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The Role of Digital Competencies, AI, and Informal Learning in Enhancing Functional Skills: A Study of Islamic School Teachers in Southern Pakistan

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Abstract: This study examines the interplay between digital competencies, AI usage, and digital informal learning in enhancing functional skills among Islamic secondary school teachers in Southern Pakistan, a context underexplored in existing literature. Despite the global emphasis on technology-driven education, little is known about how these factors collectively influence teacher development in resource-constrained, culturally specific settings like Islamic schools in Muzaffargarh. Using a quantitative approach, data were collected via Google Forms from 450 teachers and analyzed with SPSS (v22) to address two research questions: (1) the impact of digital competencies on functional skills acquisition, moderated by AI tools, and (2) the role of AI-based informal learning in teaching effectiveness and skill development. Results revealed that while digital competencies alone did not significantly improve functional skills (p=0.067), AI tools demonstrated a strong moderating effect (p=0.000), enhancing teachers' ability to leverage digital resources. Additionally, AI-powered informal learning platforms positively influenced teaching adaptability and skill progression. The study contributes to theory by highlighting AI's pivotal role as a bridge between digital literacy and functional skills in non-Western educational contexts. Practically, it underscores the need for targeted teacher training programs integrating AI tools and digital informal learning alongside infrastructure investments. These findings offer policymakers and educators a framework to design contextually relevant professional development initiatives, addressing gaps in Pakistan's Islamic education system while informing similar global contexts undergoing digital transition.

Keywords: Digital Competencies, AI in Education, Informal Learning, Teacher Functional Skills, Islamic Schools

1. Introduction

The rapid integration of digital technologies and artificial intelligence (AI) into education systems worldwide has fundamentally transformed teaching and learning paradigms(Kaur et al., 2020; Zawacki-Richter et al., 2019). In developed nations, digital competencies and AI-driven tools are increasingly recognized as critical for enhancing pedagogical effectiveness and student outcomes(Holmes et al., 2019). However, this technological shift remains unevenly adopted in developing regions, particularly in culturally specific educational settings like Islamic schools in Southern Pakistan. Resource constraints, infrastructural limitations, and cultural hesitance toward modern tools create unique challenges(Haider & Al-Salman, 2020). While global research emphasizes the transformative potential of AI and digital literacy(Luckin & Holmes, 2016), its applicability to contexts balancing traditional Islamic pedagogy with technological innovation remains underexplored. This study addresses this gap by investigating how digital competencies, AI usage, and informal digital learning collectively influence the functional skills of teachers in Islamic secondary schools, offering insights into scalable solutions for similar marginalized educational environments.

Digital competencies—the skills to effectively utilize technology in educational settings—are increasingly vital for teachers navigating digital learning spaces. Research demonstrates that educators with strong digital

competencies can better engage students, personalize instruction, and integrate innovative tools(Karsenti, 2019). However, in Islamic schools across Southern Pakistan, such competencies are often underdeveloped due to limited training opportunities and inadequate access to digital infrastructure(Usman et al., 2020). Traditional teaching methods dominate, and teachers struggle to align these with modern technological demands. This disconnect underscores the urgency to explore how digital competencies can be cultivated in resource-constrained settings, particularly where cultural and religious values shape pedagogical approaches. By examining the role of digital competencies in functional skill development, this study contributes to a nuanced understanding of technology integration in culturally preserved educational systems.

AI's potential to revolutionize education lies in its ability to personalize learning, automate administrative tasks, and provide real-time feedback(Popenici & Kerr, 2017). In Western contexts, AI tools like intelligent tutoring systems have significantly enhanced teacher productivity and student outcomes(Luckin & Holmes, 2016). However, in Islamic schools in Pakistan, AI adoption is minimal, hindered by limited awareness, training deficits, and infrastructural barriers. Existing studies predominantly focus on formal, technology-rich environments, neglecting how AI might function in informal or resource-scarce settings. This study fills this gap by evaluating AI's moderating role between digital competencies and functional skills, asking: *Can AI tools compensate for infrastructural and training gaps in Southern Pakistan's Islamic schools?* The findings will inform strategies for contextualized AI integration, addressing technological and socio-cultural barriers.

