EDUCARE Journal of Primary Education
https://educare.uinkhas.ac.id/index.php/jie
ISSN 2716-1021 (p) 2716-1013 (e)
OPEN ACCESS
DOI: 10.35719/educare.v6i2.379
Vol 6, No 2 (2025), pp. 127-140

Functional skills gap: The role of artificial intelligence and teachers' digital competence in South Pakistani Islamic schools

Muhammad Kashif Majeed[1*], Tunku Badariah Ahamad[2],
[1&2]Education Department, faculty of Curriculum and Instructions Development,
International Islamic University Malaysia

Article Information:
Received 2025-07-29
Revised 2025-10-08
Published 2025-12-16

Keywords: Gender Differences, Digital Competency, AI Usage, Functional Skills, Islamic Education.

ABSTRACT

The gap in teachers' functional skills in utilizing artificial intelligence and digital competencies remains a major issue in Islamic schools in Southern Pakistan. Gender variations show differences in technological adaptation abilities, so that AI integration has not had an equal impact on improving functional pedagogical practices. This study aims to analyze the influence of digital competence and AI use on the functional skills of Islamic school teachers in Southern Pakistan and to examine the moderating role of gender in this relationship. This quantitative research with a cross-sectional survey design involved 450 Islamic school teachers in South Punjab using a Likert scale questionnaire to analyze the relationship between digital competence, AI use, and functional skills, as well as to identify gender-based differences in technology integration. This study concludes that the integration of AI and digital competence in Islamic education in Southern Pakistan is influenced by gender factors, with female teachers being more effective at converting AI into functional teaching skills. These findings call for gender-sensitive, inclusive, and sustainable professional development policies. This research contributes by strengthening empirical evidence of the role of gender in AI integration, enriching gender-perspective organizational theory, and offering a conceptual basis for gender-sensitive professional development policies for Islamic teachers.

To cite this article (APA Style):
Majeed, M. K., & Ahamad, T. B. (2025). Functional skills gap: The role of artificial intelligence and teachers' digital competence in South Pakistani Islamic schools. *EDUCARE Journal of Primary Education, 6(2)*, 127–140. https://doi.org/10.35719/educare.v6i2.379

[*]**Corresponding Author**: Muhammad Kashif Majeed, Education Department, Faculty of Curriculum and Instructions Development, International Islamic University Malaysia, Malaysia email: kashich4302399@gmail.com

INTRODUCTION

Artificial intelligence (AI) and digital competencies have become core pillars of contemporary education, fundamentally transforming pedagogical practices, curriculum delivery, and patterns of teacher student interaction. Zhao et al. (2002) argue that digital technologies reshape how knowledge is constructed, accessed, and mediated in classroom settings, while Spante et al. (2018) emphasize that digital competence extends beyond technical skills to include pedagogical, cognitive, and ethical capacities. In the Pakistani context, particularly within faith-based Islamic elementary schools in rural Southern Punjab, the integration of AI-driven tools is shaped by intersecting gender norms, cultural expectations, religious values, and infrastructural limitations. Kruskopf et al. (2024) note that rural education systems often reproduce gender-based disparities in digital access and professional confidence, a perspective reinforced by Almazroa and Alotaibi (2023), who highlight unequal opportunities for technology-oriented professional development. In areas such as Kot Addu, limited technological infrastructure and conservative gender norms further constrain teachers' engagement with AI. Nevertheless, Wahid (2024) observes that female educators frequently demonstrate greater adaptability, pedagogical innovation, and intrinsic motivation in adopting digital learning practices, even under restrictive structural conditions.

Various studies show that AI competency is a fundamental requirement for teachers in the digital age. Khalil & Alsenaidi (2024) emphasize that AI competency is important for all teachers regardless of their length of service, with readiness determined by targeted training, continuous professional development, institutional support, and infrastructure. Tjahjono et al. (2025) emphasize the integration of AI, IoT, automation, and data analytics in vocational education to strengthen cross-functional skills and industry collaboration. Ali (2025) shows that AI improves personalized learning and administrative efficiency in Oman, although challenges related to infrastructure, training, and data privacy remain significant. Muttaqin (2022) highlights the importance of teachers' professional, pedagogical, personal, and social competencies in utilizing digital technology. Meanwhile, Kim & Kwon (2023) found low teacher confidence in TPACK related to AI and developed 22 AI competencies as a practice guide. Preliminary studies show differences in the focus of teacher AI competencies, digital readiness, and institutional support, confirming a functional skills gap in AI utilization in South Pakistani Islamic schools that requires continuous training and collaborative strategies.

Although research on digital competence and the adoption of artificial intelligence (AI) in education continues to grow, most studies still focus on urban and secular schools, thereby neglecting the context of rural Islamic schools that face the greatest digital challenges. Weinhandl and colleagues (2025) emphasize that gender dynamics can moderate the relationship between digital competence, AI use, and the development of teachers' functional skills, but this is rarely explored. This limited understanding hinders the design of inclusive training and policies that are responsive to gender needs. Furthermore, Aditya and colleagues (2023) show that social, cultural, and infrastructural conditions in rural Islamic schools in Southern Punjab influence technology engagement. Therefore, this study aims to explore how gender moderates the relationship between AI integration, digital competence, and teachers' functional skills in Kot Addu and its surroundings.

