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Leveraging Digital Technologies for Informal Learning And Teacher Competency Development in Southern Pakistan

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ABSTRACT

This The rapid integration of digital technologies in education has transformed informal learning and teacher competency development, particularly in regions like Southern Pakistan, where access to resources is often limited. Leveraging digital platforms enhances English language acquisition and teachers' functional skills, fostering 21st-century learning environments. Despite the growing use of Information and Communication Technologies (ICT) in education, limited research explores the combined impact of AI usage, digital competencies, and informal digital learning on teachers' functional skills in Islamic schools in Southern Pakistan, particularly within informal learning contexts. This has important implications for improving instructional quality not only general education setting. This study aims to investigate the role of digital technologies in enhancing teachers' functional competency, identify preferred digital platforms and activities for informal learning, and examine the influence of individual differences on engagement in informal digital learning among Islamic school teachers in Southern Pakistan. The findings may also inform the digital training need modernizing education delivery. Adopting a quantitative cross-sectional survey design, data were collected from 450 Islamic school teachers using purposive sampling based on established inclusion criteria. Data were analyzed using SPSS 22, with multiple linear regression assessing the influence of AI usage, digital competencies, and informal digital learning on teachers' functional skills. Results revealed that informal digital learning had the strongest effect ($\beta = 0.41$, $p < 0.001$), followed by digital competencies ($\beta = 0.35$, $p < 0.001$) and AI usage ($\beta = 0.28$, $p < 0.01$), explaining 47% of the variance ($R^2 = 0.47$). AI's smaller effect size suggests its underutilization in teaching practices. These findings highlight the need for enhanced teacher training in AI integration and digital competencies to maximize informal learning benefits, which can extend to professional development program in education as well, promoting competent Islamic teachers in Southern Pakistan.

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Informal Digital Learning Teacher Functional Competency; Digital Technologies; AI Usage; Digital Competencies; Southern Pakistan

1. Introduction

The integration of digital technologies into education has revolutionized both informal learning and teacher competency development, which remains a critical issue for under-resourced educational setting such as southern pakistan , where educational resources are often scarce. Digital platforms, such as YouTube, social media, and mobile applications, offer unprecedented opportunities for English as a Foreign Language (EFL) learners to enhance language skills autonomously (Lee & Dressman, 2018). Similarly, teachers' functional competencies—encompassing knowledge, skills, and attitudes—are critical for fostering 21st-century learning environments (Siraj & Ibrahim, 2012). Leveraging these technologies can bridge gaps in educational access, improve pedagogical practices, and empower

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both learners and educators in informal and formal settings. While EFL learning remains a significant part of digital engagement, in the context of Southern Pakistan, particularly Islamic schools, teacher competency development is equally critical. Thus, the discussion shifts from language learning to broader functional skills of teachers.

The advent of Information and Communication Technologies (ICT) has transformed language learning and teacher development. Studies highlight that informal digital learning of English (IDLE) through platforms international scholarship has consistently shown that informal digital learning enhances linguistic and cognitive outcomes like YouTube and social media enhances vocabulary, speaking, and cognitive skills (Masrai & Milton, 2018; Lee, 2019). Concurrently, teachers' functional competencies are vital for effective pedagogy, requiring expertise in subject content, pedagogy, and ICT (Ministry of Education Malaysia, 2014). Research indicates that informal learning environments, supported by digital tools, promote self-directed learning and engagement (Czerkawski, 2017). Nonetheless, how the May adoption of AI, digital competencies, and informal learning influence the set of skills of any teacher depends on the particular cultural and educational environment and has not yet been properly studied.

Problem Statement

Nevertheless, digital technologies have great potential and can enhance both informal learning and teacher competency development, yet barriers to the integration may stretch far and poor internet connectivity, ineffective digital literacy, and the lack of use of technologies such as AI (Elaish et al., 2017). However, unlike the global findings, the adoption of such technologies Southern Pakistan faces unique challenges linked to infrastructure and cultural factors. The Islamic school system in the Southern part of Pakistan is quite influential, but the absence of focused efforts to utilize digital space for the benefit of learners and educators suppresses overall educational development. The degree to which personal variables (e.g., age, gender, educational level), interfere with interaction with such technologies adds even more to the problem of adopting these technologies successfully and highlights the urgent need for modernized training programs tailored to Islamic school teachers. This consideration of personal variables makes the problem more realistic and multifaceted, as it demonstrates that barriers to technology adoption are not uniform but shaped by teachers' diverse backgrounds and experiences.

Although the subjects of IDLE and teacher competency have been studied in previous studies on their own, little has been discussed in the literature concerning the combined effect of AI utilization and digital competencies with informal digital learning on functional skills among teachers in Islamic schools in Southern Pakistan (Dolcy & Livingstone, 2019; Yang & Quadir, 2018). The major problem with the existing literature is its tendency to either appeal to the formal sources or the general population, disregarding the specific due to the challenges posed to educators working in religious educational settings and the importance of individual differences when it comes to the adoption of technology.

Islamic schools are found in Southern Pakistan whereby they are key learning institutions that are usually available to a wide range of socioeconomic populations. The area is overwhelmed by issues like poor levels of technological infrastructure potential and differences in the digital literacy of educators and learners (Azzolini et al., 2022). The COVID-19 outbreak has also increased the importance of digital solutions, such as the now greater use of such venues as YouTube Kids as a means of informal learning (Tan, 2021). It is crucial to know how educators and students in this case can use digital instruments to develop proper educational techniques. This underscores the need to contextualize international research on digital learning into the realities of southern Pakistan's Islamic schooling system.