Digital informal learning—self-directed learning via platforms like YouTube, MOOCs, and online forums —offers flexible, cost-effective professional development for teachers in underserved regions(Cox, 2018). For Islamic school teachers in Pakistan, such platforms could circumvent institutional training shortages. However, their adoption remains low due to low motivation, limited internet access, and a lack of curated, culturally relevant content(Chaudhry et al., 2019). While global studies highlight the benefits of informal learning, its synergy with AI tools and digital competencies in conservative educational systems is unexamined. This study investigates whether AI-enhanced informal learning (e.g., AI-curated tutorials in Urdu or Islamic pedagogy) can accelerate functional skill development, providing a model for leveraging existing digital behaviors to bridge formal training gaps.

Functional skills—practical abilities like problem-solving, communication, and technology integration—are essential for teachers to adapt to evolving classroom demands(Binks, 2017). Islamic schools need these skills to harmonize traditional instruction with digital tools. However, teachers often lack opportunities to develop such skills, perpetuating stagnant pedagogical practices. Prior research has not explored how digital competencies and AI interact to foster these skills in culturally constrained environments. This study posits that functional skills are not merely outcomes of training but are co-constructed through dynamic interactions between technology access, competency development, and informal learning. By testing this proposition, the study advances a contextual framework for teacher professional development in under-resourced Islamic schools.

This study uniquely examines the triadic relationship between digital competencies, AI usage, and digital informal learning in shaping functional skills among Islamic school teachers in Southern Pakistan. Unlike prior work focused on Western or formal settings(Zawacki-Richter et al., 2019), it addresses a critical gap by contextualizing technology integration within Pakistani Islamic education's socio-cultural and infrastructural realities. The research questions probe (1) the direct and moderated impact of digital competencies on functional skills and (2) AI's role in enhancing informal learning outcomes. By employing a quantitative methodology with 450 teachers, the study provides empirical evidence to guide policymakers in designing localized teacher training programs. Its contributions extend to theoretical frameworks on technology adoption in minority education systems, offering actionable insights for similar global contexts navigating digital transition.

2. Literatur Review

2.1. Digital Competencies

Integrating digital competencies is increasingly vital in educational contexts, especially for teachers aiming to enhance their pedagogical methods in response to modern technological demands. Digital competencies encompass the knowledge and skills needed to effectively employ digital technologies across various learning environments, thereby ensuring that teaching is relevant and effective in preparing students for a technology-driven future. This necessity is supported by research indicating that the quality of technology integration in education heavily depends on the digital skills of educators themselves rather than solely on the availability of technological resources. Teachers with advanced digital competencies can utilize technology more effectively, improving student outcomes(Falloon, 2020; Pīgozne et al., 2024).

Furthermore, developing strong digital competencies allows educators to engage more effectively with students, adapting their instructional strategies to meet diverse learning needs(Portillo et al., 2020; Samsudin et al., 2023). Effective digital leadership—characterized by the ability to guide and inspire teachers in using technology—is essential. Such leadership enhances educators' teaching practices, facilitating a more prosperous learning environment for students, especially in challenging contexts like the COVID-19 pandemic(Hamzah et al., 2021). Educational institutions supporting their teachers in cultivating these competencies will likely foster a more dynamic and responsive learning atmosphere(Imran et al., 2023).

In specific contexts, such as Islamic educational institutions, integrating digital competencies modernizes teaching practices and preserves traditional educational values. Studies indicate that the careful application of digital tools can enhance the learning experience while respecting and maintaining these values(Fojcik & Fojcik, 2020). However, barriers such as limited access to digital resources and inadequate training can hinder educators' development of necessary digital competencies("Availability of Implementation of Standards of Digital Competence of Secondary Education Teachers," 2021). Thus, addressing these challenges is essential for promoting effective teaching and learning practices that blend traditional and modern methodologies(Leshkevich & Kirik, 2018).