The purpose of this study is to analyze the effect of digital competence on the functional skills of teachers in Islamic schools in Southern Pakistan, as well as to examine how patterns of Artificial Intelligence (AI) use affect teachers' performance in developing these core skills. This study also aims to explore the moderating role of gender in the relationship between digital competence, AI utilization, and the development of teachers' functional skills. Through this understanding, the study is expected to provide academic and practical benefits, including as a basis for developing training programs that emphasize the improvement of digital competence and the effective use of AI for teachers, as well as providing insights into gender-based challenges in the context of Islamic education. The results of this study are expected to support strategies for improving teaching quality, optimizing the use of technology, and creating equal opportunities for both male and female teachers to improve their professional competence in the digital age.

Based on the research objectives, preliminary findings indicate that digital competence has a significant effect on the functional skills of teachers in Islamic schools in southern Pakistan, while the use of artificial intelligence (AI) enhances teachers' performance in developing core skills such as communication, time management, and problem solving. Additionally, preliminary indications suggest that gender moderates the relationship between digital competence, AI use, and functional skill development, with differences in adoption patterns and responses between female and male teachers to digital technology and training. These findings emphasize the importance of AI integration and strengthening digital competence to holistically improve teacher professionalism. The research questions posed include: how do teachers' digital competence influence the development of functional skills; to what extent do patterns of AI use impact teacher performance related to functional skills; and does gender moderate the relationship between digital competence, AI use, and the development of teachers' functional skills.

RESEARCH METHOD

Quantitative research designs with cross-sectional surveys are considered effective because they enable the systematic collection of numerical data from large populations over a specific period of time, as stated by Wang and Cheng (2020). Sterrantino (2024) asserts that this design is appropriate for examining statistical relationships between variables such as digital competence, AI use, and functional skills as well as for identifying gender-based differences among teachers. Capili (2021) adds that the cross-sectional approach allows for the capture of current attitudes, practices, and skills in a real educational context, thus aligning with the research objective of analyzing the interaction of these factors in a contemporary teaching environment.

This quantitative study employs a questionnaire comprising three main sections with a total of 36 items, each rated on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). According to Kmetty and Stefkovics (2022), digital competence includes digital literacy, online communication, the use of collaborative tools, and the ability to integrate technology into teaching practices (12 items). AI usage patterns encompass the frequency of AI tool use in lesson planning, assessment, content creation, and classroom engagement (12 items). Functional skills (12 items) reflect critical thinking, communication, time management, and digital ethics in teaching practices.

Content and presentation validity were ensured through review by three experts in educational technology and Islamic pedagogy. A pilot study involving 30 teachers helped refine the wording and clarity of the constructs. According to Saifuddin and colleagues (2024), Cronbach's alpha values ranging from 0.78 to 0.89 indicate strong internal consistency across the three scales. Data were analyzed using SPSS version 22 through descriptive statistics, Pearson correlations, and multiple regression analysis. Pérez-Guerrero and colleagues (2024) suggest that cross-tabulation and t-test group comparison techniques are effective for examining gender-based subgroup imbalances.

Data analysis was conducted in multiple steps. First, descriptive statistics (mean, standard deviation, frequency) were calculated to summarize demographic variables and overall trends, as noted by Kotronoulas and colleagues (2023). Pearson's correlation analysis was performed to examine the strength and direction of the relationships between digital competence, AI use, and functional skills. Prior to multiple regression analysis, key statistical assumptions linearity, independence of errors, homoscedasticity, and normality of residuals were checked and satisfied. According to Zapf and colleagues (2024), regression analysis can effectively test the predictive influence of digital competence and AI use on functional skill outcomes. Additionally, independent t-tests were used to compare mean scores between gender groups, while cross-tabulation helped identify gender-related patterns and subgroup distributions. This combination of techniques provided a comprehensive understanding of variable relationships and group-level variations.

Kot Addu district, Southern Punjab is an example of the rural Islam schooling. The region is defined by the weak digital infrastructure presence, gender-specific social rules and the restrictions in the teacher mobility. In this respect, Islamic learning is usually a combination of traditional religiosity and sluggish acceptance of new instruments. That is why the field is perfect for gender-

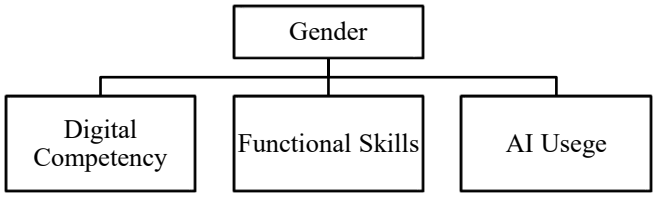
separated work in AI and integration of digital skills.

Data was collected using a Likert scale-based questionnaire that measured three variables, namely the use of AI-based tools in learning planning and assessment (AI Usage), the ability to use digital platforms effectively to collaborate with peers (Digital Competency), and the application of critical thinking skills in integrating technology into teaching (Functional Skills). The variables studied consisted of Digital Competency (X1), AI Usage Patterns (X2), and Functional Skills (Y). A total of 450 Islamic school teachers were surveyed, with a balanced gender distribution and spread across four tehsils. The research process obtained ethical approval, and each respondent was guaranteed confidentiality and voluntary participation.

The conceptual framework reflects the relationship between gender, digital competency, AI usage, and functional skills development

Figure 1

Consptual Framework



The research hypothesis was formulated to examine the relationship between digital competence, AI use, and functional skills among Islamic school teachers. H1 states that there is a significant relationship between digital competence and functional skills. H2 suggests that AI use is significantly related to functional skills. H3 confirms the moderating role of gender in the relationship between AI use and functional skills. Furthermore, H4 states that female teachers demonstrate higher functional skills when both AI usage and digital competence are at high levels. This narrative forms a conceptual framework that integrates digital competence, technology utilization, and gender factors in understanding the development of teachers' functional skills.