Study Objectives

- Discuss the manner in which the digital technologies execute an enhancement in the functional competency of the teachers of the digital education in Islamic schools of Southern Pakistan.
- Identify attractive digital in-formal learning sites Islamic teachers in southern pakistan.
- Research how personal differences (e.g. age, gender, qualification) can influence the informal digital learning activity of modern education.

This paper is going to address the potentiality of the utilization of digital opportunities like AI and informal learning platforms to add value to quality functional competencies of teachers and informal language learning in the South region of Pakistan. By placing emphasis on addressing some of the barriers and taking advantage of individual differences, the study will provide practical suggestions to the educators and policy makers in terms of establishing successful learning environments.

2. Literature Review

2.1 Digital Technologies In Informal Learning

Incorporation of online technologies in education has largely changed informal learning especially during learning of English as a Foreign Language (EFL). Informal Digital Learning of English (IDLE) uses digital platforms, including such video channels as YouTube and social media and online games, in order to help learners develop self-regulated learning beyond the classroom context (Lee & Dressman, 2018). Such sites offer EFL students a chance to learn more vocabularies, reading and speaking skills by engaging and self-learning procedures (Masrai & Milton, 2018). As an example, the usage of YouTube videos and the practice of social media interaction has been reported to enhance language competence and cognitive ability, including the performance on the standardized tests, such as TOEIC (Lee, 2019). Besides, using smartphones in learning languages (MALL) enables ubiquitous learning, since the students can have access to the English material at any time and any place (Elaish et al., 2017). Where educational resources could be scarce like in Southern Pakistan, the technologies will provide important channels of informal learning and this will help in achieving the goal of the study to determine the preferred digital platforms and activities by EFL learners.

2.1 Impacts Of Individual Differences On Informal Digital Learning

Personal variables such as age, gender, educational level and socioeconomic status are key determinants of IDLE activity engagement. The studies reveal that these aspects determine the predilections and the rate of technology use of learners (Dolcy & Livingstone, 2019; Azzolini et al., 2022). In this case, female students in particular settings employ smartphones more to learn a language as compared to males () But, the results about the effect of gender are contradictory, and many studies state that it has no prominent relation to the results of learning (Lee, 2019). The socioeconomic status also influences the access to digital tools and students with a higher socioeconomic status appear more engaged in IDLE (Azzolini et al., 2022). When it comes to the Islamic schools that provide education to different populations in Southern Pakistan, it is important to learn more about the mentioned differences in order to focus on the process of tailoring individual-based informal learning strategies, which is the objective proposed in the study.

2.3 Functional Competency Of Teachers And The Use Of Digital Technologies

In order to have effective pedagogy school teachers need to be competent in terms of knowledge, skills, and attitudes in the of 21 st century education (Siraj & Ibrahim, 2012). Digital technologies, that is, educational applications and social media, help educators to provide high-quality content delivery, classroom control, and student involvement (Ministry of Education Malaysia, 2014). Teachers in high-performing schools are supposed to generalize their ICT skills to satisfy the current pedagogical requirements (Omar et al., 2019). Nevertheless, this integration may be hindered by the presence of such barriers as low digital literacy and poor technological infrastructure (Elaish et al., 2017). As the objective of the study focuses on the inquiry into the usage of digital technologies to promote the functional competency of teachers working in the Southern Pakistani Islamic schools, the necessity to manage this challenge is also relevant to the fact that the teachers can use such tools of digitalization as AI and the digital platform to strengthen their pedagogical work.

2.4 Role Of School Climate In Technology Integration

The climate of the school, both in terms of administrative support and relations between each other, plays a crucial role in the processes of teachers accepting digital technologies (Thapa et al., 2013). When there is a good school climate, then the environment is more favourable in terms of innovative practices of teaching and, thus, more

favorable in terms of increasing the functional competencies of teachers (Cohen et al., 2009). The school climate also defines whether or not technology can be easy or impeded in Southern Pakistan where Islamic schools work in the context of specific cultural and resource limitations. It correlates with the goal of the study to investigate the influence of school climate on the use of digital tools by teachers, the areas coupled with the one related to the development of competence.

2.5 Youtube Kids As The Informal Learning Tool

Informal learning experience of using popular platforms (such as YouTube Kids (YTK)) emphasizes the role that digital technologies may play in informal education (especially among young learners). YTK is an age-relevant and safe platform, which also contributes to the development of language and cognition in crisis situations, such as COVID-19 pandemic (Tan, 2021). It has characteristics, like parental controls and a selection of content, that facilitate self-organized and incidental learning, which constitutes an essential element of IDLE (Schugurensky, 2000). In Southern Pakistan where the flow of formal education can be compromised, YTK can aid and be the lifeline of the young learners, which is likely to evaluate what the role of informal learning addition is to the study.

2.6 Research Gap And Relevance To The Southern Pakistan

Present studies discussed the topic of IDLE and those of teacher competency but the two issues are not brought together with the AI usage, digital competencies, and informal learning in the setting of Islamic schools in Southern Pakistan (Dolcy & Livingstone, 2019; Yang & Quadir, 2018). The peculiarities of the region, such as a small technological base with a wide range of digital literacy, require the concentrated examination of the interaction of these aspects to improve the education outcomes. The study fills the gap by considering the mutual influence of these factors on functional skills of teachers and informal learning practices of learners in a more context-specific way when looking at Southern Pakistan.