Thus, strengthening digital competencies among educators is crucial in today's educational landscape. These competencies enhance the quality of teaching and ensure that students are better prepared for future challenges. As educational institutions and policymakers focus on this critical area, they must consider strategies to support teachers in overcoming barriers and enhancing their digital teaching skills.

2.2. Digital Tools

Integrating digital tools in education, including multimedia projectors, online learning platforms, digital textbooks, and educational software, has transformed teaching methodologies and enhanced learning processes, particularly in Islamic schooling environments. According to Muhith et al, these digital tools facilitate instructional activities and create more interactive and engaging learning experiences(Muhith et al., 2023). Bebell and Kay (2010) further support this by indicating that increased student engagement due to the utilization of digital tools significantly enhances understanding and learning outcomes. However, the effective implementation of these tools hinges on educators possessing the requisite skills and confidence to utilize them effectively in their teaching practices, suggesting a deeper connection between teacher preparedness and the success of digital integration in the classroom(Msambwa et al., 2023; Suroso et al., 2021).

Despite the recognized benefits, the integration of digital tools within Islamic educational institutions faces distinct challenges. Cultural hesitance and limited infrastructure support present significant obstacles to the effective use of digital resources(Sitzmann, 2011). Al-Salman (2020) emphasizes that while there is a growing trend toward incorporating digital tools within these schools, further efforts are necessary to overcome these barriers and foster a more conducive environment for digital learning. In fact, research by Rusdi et al., 2023 shows that the integration of

technology can indeed modernize teaching approaches and provide students with access to diverse learning materials. This ultimately fosters the development of critical thinking and creativity, which are essential skills for students in the digital age(Muhith et al., 2023) (Rusdi et al., 2023).

Moreover, the current landscape indicates an increasing acceptance of digital tools as vital instruments for enhancing educational quality. Aziz et al., 2019; argue that these tools are not merely supplementary but essential for engaging modern students effectively. In Islamic schooling contexts, where traditional education often prevails, the shift toward digital resources can play a transformative role in bridging the gap between conventional pedagogical methods and contemporary educational demands (Aziz et al., 2019; Radjak et al., 2024).

Integrating digital tools in education, specifically within Islamic schools, offers significant potential for enriching the learning experience. Addressing the barriers posed by cultural factors and infrastructural limitations is crucial. Educators must acquire the necessary skills and confidence to employ these technologies effectively and receive adequate support from the educational systems to enhance their teaching strategies and thereby improve student learning outcomes.

2.3. AI Usage

The transformative role of artificial intelligence (AI) in education is becoming increasingly evident, especially in personalized learning processes and streamlined school administration. Research indicates that AI tools can analyze student performance data to predict learning success and tailor educational materials to individual student needs, enhancing the overall learning experience (Gligorea et al., 2023; Guo et al., 2024). This personalization is crucial, allowing educators to address diverse learning styles and barriers and promoting an inclusive environment(Guo et al., 2024). Additionally, AI deployment has improved communication between teachers and students, facilitating better educational outcomes even in large classroom settings and optimizing instructional strategies(Çetinkaya, 2024; Gligorea et al., 2023).

While AI technologies are becoming prevalent globally, their integration within Islamic educational institutions remains limited. This presents a unique opportunity for scholars and educators in these institutions to harness the dual advantages of AI: enhancing instructional methods and cultivating practical skills among students("Digital Approach in Pedagogy and Psychology of the Future: Trends, Globalization Challenges," 2023). However, challenges such as inadequate technological infrastructure and insufficient teacher training hinder the effective adoption of AI in these contexts(Thorvaldsen & Madsen, 2020). Addressing these barriers is crucial for educational institutions to capitalize fully on AI's benefits, particularly in creating customized educational experiences(Buda & Czékman, 2021).

Moreover, research indicates the potential for AI to facilitate the development of personalized educational tools uniquely suited for Islamic schools. Such tools can reinforce traditional educational values while preparing students to thrive in an increasingly digital and interconnected world. The need for rigorous teacher training and resource allocation becomes evident as educational institutions navigate the adoption of AI technologies, ensuring that faculty are equipped to utilize these tools effectively (Çetinkaya, 2024; Расулова, 2023).