RESULTS AND DISCUSSION

Results

Differences in teachers' digital competencies based on gender

Differences in digital competence between male and female teachers in various tehsils in Kot Addu District, highlighting the relative contributions of each gender to functional skills and their implications for professional development and the use of technology in teaching practice.

Table 1

Gender-wise Digital Competency Influence on Functional Skills

Tehsil	Male (%)	Female (%)	Total (%)
Kot Addu	19.42	25.30	44.72
Khan Bela	13.51	17.26	30.77
Daira Din Panah	12.78	18.94	31.72
Nawan Kot	14.09	22.13	36.22

The data clearly indicates that female teachers consistently outperform their male counterparts in terms of digital competencies across all tehsils in District Kot Addu. In Kot Addu, female teachers accounted for 25.30% of the total contribution to digital competency outcomes compared to 19.42% for male teachers, representing a noticeable gap of nearly 6%. This pattern is similarly evident in Khan Bela, where female teachers contributed 17.26%, surpassing males at 13.51%. The disparity becomes even more significant in Daira Din Panah and Nawan Kot, where female teachers achieved 18.94% and 22.13%, respectively, while male teachers lagged behind with 12.78% and 14.09%.

These statistics indicate that girls in the teacher profession are more actively involved in the process of acquiring and using digital skills, and this could be the stronger professional interest, better adjustability to training initiatives or more active involvement in digital informal learning resources. This steady advantage of female teachers in all tehsils would indicate that gender is an important factor in the process of adopting and using digital tools in the classroom. It is also the indication of new educational trend where female teachers in Islamic schools are now increasingly leading the processes of incorporating digital technologies even in rural and traditionally conservative areas. This trend reveals the necessity of gender-responsive policies that would continue and expand the pace of female teachers becoming digital competent.

The dominance of female teachers in the application of artificial intelligence

Digital transformation in Islamic education has encouraged the integration of artificial intelligence (AI) as a strategic tool for improving teachers' pedagogical competencies. In this context, gender is an important aspect to analyze, particularly in relation to the role and contribution of female teachers in effectively adopting and implementing AI technology in Islamic schools in Southern Pakistan.

Table 2
Gender-wise AI Usage Influence on Functional Skills

Tehsil	Male (%)	Female (%)	Total (%)
Kot Addu	14.05	20.22	34.27
Khan Bela	11.47	18.31	29.78
Daira Din Panah	09.18	19.67	28.85
Nawan Kot	13.12	22.23	35.35

The data clearly shows that female teachers in South Pakistani Islamic schools are more successful than male teachers in utilizing artificial intelligence (AI)-based tools to develop functional teaching competencies across all tehsils studied. In Kot Addu, the contribution of AI-based functional skills from female teachers reached 20.22 percent, while male teachers only reached 14.05 percent, showing a difference of 6.17 percent. A similar pattern was observed in Khan Bela, where female teachers contributed 18.31 percent, significantly higher than male teachers who only reached 11.47 percent. The largest gap was found in Daira Din Panah and Nawan Kot. In Daira Din Panah, female teachers contributed 19.67 percent, while male teachers only contributed 9.18 percent. In Nawan Kot, female teachers contributed 22.23 percent, compared to 13.12 percent for male teachers. These findings indicate that female teachers are not only more interested in AI technology, but also more effective in implementing it due to their digital adaptation skills, involvement in learning communities, and readiness to participate in pedagogy and ethics-based training.

The consistently strong performance of female teachers in the application of AI clearly indicates a reversal of traditional patterns of digital leadership within Islamic education. Despite historically limited access to technology compared to their male counterparts, female educators are now demonstrating greater effectiveness in implementing AI tools in classroom practice, particularly in enhancing communication, classroom management, and differentiated instruction. These findings carry significant implications for teacher training and AI-related educational policies. Educational administrators are therefore encouraged to capitalize on this momentum by providing female teachers with advanced AI-based pedagogical tools, structured leadership opportunities in digital transformation, and sustained professional development. Simultaneously, targeted capacity-building initiatives should be directed toward male teachers to address engagement gaps and promote more balanced gender participation in AI integration. Overall, these gender-based disparities highlight the urgent need for inclusive, accessible, and context-sensitive AI and digital competency curricula, especially for religious schools in rural and underserved regions such as Southern Pakistan.

The impact of artificial intelligence and teachers' digital competence on teaching skills

The integration of artificial intelligence (AI) and digital competency is increasingly recognized as a key determinant of functional teaching skills in contemporary Islamic education. This study investigates gender-based differences in how AI usage and digital competence jointly influence teaching effectiveness among Islamic school teachers in Southern Pakistan. Findings reveal statistically significant disparities between male and female educators, indicating unequal adaptation to technology, differences in instructional effectiveness, and varying pedagogical outcomes. The study underscores the strategic role of female teachers in leveraging AI and digital skills to enhance classroom practices and learning experiences.

Table 3

Combined Impact of AI & Digital Competency on Functional Skills (by Gender)

Gender	Mean Score	Std. Deviation	Sample Size
Male	6.10	1.45	225
Female	7.08	1.32	225

The t-test results ($t = 5.72$, $p < 0.001$) provide strong statistical evidence of significant gender differences in functional teaching skills among Islamic school teachers in Southern Pakistan. Female teachers achieved a higher mean score ($M = 7.08$, $SD = 1.32$) than male teachers ($M = 6.10$, $SD = 1.45$), confirming that gender significantly moderates the combined impact of AI usage and digital competency on productive teaching practices. This mixed-impact analysis indicates that female teachers are benefiting more substantially from the integration of AI and digital skills. Their superior performance may be attributed to a stronger adaptive capacity to rapidly changing technological environments, higher levels of commitment to continuous professional development, and a more collaborative and student-centered instructional approach that aligns well with AI-supported and digitally mediated learning strategies. Collectively, these findings demonstrate that female educators are not only engaging with AI tools more effectively but are also translating digital competencies into tangible functional teaching outcomes.