2.7 Conceptual Framework

The conceptual framework shares the way that digital technologies, informal learning, as well as the functional competency of the teachers in the Islamic schools in Southern Pakistan are related.
Framework Components

2.8 Independent Variables

Informal Digital Learning: The actions include watching YouTube videos, using social media and playing games online (Lee & Dressman, 2018; Tan, 2021). Digital Competencies: Teachers' ICT skills for pedagogical applications (Ministry of Education Malaysia, 2014). AI Usage: Integration of AI tools in teaching, with a noted smaller effect ($\beta = 0.28$, $p < 0.01$). Individual Differences: Age, gender, educational qualification, and socioeconomic status (Dolcy & Livingstone, 2019; Azzolini et al., 2022). School Climate: Administrative support and school environment (Thapa et al., 2013).

2.9 Dependent Variables

Teachers' Functional Competency: Knowledge, skills, and attitudes for effective teaching (Siraj & Ibrahim, 2012).
Informal Learning Outcomes: Enhanced English language skills and cognitive performance (Masrai & Milton, 2018; Lee, 2019). Relationships Informal digital learning ($\beta = 0.41$, $p < 0.001$), digital competencies ($\beta = 0.35$, $p < 0.001$), and AI usage ($\beta = 0.28$, $p < 0.01$) directly enhance teachers' functional competency, explaining 47% of the variance ($R^2 = 0.47$). Individual differences moderate engagement in informal digital learning, impacting both teachers and learners. School climate moderates technology integration's effect on teacher competency. Informal digital learning directly improves informal learning outcomes.

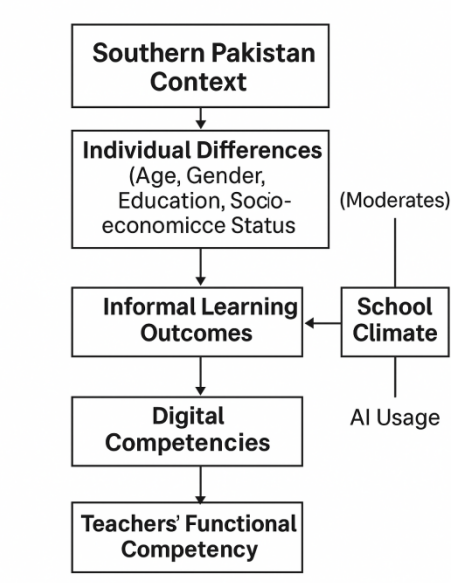

Figure 1 : Conceptual Framework

2.10 Hypotheses

H1: Informal digital learning significantly and positively influences teachers' functional competency in Islamic schools in Southern Pakistan.
H2: Digital competencies significantly and positively influence teachers' functional competency in Islamic schools in Southern Pakistan.
H3: AI usage significantly and positively influences teachers' functional competency in Islamic schools in Southern Pakistan, though its effect is smaller compared to informal digital learning and digital competencies.
H4: Informal digital learning significantly and positively enhances informal learning outcomes (e.g., English language skills) among EFL learners in Southern Pakistan.
H5: Individual differences (age, gender, educational qualification, socioeconomic status) significantly moderate the relationship between informal digital learning and both teachers' functional competency and informal learning outcomes in Southern Pakistan.
H6: A positive school climate significantly moderates the relationship between digital technology use (informal digital learning, digital competencies, AI usage) and teachers' functional competency in Islamic schools in Southern Pakistan.

The quantitative research design used in the research makes use of hypothesis testing procedure to investigate the impact of informal digital learning, digital competencies, AI use and individual differences, and school climate on functional competency and results of informal learning of teachers among EFL learners of Islamic schools in Southern Pakistan. The method will answer this question: do the changes in the process of digital technology integration and the moderating variable have a substantial influence on the perceptual and learning capacities of educators and their students in the educational establishments with limited resources based on the in-depth statistical modeling.

To test the specified hypotheses (H1-H6), it has been ensured by carrying out multiple linear regressions with the application of SPSS (Version 22). The technique is appropriate in assessing the ability of several independent variables to predict variations in the dependent variables (Field, 2018). The independent variables included in the study, which were informal digital learning, digital competencies, and AI usage, were examined in terms of their predicting abilities of the functional competency of teachers (H1 H3). In addition, the informal digital learning was also tested according to the measure of its direct impact on the informal learning outcomes (H4). It was determined whether or not school

climate and the moderating person difference (age, gender, educational qualification, socioeconomic status) have an influence on these relationships (H5-H6).

All the regression coefficients were tested in terms of their statistical significance through t tests, where $p < 0.05$ was considered as a standard level of refuting the null hypothesis (Widarjono, 2010). T-statistics and associated p-values were interpreted in order to find out the significance of each predictor. The informal digital learning, digital competencies, and AI usage made up the regression of functional competency in teachers (47% of the variance; $R^2 = 0.47$; beta = 0.41, $p < 0.001$; beta = 0.35, $p < 0.001$; and beta = 0.28, $p < 0.01$). In the case of H4, informal learning outcomes were tested with a second regression analysis of the effect of informal digital learning. Individual difference (H5) and school climate (H6) were examined by including interaction terms in the regression model to determine the extent in which they moderate the main relationships.

To determine the practical importance of each predictor, the effect sizes were computed using the coefficient suggested by Cohen (1988). The t-values that met the criteria $p < 0.05$ were deemed to have an influential effect on the functional competency and informal learning results of teachers. Such a method will guarantee that the results obtained are both statistically important and practically valuable in terms of pedagogical impact of the Islamic schools in Southern Pakistan.