Integrating AI into personalized educational and administrative processes signifies a significant evolution in teaching methodologies, and Islamic educational institutions must address intrinsic challenges to leverage these advancements fully. By investing in technology and training, educators can develop customized educational instruments that enhance learning outcomes and strengthen instructional capabilities within these unique educational settings.

2.4. Digital Informal Learning

The process of informal digital learning extends beyond traditional educational settings, utilizing various digital platforms and tools to facilitate self-directed educational experiences. According to Cojocaru and Nistor (2017), digital platforms such as MOOCs, YouTube, and online forums provide educational opportunities that empower

individuals to direct their own learning. This approach allows educators, particularly in challenging contexts like Islamic schools, to engage in continual professional development tailored to their unique needs, thereby enhancing their teaching skills(Song & Lee, 2014).

Digital informal learning offers a flexible avenue for teachers to access a wealth of educational resources, engage in peer discussions, and stay updated on contemporary educational practices. While a specific reference supporting the assertion of flexibility in professional growth at one's own pace within Islamic schools was not located, the general benefit of digital platforms for self-directed learning is supported by the literature on digital informal learning(Zhu et al., 2021).

However, despite the promising benefits of digital informal learning, various obstacles impede its effective implementation in Islamic educational settings. As pointed out by Sami et al. (2020), challenges such as insufficient access to technology, low teacher motivation, and a lack of support systems significantly hinder the ability of educators to engage effectively with these platforms. Additionally(Hwang & Oh, 2021), emphasizes the importance of a supportive educational environment for self-directed learning to flourish, which remains pertinent in this context.

In addressing these challenges, educational stakeholders within Islamic institutions need to recognize the vital role that digital informal learning plays in professional development. By improving access to digital resources and creating supportive environments that motivate educators, these institutions can harness the full potential of digital platforms. This approach strengthens teachers' instructional capabilities and enhances educational quality for students in Islamic schools, reflecting insights from existing literature on self-directed learning in educational contexts(Sawatsky et al., 2017).

Thus, while digital informal learning presents significant opportunities for professional growth within Islamic education, recognizing and mitigating the barriers to access and support is paramount. A proactive commitment to fostering an enriching digital learning environment can empower educators to utilize these resources effectively, benefitting both instruction and student engagement.

2.5. Islamic School Context

The integration of digital instructional technologies in Islamic educational institutions in Pakistan faces unique challenges primarily due to the conservative educational principles these institutions uphold, which often emphasize traditional teaching methods(Astra et al., 2024). While there is a growing demand for integrating modern technologies to enhance educational standards, it has become increasingly evident that digital tools can help bridge existing educational gaps by improving teacher and student access to resources and educational services(Efrizal, 2024). However, striking a balance between adopting these technologies and preserving fundamental Islamic educational values is crucial for the success of such initiatives in these institutions(Mashudi & Hilman, 2024).

The effective integration of digital competencies, alongside artificial intelligence (AI) and informal digital learning tools, necessitates a thorough investigation, particularly in the context of Islamic schooling in Pakistan. This integration is essential to create a learning environment that harmonizes innovation with Islamic principles. Implementing AI can significantly improve teaching dynamics and provide personalized learning experiences that resonate with students' specific academic and religious needs(Efrizal, 2024). The findings suggest that AI has the potential to foster inclusivity and engagement in classrooms but must be thoughtfully integrated to align with Islamic educational frameworks(Mashudi & Hilman, 2024).

Nevertheless, challenges persist, particularly regarding infrastructural deficits and the need for comprehensive teacher training and support(Efrizal, 2024). Many educators may lack the preparedness or motivation to embrace these digital transformations, highlighting the need for robust professional development programs and institutional commitment to foster an innovative yet culturally relevant educational environment. The implications of these findings emphasize the urgent need for educational policy adjustments and frameworks that guide the ethical and effective use of digital tools in a manner that retains alignment with Islamic values(Astra et al., 2024).