In contrast, male teachers exhibited a lower average score alongside a higher standard deviation, suggesting greater variability in their ability to integrate AI and digital tools into classroom practice. While a small proportion of male teachers demonstrated high levels of competence, many showed limited engagement or uneven skill development, potentially due to disparities in access to training, lower confidence in using emerging technologies, or the perceived lack of relevance of available professional development programs. These gender-based disparities reinforce the argument that AI tools and digital expertise are not utilized equally, even within the same cultural and institutional contexts. Consequently, there is a pressing need for gender-sensitive professional development initiatives. Female teachers should be supported through advanced leadership pathways in AI integration, while male teachers may benefit from targeted interventions focused on confidence building, hands-on training, and culturally responsive digital pedagogy to achieve more balanced and equitable teaching competencies.

Gender-based patterns of AI use and digital competence in shaping teaching skills

The rapid integration of artificial intelligence (AI) and digital technologies has transformed teaching practices in Islamic schools. This study examines gender-based differences in AI usage and digital competency among Islamic school teachers in Southern Pakistan, focusing on their impact on functional teaching skills. The findings highlight stronger AI adaptation among female teachers and emphasize the need for gender-sensitive professional development policies.

Table 4:

AI Usage Patterns and Digital Competency Levels Among Islamic Teachers in Southern Pakistan

Statement	SS	S	TS	STD

Female teachers demonstrate stronger digital skills in lesson planning	22	71	14	3
Male teachers face more challenges using AI tools for lesson delivery.	19	68	16	2
Male teachers face more challenges using AI tools for lesson delivery.	19	68	16	2
AI tools enhance female teachers' ability to manage classrooms effectively.	20	66	15	4
Female teachers use AI more efficiently for student feedback and progress tracking.	18	70	14	3
Male teachers require more training to achieve functional skills using AI.	21	64	17	3
Female teachers exhibit better time management using digital resources.	20	69	13	3
AI usage improves communication skills more in female than male teachers.	17	67	16	4
Digital competency development is more rapid among female Islamic teachers.	19	65	18	3
Male teachers rely more on traditional methods than AI-enhanced teaching.	16	61	22	6
Female teachers show stronger problem-solving abilities using AI tools.	18	68	15	4
AI integration has a greater impact on functional skills in female teachers.	20	66	16	3
Female teachers are more confident in using AI for student-centered instruction.	22	69	12	3

The analysis of the 12-item Likert scale responses highlights significant gender-based differences in AI usage patterns and digital competency levels among Islamic school teachers in Southern Pakistan. A majority of respondents strongly agreed or agreed that female teachers demonstrate greater digital competency in classroom planning and instructional delivery, with 93 respondents supporting the statement. Similarly, 87 respondents agreed that male teachers face more challenges when using AI tools, suggesting a notable digital proficiency gap between genders.
Statements related to the functional benefits of AI such as enhancing classroom management, student feedback, and instructional clarity received strong support, particularly when referring to female teachers. For instance, the item stating that female teachers use AI more efficiently for student feedback and progress tracking received 88 positive responses (SS + S), indicating widespread recognition of their effective integration of AI tools. Likewise, female teachers were consistently perceived as better at managing time, solving problems, and communicating through digital platforms.

Interestingly, the belief that female teachers adapt more quickly to digital devices was supported by 84 respondents, reinforcing the view that female educators in Islamic schools are more open to technological innovation, especially when it is in line with pedagogical and ethical principles. Conversely, the statement that male teachers are more dependent on traditional teaching methods also received a moderate level of agreement, reflecting the continuation of conventional practices among male educators. Overall, these findings indicate that the integration of artificial intelligence and digital competencies has a stronger influence on the functional teaching skills of female teachers than male teachers. The consistency of differences across various statements underscores the urgent need for gender-sensitive professional development programs. Female teachers need to be facilitated through mentoring and digital leadership strengthening, while male teachers require more targeted interventions to overcome the challenges of digitization in the classroom.

Discussion

The dominance and strategic role of female teachers in the implementation of AI

The findings regarding the dominance of female teachers in the application of AI in Islamic schools in Southern Pakistan can be explained through Gendered Organization Theory, which according to Ely and Meyerson (2000) states that organizational practices, including technology adoption, are always influenced by gender relations and are therefore never neutral. Within this framework, although male teachers have historically been assumed to have greater access to technology, the results of this study show a different pattern. In line with the analysis of Tan et al. (2025), female teachers have proven to be more capable of converting the use of AI into functional and applicable pedagogical competencies. These findings are also in line with the digital capability framework as interpreted by Antonietti et al. (2022), which views digital competence as reflective, adaptive, and contextual abilities. Comparatively, the high contribution of female teachers in various

tehsils, such as 22.23 percent in Nawan Kot and 19.67 percent in Daira Din Panah, reinforces Ding et al.'s (2024) view that AI functions as a pedagogical empowerment tool that strengthens the professional position of female teachers in Islamic education.