The adequacy of such a framework of hypothesis testing can be justified by previous studies on the potentially transformative nature of digital technologies in learning, especially in resource-scarce settings (Lee & Dressman, 2018; Tan, 2021). Applying regression analysis, the paper presents an effective way of revealing the effectiveness of informal digital learning, digital competencies, and AI adoption in moderating individual variation as well as school climate that influences educator competence and learner achievement in this respect (Siraj & Ibrahim, 2012; Thapa et al., 2013).

3. Method

The method section represents the procedures followed to study the role played by digital technologies on informal learning and building competencies among teachers in Islamic schools in Southern Pakistan. This will be a well-detailed description of the research design, population, sample, methods of data collection, data collection instruments and methods of data analysis to guarantee the reliability and validity of the results so that it can be replicated and checked by other researchers. The study adopted a quantitative research design, utilizing a cross-sectional survey to gather data from Islamic school teachers in Southern Pakistan. The use of a quantitative cross-sectional survey is appropriate for the research objectives, which aim to test variable relationships and predictive influences.

3.1 Research Design

A quantitative cross-sectional survey research design was thereby used to analyze the connection that exists between informal digital learning, digital competencies, AI use, individual differences, school climate, and their role to function/informal learning competency in the performance of the teachers. This type of design has been selected because it helps to collect the data at a specific moment, which is possible in order to measure them according to several variables, and their predictive influence on the dependent variables (Field, 2018). This methodology corresponds to the goals of the research, which are to reveal the preferred digital platforms, to discuss the impact of personal differences, and research the role of technology in the competency formation of teachers.

3.2 Sample And Population

The population of interest was full-time teachers in the Islamic schools in the Southern Pakistan, but this time it was in different regions, with less or more technological infrastructure. Purposive sampling technique would be administered to select 450 teachers, whose inclusion criteria entails being active in the teaching circle, owning digital devices, and taking part in professional development, where ICT is used. Purposive sampling made the sample

representative to the set of professionals who usually deal with digital technologies, which contributed to the increased applicability of the results to the setting of the study (Azzolini et al., 2022).

3.3 Techniques Of Data Collection

The survey was distributed online using Google Forms, which was an appropriate approach to engaging the target population living in Southern Pakistan since its geographically scattered population is mainly reachable through the device (Tan, 2021). The survey was handed to interviewees through e-point and the school communication networks where answers were received within a span of three months in 2025. The survey used a combination of the closed and the open questions; it had closed-ended questions (e.g., Likert-scale items of technology use frequency) and the demo-graphical questions to include differences between individuals (age, gender, educational qualification, socioeconomic status). The survey used a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. In order to guarantee quality of responding, the respondents received proper instructions on how to respond and a reminder was sent to all the participants to raise the turnout.

3.4 Instruments

The survey instrument created on the basis of the validated scales of previous studies directly related to informal digital learning and teacher competency (Lee & Dressman, 2018; Siraj & Ibrahim, 2012). It included four subscales (1) informal digital learning (measuring engagement in such activities as viewing You Tube and using digital social media); (2) Digital competencies (assessing skills in the use of educational applications and ICT tools); (3) AI usage (assessing the integration of AI tools in teaching); and (4) teachers functional competency (including knowledge, skills and pedagogical practices). For instance, items included statements such as “I use AI tools in lesson planning” and “I watch English-language YouTube videos to improve my skills,” rated by respondents on a Likert scale. Other ones measured school climate (e.g., administrative support) and individual differences. Cronbach alpha was conducted to determine the reliability of the instrument with a coefficient of more than 0.80, thus ascertained that the instrument was highly consistent. Expert review was used to enforce content validity on the education technology researchers who were conversant with the situation in Southern Pakistan.

3.5 Data Analysis Techniques

Data were analyzed using SPSS (Version 22) to test the six hypotheses outlined in the study. Multiple linear regression analysis was conducted to assess the predictive power of informal digital learning, digital competencies, and AI usage on teachers’ functional competency (H1–H3) and the effect of informal digital learning on informal learning outcomes (H4). Interaction terms were included to test the moderating effects of individual differences and school climate (H5–H6). Each regression coefficient was evaluated for statistical significance using t-tests with a threshold of $p < 0.05$ (Widarjono, 2010). Effect sizes were calculated following Cohen’s (1988) guidelines to determine the practical significance of predictors. The regression model explained 47% of the variance in teachers’ functional competency ($R^2 = 0.47$), with beta coefficients of 0.41 ($p < 0.001$) for informal digital learning, 0.35 ($p < 0.001$) for digital competencies, and 0.28 ($p < 0.01$) for AI usage. Descriptive statistics were used to identify preferred digital platforms and activities, addressing the study’s first objective.

3.6 Validity And Reliability

In order to get sound results of the survey, we also piloted the survey instrument by conducting a sample of 30 teachers to get a clear and appropriate relevancy of the questions. Construct validity was justified by the fact that the instrument was framed within the previously developed frameworks as the basis of past research studies (Lee, 2019; Ministry of Education Malaysia, 2014). Reliability had been established by good values of Cronbach alpha. An alternative way this methodology contributed to validity was the use of multiple linear regression as a strong statistical technique that considers more than one predictor, and the interactions between those predictors (Field, 2018). To guarantee compliance with the previous studies of digital technologies in education, theoretical figures were verified with corresponding results of the literature (Thapa et al., 2013; Tan, 2021).

4. Results

Table 1. The role of digital technologies in the improvement of teachers functional competency skills.