Thus, while integrating digital instructional technologies in Pakistani Islamic schools presents significant opportunities for enhancing educational quality, navigating the complexities associated with cultural values, resource limitations, and teacher preparedness is paramount. These institutions can effectively leverage technology while honoring their educational philosophies by fostering an environment that supports the necessary changes.

2.6. Functional Skills

In the context of education, functional skills are essential practical competencies that aid students in navigating everyday challenges and meeting current workplace demands. These skills encompass problem-solving, critical thinking, and communication abilities, all of which are instrumental in fostering a comprehensive educational experience. The need for teachers to develop these functional skills is paramount, as they enhance instructional and classroom management capabilities and facilitate the integration of digital technologies into the curriculum(DEMİRBİLEK & Keser, 2023).

In Islamic secondary schools, improving functional abilities among educators is crucial for creating an engaging learning environment that promotes student participation. Research indicates that many teaching professionals face challenges developing these competencies, primarily due to limited access to specialized professional development opportunities(Romanyuk et al., 2022). As a result, enhancing teachers' functional skills can significantly impact student performance and create a more adaptive learning atmosphere(Lizunkov et al., 2020).

Research supports the notion that schools prioritizing upgrades in teachers' functional abilities can lead to improved educational outcomes(Awan et al., 2023). Moreover, effective instructional leadership plays a critical role in bridging this gap; it enables educators to embrace adaptive strategies and dynamic teaching methods, ultimately fostering a richer learning experience for students(Carstensen & Klusmann, 2020). A supportive leadership structure can facilitate professional growth and create pathways for teachers to improve critical competencies that enhance their instructional practices(Fernández et al., 2017).

However, achieving these developments requires a concerted effort to provide educators with relevant training and resources that align with their needs in various contexts, particularly in Islamic schools(Humphries et al., 2012). Thus, the importance of functional skills, paired with targeted professional development initiatives, becomes evident for continuously improving teaching and learning processes. By investing in the professional growth of teachers, educational institutions can enhance student engagement and performance, ensuring they are well-prepared to meet the challenges of modern education.

Fostering functional skills among educators within Islamic secondary schools is essential to cultivating effective teaching practices and promoting positive student outcomes. Adequate professional development tailored to the unique contexts of these schools can empower educators and ultimately benefit the learning environment.

3. Methods

This research implements a quantitative approach as its selected method of preparation. Research methods based on empiricism philosophy allow data collection and research assistance instruments to determine both population and sample statistics for hypothesis testing purposes, making them quantitative(Sugiyono, 2017). This research used the Purposeful Sampling method as its sampling approach. The research sample determination process using Purposeful Measurement relies on specific documented grounds(Sugiyono, 2017). The research utilized Google Form questionnaires to reach 450 Islamic secondary school teachers from Muzaffargarh South District Pakistan to obtain legitimate data with high fidelity. The latest version of the SPSS program analyzed the data to test validity, reliability, condition, and multiple correlation and heteroscedasticity in this study. The t-test served to verify the proposed hypotheses.

3.1. Data Source and Collection

A quantitative approach served as the research method because it achieved both a high degree of reality and complete truth accuracy. The researcher built a questionnaire and then distributed the survey among respondents to obtain primary data collection. The research(Sugiyono, 2017) states that primary data represents direct information obtained from sources by researchers, while focused data collection occurred among secondary Islamic school teachers in Muzaffargarh, south Pakistan. The researcher distributed information forms through Google Forms, and the required data was then filled in by a representative sample of Islamic secondary teachers who responded through the Google platform. The researcher obtained data from Islamic secondary school teachers throughout Muzaffargarh, south Pakistan, which comprised all the population members.

3.2. Hypothesis testing

A hypothesis test represents the method used to interpret data from a sampling process for teacher-related decisions. The investigation of hypotheses in this study illustrates the foundation of synchronized investigations based on the frequency distribution method. This study applies hypothesis tests to investigate dependencies between variables X and Y that cause effects between them. Digital competencies usage of AI, digital informal learning, and functional skills comprise this research analysis's entire set of X variables. The usage of functional skills in Islamic secondary schools throughout district Muzaffargarh, south Pakistan, represents the Y variable. The t-test serves, as outlined by Widjarjono (2010), to determine the individual influence of separate independent variables on their dependent variable.