In terms of policy, the findings of this study call for a paradigm shift in teacher professional development. In line with the views of Alanazi et al. (2025), AI training is no longer effective if it is designed uniformly, but must be gender-sensitive and based on the real needs of learning practices. The superior performance of female teachers in this study's findings reinforces Rahimi et al.'s (2024) argument that female educators need to be facilitated through digital leadership pathways, advanced training, and mentoring roles in AI-based learning communities. Conversely, the relatively lower achievements of male teachers indicate the need for more targeted interventions, such as practice-based training, strengthening technological confidence, and emphasizing the relevance of AI to Islamic pedagogy. The contribution gap of more than 10 percent in Daira Din Panah, when analyzed comparatively, is in line with Shahi and Chaudhary's (2025) warning that without affirmative policies, the gender gap in the digital transformation of education has the potential to widen and hinder the realization of inclusive and sustainable Islamic education.

Based on the research findings, a conceptual model of gender-based AI integration in Islamic education can be formulated, which places digital competence, adaptive attitudes, and involvement in learning communities as key mediators between AI use and the improvement of teachers' functional skills. This is in line with the view of Tran et al. (2024) that the effectiveness of AI is largely determined by teachers' ability to develop contextual and sustainable digital competencies. In a comparative framework, the stronger influence on female teachers supports Pozas et al.'s (2023) analysis that pedagogical readiness, digital collaboration, and student-centered learning orientation strengthen the success of technology integration. Conversely, for male teachers, this study's findings reveal structural and cultural barriers, which, according to Uren and Edwards' (2023) interpretation, are related to unequal access to training and pedagogical resistance. Thus, this model confirms that the success of AI integration in Islamic education is not solely determined by technological sophistication, but by institutional policies, organizational culture, and accompanying gender sensitivity.

Gendered effects of AI and digital competency on functional teaching skills

The results of this study provide strong empirical evidence that the combined impact of artificial intelligence (AI) use and digital competence on functional teaching skills is significantly moderated by gender factors in South Pakistani Islamic schools. A significant t-test value ($t = 5.72$; $p < 0.001$) shows that female teachers have a higher average functional skill score ($M = 7.08$; $SD = 1.32$) than male teachers ($M = 6.10$; $SD = 1.45$). This difference confirms that AI integration and digital competence do not have a uniform impact, even though teachers are in a relatively similar institutional, cultural, and curricular context. In line with the analysis of Wiziack and dos Santos (2021), structural equality does not always result in equality of outcomes in the adoption of educational technology. Theoretically, these findings reinforce Clark-Saboda and Lemke's (2023) argument that organizational and technological practices are always mediated by gender relations. Furthermore, Adewale et al. (2024) also emphasize that the successful utilization of AI is influenced by gender dynamics that shape how teachers access, interpret, and integrate technology into their daily pedagogical practices.

From a theoretical perspective, the findings of this study support the Digital Competence and Capability Framework, which, according to Sibley et al. (2024), views technological competence as an adaptive and reflective ability to integrate technology into pedagogical practices, rather than merely technical mastery. The higher scores of female teachers in this study are in line with the analysis by Langelaan et al. (2024), which shows that educators with strong digital readiness are better able to translate AI into meaningful learning practices, such as classroom management, learning differentiation, and strengthening teacher-student interactions. Conversely, the lower average scores accompanied by greater standard deviation among male teachers indicate significant variation in

ability. Comparatively, these findings reinforce the view of Gkrimpizi et al. (2023) that some educators are able to adapt well to digital innovations, while others are still hampered by low technological confidence, limited relevant training, and resistance to pedagogical change. This condition confirms that the integration of AI is greatly influenced by the reflective readiness and professional context of teachers.

The policy implications of these research findings are highly significant for the development of technology-based Islamic education. In line with the views of Scherer et al. (2023), teacher professional development needs to be directed towards a gender-sensitive approach, in which female teachers are facilitated as key actors in digital leadership and AI integration. These findings analytically show that the adaptive capacity of female teachers can be the main driver of technology-based pedagogical transformation. Conversely, the condition of male teachers in this study supports Schmid et al.'s (2021) argument that more targeted support through practice-based training, strengthening technological self-efficacy, and culturally and religiously contextual digital pedagogy is an urgent need. Based on these results, a conceptual model of gender-based AI integration can be formulated, placing gender as a moderating variable between AI use, digital competence, and functional teaching skills. In line with the analysis of Dringó-Horváth et al. (2025), this model emphasizes that sustainable digital transformation in Islamic education can only be achieved through inclusive, gender-fair policies that are oriented towards the real needs of learning practices.

Integrating AI and digital competencies to improve teachers' teaching skills

The results of the study show consistent gender differences in the use of AI and digital competency levels among Islamic school teachers in Southern Pakistan. The majority of respondents agreed that female teachers have stronger digital skills in lesson planning and material delivery, in line with Lohr et al.'s (2024) analysis of the tendency for female educators to develop reflective and structured digital practices. Conversely, the agreement of 87 respondents that male teachers face more challenges in using AI indicates a technology adaptation gap. Analytically, Brocca (2024) asserts that the adoption of educational technology is influenced by social constructions and gender norms that shape professional attitudes. This explanation is consistent with Zamiri and Esmaeili's (2024) interpretation of Gendered Organization Theory, which places gender as a key factor in work patterns and institutional innovation. Thus, differences in digital competence between genders reflect the complex interaction between organizational structure, school culture, and pedagogical practices.

From a pedagogical perspective, the findings of this study are in line with the views of Demissie et al. (2022), who emphasize that the successful integration of technology in learning is not only determined by access, but primarily by teachers' adaptive, reflective, and pedagogical suitability. In this context, the higher level of agreement on the functional benefits of AI, such as improved classroom management, feedback, time management, communication, and problem solving, when associated with female teachers supports Wang et al.'s (2024) analysis of the effectiveness of student-oriented digital pedagogy. The fact that 88 respondents rated female teachers as more efficient in using AI for tracking student progress and providing feedback, and 84 respondents rated them as more adaptable to digital devices, indicates stronger adaptive capacity. Conversely, the tendency of male teachers to still rely on traditional teaching methods reinforces Alieto et al.'s (2024) argument regarding pedagogical resistance to AI-based innovations, which can hinder the optimization of digital learning.