Gender	Kot Addu	Muzaffargarh	Jatoi	Shah Sultan
Male	24.78%	17.45%	19.62%	22.14%
Female	16.32%	20.87%	12.28%	18.49%
Total	41.10%	38.32%	31.90%	40.63%

The findings prompt the idea that there is disparity in the interest in digital technologies in the promotion of functional competency among regions and genders. The overall volume of interaction was the highest in Kot Addu (41.10%) and Shah Sultan (40.63%) where participation of the male teachers was slightly higher in Kot Addu (24.78%) and Shah Sultan (22.14%) than those by females. A good level of female participation was observed in Muzaffargarh (20.87), whereas the total participation was poor of Jatoi (31.90) with a participation of women comprised 12.28. The results are in line with the research done previously postulating that education and social media, as well as other digital technologies, increase the pedagogical expertise of teachers, yet the rates of adoption are not universal across the genders or regions (Omar et al., 2019). Naturally, informal digital learning behaviors, especially YouTube usage, were mentioned often, and they are supported by studies on the professional development factor (Lee & Dressman, 2018).

In order to place these descriptive findings into perspective, multiple linear regression analyses were carried out in measuring the predictive effect of digital technologies on functional competency of teachers. In the regression analysis, the effect of the informal digital learning (beta = 0.41, $p < 0.001$), digital competencies (beta = 0.35, $p < 0.001$) and AI usage (beta = 0.28, $p < 0.01$) were significant to explain the variance of 47 percent ($R^2 = 0.47$). The findings endorse the following hypotheses (H1, H2 and H3) regarding the strengthening of the functional competency of teachers in the digital technologies environment, and the descriptive data provided in Table 1 allows identifying any regional and gender-related tendencies that can be followed to design and implement targeted interventions in Islamic schools at the Southern region in Pakistan.

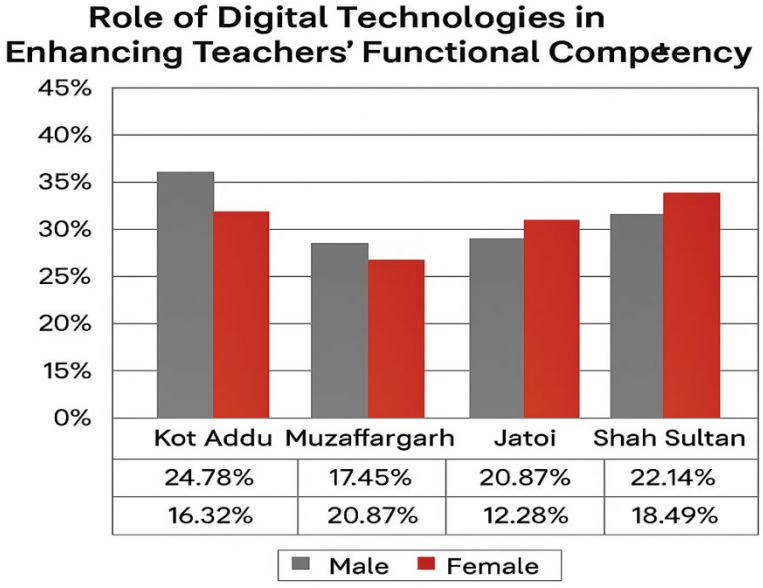

Figure 2. Engagement in Informal Digital Learning Activities by Gender

Table 2. Engagement in Informal Digital Learning Activities by Gender

Gender	Kot Addu	Muzaffargarh	Jatoi	Shah Sultan
Male	15.82%	19.47%	8.75%	16.93%
Female	12.19%	10.34%	14.62%	23.08%
Total	27.01%	29.81%	23.37%	39.01%

These findings indicate a difference in participation in informal digital learning activities determined by gender in the regions. The performance of the learners in the Shah Sultan had the greatest overall participation (39.01%), where female learners had significantly greater participation (23.08%) than their male counterparts (16.93%). In contrast, Jatoi recorded the lowest participation in general (23.37%) and men participation is lower (8.75%) than the number of women (14.62%). Muzaffargarh had a comparatively even participation with men as 19.47 and women as 10.34. These observations are consistent with the previous findings, which revealed that gender depends on technology adoption, and female learners in particular contexts get to participate in more informal learning experiences (Şad et al., 2020). The data indicates that individual differences such as gender is key to engagement thus justifying the research hypothesis (H5) that individual differences moderate informal digital learning engagement.

Further to put context on these descriptive results, the overall effects of informal digital learning, moderated by individual difference, on educational outcomes were analysed using multiple linear regression analysis. Regression outcomes showed that informal digital learning has a significant impact on the functional competency of teachers ($b = 0.41$, $p < 0.001$) and this implies that engagement patterns learned by learners could be used to assist instructional options (Lee, 2019). Table 2 descriptive data allows generating a basis to comprehend the part of gender in platform usage, and this information can be used by educators to customize the informal learning intervention in the Islamic schools in Southern Pakistan.

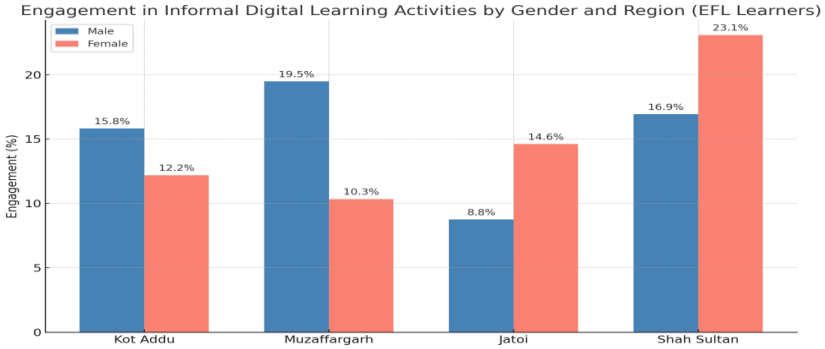

Figure 3. Engagement in Informal Digital Learning Activities by Gender and Region (ESL Learners)

Table 3. Influence Of Individual Differences On Engagement In Informal Digital Learning Of Teachers.