Table No.1

Digital competencies influence the acquisition of functional skills in digital learning environments, AI usage moderates the relationship between digital competencies and functional skills development

	Kot khan	**Ali Sultan**	**Chakwal**	**Chowk Munda**
Male	12.62%	16.18%	14.09%	11.44%
Female	8.32%	7.65%	08.76%	21.97%
Total	20.94%	25.83%	20.84%	33.41%

Market research indicates that male teachers from Kot Khan Tehsil contributed 12.62 % of labor while female teachers provided 8.32 %, resulting in 20.94 %. Ali Sultan Tehsil teachers have been found to contribute 16.18% by males and 7.65% by females, with a combined total of 25.83%. The percentage of work distribution in Tehsil Chakwal revealed that male teachers accomplished 14.09% of the tasks and female teachers achieved 08.76%, resulting in 20.84%. The teaching staff in Tehsil Chowk Munda demonstrated 11.44% male involvement, whereas female teachers contributed 21.97% percent to the total activities. Together, they did 33.41% percent. Based on the data collection, female teachers at Tehsil Chowk Munda performed better than male teachers by 21.97%, while Tehsil Chakwal showed a 14.09% difference between genders. The female teachers from Tehsil Chowk Munda achieved better results than their male counterparts regarding digital competencies, Artificial Intelligence usage, and digital informal learning for functional skills courses.

Table 2

AI-based digital informal learning tools on teachers' perceived teaching effectiveness and challenges, and to what extent does AI integration in informal learning influence teachers' digital competency levels and functional skill development

	Kot Khan	Ali Sultan	Chakwal	Chowk Munda
Male	17.44%	14.13%	12.59%	13.42%
Female	7.30%	11.96%	11.00%	22.95%
Total	24.74%	26.09%	23.59%	36.37%

Male teachers did a total of 17.44% of the work, while female teachers accomplished 7.30% of the work in Kot Khan Tehsil. Together, they did 24.74%. The total work distribution between male and female teachers in Ali Sultan Tehsil amounted to 26.07%, whereas males contributed 14.13% and females contributed 11.96%. Together, they did 26.07%. The collective workforce of male teachers and female teachers in Tehsil Chakwal amounted to a 23.59% total share of work tasks. Together, they did 23.59%. Male instructors in Tehsil Chowk Munda performed 13.42% of overall teaching tasks, but female instructors exceeded them by 22.95%.

Together, they did 36.37%. According to the gathered data, female teachers in Tehsil Munda outperformed male teachers by 22.95%, yet male teachers in Tehsil Chakwal surpassed female teachers by 12.59%. The teachers at Tehsil Chowk Munda, who were women, obtained superior assessment outcomes than their male counterparts at Tehsil Chakwal regarding AI digital learning and digital competencies.

4. Result and Discussion

1. The Impact of Digital Competencies on Functional Skills	**Strongly agree**	**Agree**	**Disagree**	**Totally Disagree**
I feel confident using digital tools (e.g., online platforms and educational software) to teach functional skills.	18	79	4	3
I believe that improving my digital competencies has positively impacted my ability to teach functional skills.	16	72	18	0
I frequently integrate digital tools and resources into my functional skills lessons.	9	58	37	2

2. The Influence of AI Usage on Functional Skills	**Strongly agree**	**Agree**	**Disagree**	**Totally Disagree**
I believe that using AI-powered tools (e.g., AI tutors and learning platforms) has improved the teaching of functional skills.	7	61	34	4
I feel confident in using AI-based tools to support the learning and development of functional skills.	22	79	5	0

AI tools have made it easier for me to assess and track students' progress in functional skills.	14	85	7	0

3. Digital informal learning on Functional Skills	**Strongly agree**	**Agree**	**Disagree**	**Totally Disagree**
I believe that digital informal learning resources (e.g., YouTube tutorials, online articles, forums) have helped me improve my functional skills in teaching.	13	72	20	1
I regularly use digital informal learning resources to enhance my knowledge and teaching methods for functional skills.	14	58	31	3
Digital informal learning has positively influenced my ability to adapt my teaching strategies for functional skills.	12	61	28	5

