and success.	○	○	○
37.	I demonstrate genuine warmth towards students and avoids aggressive behaviors.	○	○	○
38.	I am aware of ethical considerations in using AI in education.	○	○	○
39.	I assist students in being aware of the policy of responsible and legal use of technology and the risks of inappropriate use legally, ethically, and healthily.	○	○	○
40.	I Clarify and practices with students the ethical use of social media and real-time and asynchronous communication tools.	○	○	○
41.	I have skills in promoting ethical AI use among students.	○	○	○