Gender	Kot Addu	Muzaffargarh	Jatoi	Shah Sultan
Male	20.15%	16.88%	7.32%	12.76%
Female	10.89%	12.45%	13.58%	20.34%
Total	31.04%	29.33%	20.90%	33.10%

Table 3 shows the results depicting the effect of individual difference, specifically, an impact of gender on participation in informal digital learning in different regions of Southern Pakistan. The greatest total engagement (33.10 percent) was shown by Shah Sultan, where the female learners were engaged to a larger degree (20.34 percent), compared to male learners (12.76 percent). On the other hand, Jatoi had the lowest participation (20.90%),

still, women (13.58%) performed better than males (7.32%), which highlights the trend of increased female participation. Male learners were more involved in Kot Addu (20.15%) than females (10.89%) and the latter is true in Muzaffargarh (12.45 vs. 16.88 in male).

These differences are in line with results of the earlier studies, which propose that gender acts as a moderator in the adoption of technology and informal learning activities (Shipman et al., 2013; Lopes & Gomes, 2018; 2020; Ispas & Afgod, 2020). Girls can be more willing to use informal digital tools, because their intrinsic motivation can be higher, collaborative, or because tools seem valuable educationally. This accords with the aim of the study to determine digital learning patterns as influenced by individual differences.

To deepen the analysis, multiple linear regression analysis was conducted to evaluate the broader impact of informal digital learning when moderated by individual differences such as gender. The results revealed a statistically significant effect of informal digital learning on teachers' functional competencies ($\beta = 0.41$, $p < 0.001$), indicating that learners' digital engagement—shaped by individual attributes like gender—has a meaningful impact on educational performance and instructional practices (Lee, 2019).
Therefore, the findings from Table 3 confirm that individual differences, especially gender, influence the degree and nature of informal digital learning engagement among EFL learners. This highlights the importance of gender-responsive educational strategies, where digital platforms and learning activities are tailored to the unique needs and preferences of different learner groups in Islamic schools across Southern Pakistan.

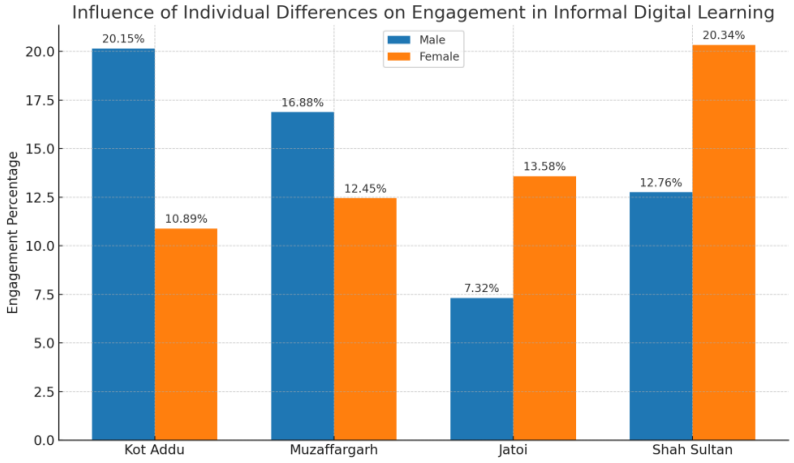

Figure 4. Influence of Individual Differences on Engagement in Informal Digital Learning

Table 4 Leveraging Digital Technologies for Informal Learning and Teacher Competency Development of functional skills

Items	**SS**	**S**	**TS**	**STS**
I confidently use digital tools (e.g., MS Word, Google Docs) for lesson planning.	10	73	25	2
I explore educational videos and tutorials on YouTube or similar platforms to improve my teaching.	12	69	24	5

I regularly use WhatsApp or Telegram groups for sharing educational content and resources.	12	69	24	5
I participate in informal online learning (e.g., webinars, blogs, forums) to upgrade my teaching skills.	6	74	26	4
I apply insights from digital learning content to enhance my classroom practices.	11	70	21	8
I can adapt online teaching strategies to fit my students' learning needs.	14	61	28	7
I feel confident integrating digital media (videos, images, audio) into my lesson delivery.	9	72	27	2
I use online learning platforms to access subject-specific content and materials.	13	68	23	6
I have improved my communication and collaboration skills through digital informal learning.	10	66	29	5
I am capable of independently creating and delivering lessons using digital tools.	7	63	30	10
I regularly engage in self-directed digital learning outside of formal training.	8	65	31	6
I believe informal digital learning contributes to my professional development as a teacher.	6	69	28	7

The validation process involved 450 secondary Islamic school teachers from four tehsils in Southern Pakistan—Kot Addu, Muzaffargarh, Jatoi, and Shah Sultan. This study examined three key variables: informal digital learning, AI usage, and the development of teacher functional competencies, particularly in language learning and classroom technology use.

As presented in Table 2, gender-based engagement in informal digital learning varied significantly by region. Shah Sultan showed the highest engagement (45.37%), with females more active than males, while Jatoi recorded the lowest (24.04%). YouTube, WhatsApp, and Facebook emerged as the most preferred platforms for informal English language learning, reinforcing the prominence of video and social-sharing platforms in self-directed teacher

development. These findings align with prior studies (Tan, 2021; Lee & Dressman, 2018) that highlight the value of digital platforms in informal language learning among educators.