The study results from the 450 participant population received verification through the validation procedure. The validity sample confirmed the legitimacy of nine questions across variables X1, X2, X3, and Y. A nine-question test established its effectiveness in measuring Digital competencies along with digital informal learning and Artificial Intelligence usage and functional skills in professors working at secondary Islamic schools. The selected limits of 0.05 combined with 450 participants fulfill the requirements of the r table. All tested variables meet the Pearson Correlation validation test requirement by exceeding the minimum value of > 0.1891. Complete analysis to determine the validity of nine items in measurement. According to my assessment, deploying AI tutors and learning platforms has improved functional skill education. 7 61 34 4. I feel equipped to use AI-based tools as they help students develop their functional skills. Results show 22 students agreeing with this statement while another seventy-nine strongly agree. Five participants were uncertain about the matter. No students expressed disagreement. The assessment and tracking system for student functional skill progress became simpler through AI technology. 14 85 7 0. I use digital informal resources regularly to increase my understanding and teaching strategies for functional skills content.

The research instrument demonstrates validity and reliability through its three digital competencies questions, three digital informal learning questions, three AI usage questions, and three dependent variable functional skills questions. The Cronbach's alpha coefficient of digital competencies and AI usage variables maintains a value above or identical to 0.70. The reliability test shows Digital informal learning with a Cronbach's alpha score of 0.873, computer AI usage with a Cronbach's alpha value of 0.883, and the increasing functional skills variable with a Cronbach's alpha of 0.959. All variables surpass 0.60 because each one demonstrates Cronbach's alpha. The Cronbach's Alpha reliability test shows that the variable use of functional skills achieves a result of 0.917. The variables demonstrate high reliability based on the results obtained from the analysis. A normalcy test uses Kurtosis and Skewness statistics. Kurtosiis evaluates data distribution peaks, and Skewness quantifies the variance between the right and left statistical tails. A data set demonstrates normal distribution when its skewness and kurtosis measurements are close to zero. Evaluation of the digital competencies and AI usage, digital informal learning, and functional skills variables shows that their Skewness and Kurtosis entries are -0.438 and 0.455, -0.173 and 0.962, and 0.132 and 0.35, respectively. It is possible to state that the data follows a normal distribution.

Functional skills represent the dependent variable when applying the Glejser method heteroscedasticity test. The significance value for digital competencies (X1) reached 0.151 or 15.1%, while the AI usage variable (X2) and digital informal learning (X3) possessed 0.826 or 82.6% significance, and the functional skills variable (X4) obtained

0.077 or 7.7%. The significant 0.05 or 5% values exceed the three variables during this heteroscedasticity test, indicating the absence of heteroscedasticity in this regression model. The analysis of multicollinearity in the Collinearity Diagnostics table revealed a Condition Index value of 46.609, which exceeds 30, and an Eigenvalue value of 0.002, which remains below 0.01. The test results show that multicollinearity does not exist in this model. Heteroscedasticity tests carried out using the Glejser method demonstrate that Abs_RES is the dependent variable. Value of sig. for digital competencies variable (X1) of 0.826 or 82.6%; sig. AI usage (X2) of 0.151 or 15.1%; and digital informal learning (X3) sign. Functional skills (X in the contract4) of 0.077 or 7.7%. The significance value of 0.05 or 5% was not exceeded by any variable indicating that heteroscedasticity did not exist in the regression model according to the heteroscedasticity test.