The implications of these research findings have strong policy relevance for the development of technology-based Islamic education. The relatively homogeneous response patterns indicate an urgent need for gender-sensitive teacher professional development programs, as emphasized by Miralles-Cardona et al. (2025) that digital training that ignores the gender dimension tends to create new gaps. Based on these empirical findings, a conceptual model of gender-based AI integration can be formulated, in which gender acts as a moderating variable between AI use, digital competence, and functional teaching skills. This approach is in line with the analysis of Hämäläinen et al. (2021), which emphasizes the importance of personal and social factors in the effectiveness of educational

technology. In this model, female teachers occupy a stronger influence pathway due to their adaptability, technological confidence, and AI implementation effectiveness, as described by Lin and Chen (2024). Conversely, the need for targeted interventions for male teachers supports Sari et al.'s (2024) view on the importance of practical training and contextual and culturally sensitive digital pedagogy to ensure fair, sustainable, and meaningful AI integration in South Pakistani Islamic schools.

CONCLUSION

This study concludes that the integration of artificial intelligence (AI) and digital competencies in Islamic education in Southern Pakistan shows a clear gender pattern. Female teachers have been proven to play a dominant and strategic role in converting the use of AI into effective functional teaching skills, both in lesson planning, classroom management, communication, and student-centered learning. These findings confirm that technology adoption is not neutral, but is influenced by gender relations and organizational practices. Empirically, female teachers demonstrate stronger adaptive and reflective abilities in the framework of digital capability, while male teachers face variations in ability and pedagogical barriers. Therefore, the digital transformation of Islamic education requires gender-sensitive, inclusive, and contextual professional development policies so that AI integration can take place in a fair, sustainable, and meaningful manner.

Theoretically, the findings of this study reinforce the relevance of Gendered Organization Theory in explaining that the adoption and utilization of educational technology, including AI, does not occur neutrally, but is influenced by gender relations and organizational culture. This study also expands the Digital Competence and Capability Framework by showing that female teachers' digital competence in Islamic education is adaptive, reflective, and contextual. Practically, the results of this study imply the need for gender-sensitive teacher professional development policies. Female teachers need to be facilitated as digital leadership agents and AI mentors in Islamic schools, while male teachers need practice-based training, strengthening of technological confidence, and a digital pedagogy approach that is in line with Islamic values. This approach is important for creating an inclusive and sustainable digital transformation.

This study has several limitations. First, the data was obtained from a limited geographical context in Southern Pakistan, so generalizing the findings to other regions or countries should be done with caution. Second, the use of perception-based survey instruments has the potential to contain subjective biases from respondents. Third, this study has not explored in depth the institutional and micro-cultural factors of schools that influence AI adoption. Therefore, further research using a mixed methods approach or longitudinal studies is recommended to capture the dynamics of changes in teachers' digital competencies over time. In addition, comparative studies across countries or across Islamic educational institutions are also important to enrich the conceptual model of gender-based AI integration.

ACKNOWLEDGEMENTS

The authors express their sincere gratitude to the teachers from the selected schools for their support, which made this research possible. Their cooperation enabled the authors to present the findings related to both the successes and limitations of the study.

REFERENCE

Adewale, M. D., Azeta, A., Abayomi-Alli, A., & Sambo-Magaji, A. (2024). Impact of artificial intelligence adoption on students' academic performance in open and distance learning: A systematic literature review. *Heliyon, 10(22)*, e40025. https://doi.org/10.1016/j.heliyon.2024.e40025

Aditya, T., Ningrum, S., Nurasa, H., & Irawati, I. (2023). Community needs for the digital divide on the smart city policy. *Heliyon, 9(8)*, e18932. https://doi.org/10.1016/j.heliyon.2023.e18932

Alanazi, M., Soh, B., Samra, H., & Li, A. (2025). The Influence of Artificial Intelligence Tools on Learning Outcomes in Computer Programming: A Systematic Review and Meta-Analysis. *Computers, 14(5)*, 185. https://doi.org/10.3390/computers14050185

Ali, D. M. J. (2025). A critical analysis of the impact of artificial intelligence on Oman's educational sector: Opportunities, challenges, and future implications. International Journal of Research and Innovation in Social Science, 9(3S), 3485–3498. https://doi.org/10.47772/IJRISS.2025.903SEDU0256

Alieto, E., Abequibel-Encarnacion, B., Estigoy, E., Balasa, K., Eijansantos, A., & Torres-Toukoumidis, A. (2024). Teaching inside a digital classroom: A quantitative analysis of attitude, technological competence and access among teachers across subject disciplines. *Heliyon, 10(2)*, e24282. https://doi.org/10.1016/j.heliyon.2024.e24282

Almazroa, H., & Alotaibi, W. (2023). Teaching 21st Century Skills: Understanding the depth and width of the challenges to shape proactive teacher education programmes. *Sustainability, 15(9)*, 7365. https://doi.org/10.3390/su15097365

Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education? *Computers in Human Behavior, 132*, 107266. https://doi.org/10.1016/j.chb.2022.107266

Brocca, N. (2024). Adoption of new technologies in pre-service teachers: The case of interaction-enhancing videos. *Teaching and Teacher Education, 138*, 104427. https://doi.org/10.1016/j.tate.2023.104427