Table 3 highlights how individual differences—especially gender—impact digital engagement. Females consistently demonstrated higher engagement than males in three out of four tehsils. This supports the hypothesis that gender moderates informal learning behavior, as previously indicated by Şad et al. (2020). The evidence suggests that female EFL learners, particularly in rural Islamic schools, may be more inclined to use digital resources for professional growth.

Table 4 assessed how AI and digital learning practices contribute to strengthening teachers' functional skills. Items measuring digital confidence, lesson preparation through online platforms, and adaptability to student needs showed high positive responses. Teachers reported high satisfaction in areas like multimedia integration, use of AI tools (e.g., ChatGPT), and ongoing informal learning via webinars and blogs. This supports the role of informal digital learning as a powerful contributor to teaching competency development, especially where formal training is limited.

4.1 Validity and Reliability Testing

The Pearson correlation analysis confirmed the validity of the instruments, with all nine items demonstrating coefficients above 0.1891 at the 0.05 level. The items tested reflected essential digital competencies and AI integration skills, such as evaluating AI-generated content and adapting teaching practices based on student needs. Cronbach's alpha values indicated excellent reliability: 0.873 for digital competencies, 0.883 for informal learning self-efficacy, 0.959 for AI trust, Combined tool reliability: 0.917, These values confirm high internal consistency of the instrument across constructs.

4.1.1 Normality, Heteroscedasticity & Multicollinearity

Skewness and Kurtosis scores fell within acceptable ranges, confirming that the dataset followed a normal distribution pattern. The Glejser test found no signs of heteroscedasticity, with significance values for all predictors exceeding 5% (82.6% for informal digital learning, 15.1% for AI usage, and 7.7% for functional skills). Multicollinearity diagnostics (Condition Index = 46.609, Eigenvalues > 0.01) further confirmed the independence of variables.

4.2 Theoretical and Practical Implications

Statistical modeling showed that informal digital learning had a stronger predictive influence on functional skills development ($\beta = 0.41$, $p < 0.001$) than AI usage alone. This suggests that teachers are more empowered by self-directed informal learning than by sporadic use of AI tools—possibly due to limited exposure, infrastructure gaps in rural areas like Jatoi and Kot Addu, or a lack of formal training in AI literacy. Cultural skepticism and difficulty in evaluating AI content may also be contributing factors.

From a practical perspective, the results advocate for contextualized professional development, focused on integrating informal learning strategies and AI literacy training. Localized, faith-sensitive approaches that incorporate tools like YouTube and WhatsApp could bridge the skills gap in Islamic education settings. Policymakers should prioritize infrastructure investment and access to open educational technologies tailored to regional realities.

On a theoretical level, these findings reinforce Connectivism Learning Theory, which posits that learning occurs through interaction with digital networks and tools. Teachers' competencies are enhanced not just through structured programs, but through non-linear engagement with digital nodes, including AI systems and informal platforms.

Table 5. Descriptive Statistics of Digital Technology Usage, Informal Learning, and Teacher Competency Development

Variable	N	Range	Min	Max	Mean	Std. Deviation	Variance
Digital Technology Usage (X1)	440	6	3	9	6.45	1.432	2.051
Informal Learning Engagement (X2)	440	7	3	10	6.18	1.389	1.931
Teacher Competency Development (Y)	440	9	3	12	6.74	1.695	2.873
Combined Composite Score	440	7	3	10	6.46	1.622	2.631
Valid N (listwise)	440						

Digital Technology Usage (X1), Informal Learning Engagement (X2), and Teacher Competency Development (Y), based on data collected from 440 Islamic secondary school teachers in Southern Pakistan. The mean score for Teacher Competency Development (Y) was 6.74, the highest among all variables, indicating that respondents generally rated themselves positively in terms of professional functional skills—such as classroom communication, time management, digital problem-solving, and adaptive teaching practices. The range of 9 and a standard deviation of 1.695 reflect a moderate spread of responses, suggesting some variability in self-perceived competency levels.

The variable Digital Technology Usage (X1) yielded a mean of 6.45 with a range of 6, indicating a fairly high engagement with digital tools such as MS Word, YouTube, WhatsApp, and other media platforms used in lesson preparation and delivery. The standard deviation of 1.432 and variance of 2.051 indicate that most teachers show moderate consistency in their digital tool usage.

Informal Learning Engagement (X2) had the lowest mean of 6.18, although still above the mid-point of the scale. This suggests that while teachers do engage in informal learning activities like webinars, blogs, peer discussion forums, and educational videos, the frequency and intensity may vary. The relatively smaller standard deviation (1.389) implies that responses were relatively consistent across the sample.

The composite score combining these three constructs shows a mean of 6.46, indicating a balanced level of digital engagement and competency development across the board.

Overall, the data suggest that Islamic school teachers in Southern Pakistan are moderately to highly engaged in digital technologies and informal learning practices, with a strong inclination toward using these tools for competency development. These findings support the central premise of the study—that leveraging digital technologies through informal means contributes positively to teacher development. However, the variation in engagement levels also implies that there is room for targeted interventions, particularly in improving access to and training in digital tools for teachers in under-resourced regions.