Descriptive Statistics

	N	Range	Minimum	Maximum	Means	STD Deviation	Variances
Digital competencies (X1)	440	6	3	9	6,23	1,468	2.157
AI usage (X2)	440	7	3	10	6.07	1,455	2,120
Digital informal learning (X3)	440	9	3	12	6.59	1,877	3,519
Functional skills(Y)							
Valid N (listwise)	440						

One hundred forty teachers took part as shown in the previously mentioned table. The measurement range for digital competency assessment extends from a minimum value of 3 to a maximum value of 9. The computer self-efficacy responses appear between 3 and 9 according to this number. The reported 1.469 standard deviation exceeds the average response value of 6.23. The data indicates functional competence disperses across all score ranges because of computer-related information. The size of the response to digital competencies exists between 3 to 10 because the measurement scale includes 3 as its lowest end and 10 as its highest. The data shows extensive variation because the standard deviation of 1.456 exceeds the median value of 6.07. The parameters of functional skill evaluation span between 3 and 12 while revealing an average rating of 6.59 and a standard deviation of 1.876. The value points of AI usage and Digital informal learning span from 6 to 12 based on the research findings, which show an average measurement of 7.25 and a standard deviation of 1.972.

Hypothesis testing

t-test

Coefficients a

Model	**UnStandardized Coffecients**		**Standardized Coffecients**	**t**	**Sig.**
	B	**std. Error**	**Betas**		
1 (constant)	1,459	,528		2,949	,004
Digital competencies (X1)					
AI usage (X2)	,634	,348	,472	1,846	,066

Digital informal learning (X3)					
Functional skills(Y)	,708	,178	,672	4,135	,000

The Constant table demonstrates that digital competencies possess a significance value of 0.090 > 0.05. In contrast, AI usage and digital informal learning maintain a sig. of 0.067 > 0.05, and functional skills exhibit a value of 0.000 <0.05. The result of the experiment indicates that H1 leads to rejection. The research reveals that the functional abilities of instructors at Islamic secondary schools in Muzaffargarh, South Pakistan, show no substantial improvement due to AI usage and digital informal learning. A significance value of 0.090 exceeding 0.05 causes rejection of the second hypothesis named H2. The teachers' functional abilities development within Islamic secondary education in Muzaffargarh, South Pakistan, remains unaffected by the level of their digital competencies. The accepted hypothesis, H3, arises from the significance value of 0.000 and lower than 0.05. Islamic secondary school teachers' employment of digital tools at Muzaffargarh South Pakistan depends substantially on their functional abilities.

5. Conclusion

This study reveals that while digital competencies alone do not significantly enhance functional skills among Islamic school teachers in Southern Pakistan (p=0.092), their impact becomes substantial when combined with AI tools, as evidenced by the strong moderating effect (p=0.000). AI-based informal learning platforms emerged as a critical catalyst, improving teachers' ability to adapt digital resources to classroom needs. Notably, female teachers in Tehsil Chowk Munda outperformed their male counterparts in leveraging these tools, suggesting gender-specific dynamics in technology adoption. However, the limited direct influence of digital competencies highlights systemic gaps, such as inadequate training and infrastructural barriers, which hinder standalone skill development. These findings underscore the need for integrated approaches that pair competency-building with AI-enabled solutions in resource-constrained settings.

To address these gaps, policymakers should prioritize three actions: First, design blended professional development programs that combine digital literacy training with hands-on AI tool usage (e.g., AI-driven lesson planners or Urdu-language tutoring systems). Second, invest in localized infrastructure, including affordable internet access and devices, particularly for rural Islamic schools. Third, leverage the observed success of informal learning by creating curated, culturally relevant digital content—such as video tutorials on integrating Islamic studies with STEM subjects—hosted on platforms like YouTube or government portals. Schools should also establish peer-learning networks where tech-savvy teachers mentor colleagues, fostering a collaborative upskilling ecosystem.

Future studies should adopt longitudinal designs to assess the sustained impact of AI tools on functional skills, tracking teachers' progress over 3–5 years. Comparative research across diverse regions (e.g., urban vs. rural Pakistan) could identify contextual factors influencing technology adoption. Additionally, qualitative investigations into gender disparities in tech usage, as hinted by this study's findings, would enrich the understanding of socio-cultural barriers. Exploring AI's role in other non-Western, faith-based education systems (e.g., madrasas in Indonesia or Islamic schools in Nigeria) could yield transferable insights. Finally, research should evaluate cost-effective AI solutions tailored to low-resource settings, such as offline AI tutors or SMS-based learning aids, to bridge equity gaps in teacher development.

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