Capili B. (2021). Cross-sectional studies. *The American journal of nursing, 121(10)*, 59–62. https://doi.org/10.1097/01.NAJ.0000794280.73744.fe

Clark-Saboda, J. L., & Lemke, M. (2023). Revisiting Acker's gendered organizational theory: What women overcome to stay in the superintendency. *Frontiers in Education, 8*, 1160225. https://doi.org/10.3389/feduc.2023.1160225

Demissie, E. B., Labiso, T. O., & Thuo, M. W. (2022). Teachers' digital competencies and technology integration in education: Insights from secondary schools in Wolaita Zone, Ethiopia. *Social Sciences & Humanities Open, 6(1)*, 100355. https://doi.org/10.1016/j.ssaho.2022.100355

Ding, A.-C. E., Shi, L., Yang, H., & Choi, I. (2024). Enhancing teacher AI literacy and integration through different types of cases in teacher professional development. *Computers and Education Open, 6*, 100178. https://doi.org/10.1016/j.caeo.2024.100178

Dringó-Horváth, I., Rajki, Z., & T. Nagy, J. (2025). University Teachers' Digital Competence and AI Literacy: Moderating Role of Gender, Age, Experience, and Discipline. *Education Sciences, 15(7)*, 868. https://doi.org/10.3390/educsci15070868

Ely, R. J., & Meyerson, D. E. (2000). Theories of gender in organizations: A new approach to organizational analysis and change. *Research in Organizational Behavior, 22*, 103–151. https://doi.org/10.1016/S0191-3085(00)22004-2

Gkrimpizi, T., Peristeras, V., & Magnisalis, I. (2023). Classification of barriers to digital transformation in higher education institutions: Systematic literature review. *Education Sciences, 13(7)*, 746. https://doi.org/10.3390/educsci13070746

Hämäläinen, R., Nissinen, K., Mannonen, J., Lämsä, J., Leino, K., & Taajamo, M. (2021). Understanding teaching professionals' digital competence: What do PIAAC and TALIS reveal about technology-related skills, attitudes, and knowledge? *Computers in Human Behavior, 117*, 106672. https://doi.org/10.1016/j.chb.2020.106672

Khalil, H. ., & Alsenaidi, S. (2024). Teachers' digital competencies for effective AI integration in higher education in Oman. *Journal of Education and E-Learning Research, 11(4)*, 698–707. https://doi.org/10.20448/jeelr.v11i4.6097

Kim, K., & Kwon, K. (2023). Exploring the AI competencies of elementary school teachers in South Korea. *Computers and Education: Artificial Intelligence, 4*, 100137. https://doi.org/10.1016/j.caeai.2023.100137

Kmetty, Z., & Stefkovics, Á. (2022). Assessing the effect of questionnaire design on unit and item-nonresponse: evidence from an online experiment. *International Journal of Social Research Methodology, 25(5)*, 659–672. https://doi.org/10.1080/13645579.2021.1929714

Kotronoulas, G., Miguel, S., Dowling, M., Fernández-Ortega, P., Colomer-Lahiguera, S., Bağçivan, G., Pape, E., Drury, A., Semple, C., Dieperink, K. B., & Papadopoulou, C. (2023). An overview of the fundamentals of data management, analysis, and interpretation in quantitative research. *Seminars in Oncology Nursing, 39(2)*, 151398. https://doi.org/10.1016/j.soncn.2023.151398

Kruskopf, M., Abdulhamed, R., Ranta, M., Lammassaari, H., & Lonka, K. (2024). Future teachers' self-efficacy in teaching practical and algorithmic ICT competencies: Does background matter? *Teaching and Teacher Education, 144*, e104574. https://doi.org/10.1016/j.tate.2024.104574

Langelaan, B. N., Gaikhorst, L., Smets, W., & Oostdam, R. J. (2024). Differentiating instruction: Understanding the key elements for successful teacher preparation and development. *Teaching and Teacher Education, 140*, 104464. https://doi.org/10.1016/j.tate.2023.104464

Lin, H., & Chen, Q. (2024). Artificial intelligence (AI) -integrated educational applications and college students' creativity and academic emotions: students and teachers' perceptions and attitudes. *BMC psychology, 12(1)*, 487. https://doi.org/10.1186/s40359-024-01979-0

Lohr, A., Sailer, M., Stadler, M., & Fischer, F. (2024). Digital learning in schools: Which skills do teachers need, and who should bring their own devices? *Teaching and Teacher Education, 152*, 104788. https://doi.org/10.1016/j.tate.2024.104788

Miralles-Cardona, C., Chiner, E., Tichá, R., Esteve-Faubel, J. M., Abery, B. H., & Sanhueza-Henríquez, S. V. (2025). Teacher Educators' Perceptions of Factors Influencing Gender Mainstreaming Implementation in University Teaching 30 Years after Beijing. *Journal of Intercultural Communication, 25(1)*, 29-44. https://doi.org/10.36923/jicc.v25i1.1005

Muttaqin, I. (2022). Necessary to increase teacher competency in facing the Artificial Intelligence era. *Al-Hayat: Journal of Islamic Education, 6(2)*, 549–559. https://doi.org/10.35723/ajie.v6i2.460

Pérez-Guerrero, E. E., Guillén-Medina, M. R., Márquez-Sandoval, F., Vera-Cruz, J. M., Gallegos-Arreola, M. P., Rico-Méndez, M. A., Aguilar-Velázquez, J. A., & Gutiérrez-Hurtado, I. A. (2024). Methodological and statistical considerations for cross-sectional, case–control, and cohort studies. *Journal of Clinical Medicine, 13(14)*, 4005. https://doi.org/10.3390/jcm13144005

Pozas, M., Letzel-Alt, V., & Schwab, S. (2023). The effects of differentiated instruction on teachers' stress and job satisfaction. *Teaching and Teacher Education, 122*, 103962. https://doi.org/10.1016/j.tate.2022.103962

Rahimi, H., Hejazi, S. Y., Lou, N. M., & Heidarzadeh, M. (2024). Are teachers with better quality of work life more innovative? The mediating roles of psychological empowerment and teaching mindsets. *Acta Psychologica, 247*, 104315. https://doi.org/10.1016/j.actpsy.2024.104315

Saifuddin, M. F. I., Mansor, W., Ismail Khan, Z., Mahmood, M. K. A., Bujang, A., & Haddadi, K. (2024). Pearson correlation and multiple correlation analyses of the animal fat S-parameter. *TEM Journal, 13(1)*, 155–160. https://doi.org/10.18421/TEM131-15

Sari, G. I., Winasis, S., Pratiwi, I., Nuryanto, U. W., & Basrowi. (2024). Strengthening digital literacy in Indonesia: Collaboration, innovation, and sustainability education. *Social Sciences & Humanities Open, 10*, 101100. https://doi.org/10.1016/j.ssaho.2024.101100

Scherer, R., Siddiq, F., Howard, S. K., & Tondeur, J. (2023). Gender divides in teachers' readiness for online teaching and learning in higher education: Do women and men consider themselves equally prepared? *Computers & Education, 199*, 104774. https://doi.org/10.1016/j.compedu.2023.104774

Schmid, M., Brianza, E., & Petko, D. (2021). Self-reported technological pedagogical content knowledge (TPACK) of pre-service teachers in relation to digital technology use in lesson plans. *Computers in Human Behavior, 115*, 106586. https://doi.org/10.1016/j.chb.2020.106586

Shahi, R., & Chaudhary, B. P. (2025). Digital transformation: Adoption of information technology systems in higher education institutions of Nepal. *Cogent Business & Management, 12(1)*. https://doi.org/10.1080/23311975.2025.2524601

Sibley, L., Lachner, A., Plicht, C., Fabian, A., Backfisch, I., Scheiter, K., & Bohl, T. (2024). Feasibility of adaptive teaching with technology: Which implementation conditions matter? *Computers & Education, 219*, 105108. https://doi.org/10.1016/j.compedu.2024.105108

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education, 5(1)*. https://doi.org/10.1080/2331186X.2018.1519143

Sterrantino, A. F. (2024). Observational studies: Practical tips for avoiding common statistical pitfalls. *The Lancet Regional Health-Southeast Asia, 25*, 100415. https://doi.org/10.1016/j.lansea.2024.100415

Tan, X., Cheng, G., & Ling, M. H. (2025). Artificial intelligence in teaching and teacher professional development: A systematic review. *Computers and Education: Artificial Intelligence, 8*, 100355. https://doi.org/10.1016/j.caeai.2024.100355

Tjahjono, B., Hermawan, D., Millah, S., & Evans, R. (2025). Bridging the skills gap curriculum transformation for automation industries and the role of digital technopreneurship. *Aptisi Transactions on Technopreneurship (ATT), 7(2)*, 650–662. https://doi.org/10.34306/att.v7i2.620

Tran, D. D., Phan, T. T., Vu, T. N. Q., La, T. D., & Pham, V. K. (2024). Digital competence of lecturers and its impact on student learning value in higher education. *Heliyon, 10(17)*, e37318. https://doi.org/10.1016/j.heliyon.2024.e37318

Uren, V., & Edwards, J. S. (2023). Technology readiness and the organizational journey towards AI adoption: An empirical study. *International Journal of Information Management, 68*, 102588. https://doi.org/10.1016/j.ijinfomgt.2022.102588

Wahid, S. H. (2024). Exploring the intersection of Islam and digital technology: A bibliometric analysis. *Social Sciences & Humanities Open, 10*, 101085. https://doi.org/10.1016/j.ssaho.2024.101085

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications, 252(Part A)*, 124167. https://doi.org/10.1016/j.eswa.2024.124167

Wang, X., & Cheng, Z. (2020). Cross-sectional studies: Strengths, weaknesses, and recommendations. *Chest, 158(1, Suppl)*, S65–S71. https://doi.org/10.1016/j.chest.2020.03.012

Weinhandl, R., Helm, C., Andic, B., Große, C. S., Mayrhofer, J., & Baldinger, S. (2025). Unpacking teachers' cognitive engagement strategies with technology by employing the ICAP-TS. *Computers and Education Open, 8*, 100259. https://doi.org/10.1016/j.caeo.2025.100259

Wiziack, J. C., & dos Santos, V. M. P. D. (2021). Evaluating an integrated cognitive competencies model to enhance teachers' application of technology in large-scale educational contexts. *Heliyon, 7(1)*, e05928. https://doi.org/10.1016/j.heliyon.2021.e05928

Zamiri, M., & Esmaeili, A. (2024). Strategies, Methods, and Supports for Developing Skills within Learning Communities: A Systematic Review of the Literature. *Administrative Sciences, 14(9)*, 231. https://doi.org/10.3390/admsci14090231

Zapf, A., Wiessner, C., & König, I. R. (2024). Regression analyses and their particularities in observational studies—part 32 of a series on evaluation of scientific publications. Deutsches Arzteblatt international, 121(4), 128–134. https://doi.org/10.3238/arztebl.m2023.0278

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *Teachers College Record, 104*(3), 482–515. https://doi.org/10.1111/1467-9620.00170