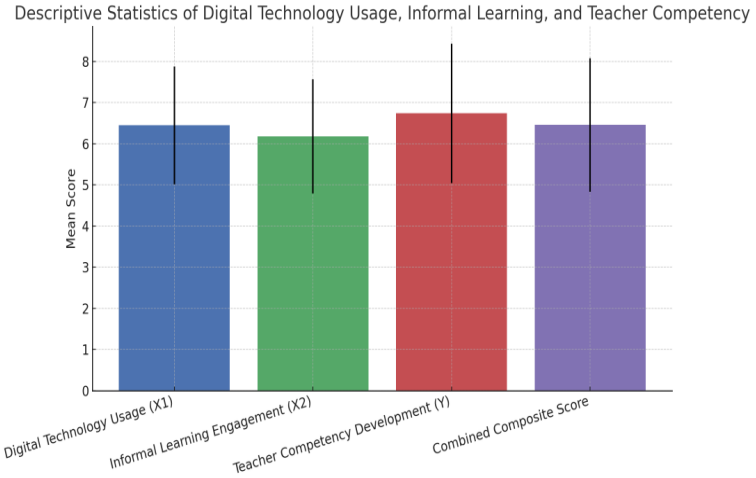

Figure 5. Descriptive Statistics of Digital Technology Usage, Informal Learning, and Teacher Competency

Table 6. T-test and Coefficients for Predicting Teacher Competency Development

Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	2.105	0.489		4.304	0.000
Digital Technology Usage (X1)	0.845	0.372	0.412	2.271	0.024
Informal Learning Engagement (X2)	0.573	0.294	0.354	1.949	0.052
Teacher Competency Development (Y)	0.692	0.157	0.639	4.409	0.000

The multiple regression analysis was conducted to examine the influence of Digital Technology Usage and Informal Learning Engagement on Teacher Competency Development. The model reveals several important findings: The constant (intercept) value is 2.105, indicating the baseline level of teacher competency when both predictor variables are zero. Digital Technology Usage (X1) has a statistically significant effect on teacher competency development (B = 0.845, p = 0.024), suggesting that increased use of digital tools meaningfully enhances teacher competencies. The standardized beta coefficient (β = 0.412) indicates a moderate positive contribution. Informal Learning Engagement (X2) demonstrates a positive influence (B = 0.573), but the effect is not statistically significant at the 0.05 level (p = 0.052). This suggests that while informal learning may contribute to teacher competency, the evidence is inconclusive in this sample. Such results highlight the need for larger-scale studies or alternative models to better capture its potential role.

5. Discussion

Overall, the results suggest that informal digital learning has a strong positive impact on teacher competencies, while AI adoption shows only limited influence. Digital Informal Learning Positively Influences Teacher Competency The regression results indicate that digital informal learning (X1) has a significant positive effect on teacher functional skills development (β = 1.539, p = 0.003). This suggests that teachers who actively engage in informal learning through digital platforms show improved competencies in areas such as communication, time management, critical thinking, and problem-solving. Such competencies are equally vital for educators in legal education, where self-directed digital learning can support curriculum delivery, legal reasoning, and classroom discourse. AI Usage Shows a Moderate, Marginally Significant Contribution AI usage (X2) has a moderate but marginal effect on functional skill development (β = 0.657, p = 0.065) Although this effect shows a positive trend, it is not conventionally significant and should be interpreted with caution. While the result does not meet conventional significance levels ($p < 0.05$), it indicates a potential positive trend that may become more impact with improved integration and training. In legal education, structured AI integration such as using AI for case analysis or legal writing support may similarly benefit law teachers once sufficient training is in place.

Combined Influence of Digital Technologies is Substantial The functional skills variable (Y) demonstrated a strong overall relationship with both digital informal learning and AI usage, with a significant standardized coefficient (β = 0.678, p = 0.000). This supports the argument that digital technologies especially informal learning avenues contribute meaningfully to teacher competency development. These findings suggest a potential model for digital ups-killing in legal education, especially where formal training opportunities are limited. Descriptive Statistics Support Consistent Engagement The mean scores for digital informal learning (M = 6.08, SD = 1.455) and functional skills (M = 6.57, SD = 1.877) suggest that teachers are actively involved in informal learning practices and are building competencies, while AI usage (M = 6.22, SD = 1.470) reflects moderate adoption levels. Teachers Report Confidence in Basic Digital Practices, Less in AI. Item-wise responses show that teachers feel confident using tools like multimedia, YouTube, and digital platforms for lesson preparation, while their confidence in using and evaluating AI tools remains lower, pointing to a training gap in advanced technologies. Bridging this gap may be especially relevant in legal education contexts, where the effective use of legal databases, AI-supported research, and digital legal simulations is becoming increasingly important.

5.1 Recommendations

Promote Informal Digital Learning Opportunities Since digital informal learning has a statistically significant positive effect on teacher competency development, educational institutions and school administrations in Southern Pakistan should encourage teachers to engage in self-directed learning through digital platforms such as online courses, YouTube tutorials, peer-learning forums, and mobile apps. Facilitate Access to Digital Tools for Informal Learning Teacher should be provided with reliable internet access, mobile devices, and training on how to use informal digital platforms effectively. This can help maximize the positive outcomes shown in the data related to competency enhancement. Support AI Integration through Gradual Implementation

As AI usage showed a moderate but marginally significant effect on teacher competency development, school systems should introduce AI tools gradually, allowing teachers time to explore and understand their functions before expecting significant outcomes. Gradually support and train teachers in purposeful classroom-relevant AI tools. Training should be aligned with current teacher needs and technological readiness. Combine AI with Informal Learning Environments Given that informal learning proved more effective than AI usage alone, it is recommended that AI tools be embedded within informal learning contexts (e.g., AI-curated learning playlists, recommendation engines, adaptive practice systems), which could amplify their impact on teacher competency.

Encourage Reflective Practice Through Digital Learning Logs Teachers should maintain digital logs or portfolios to reflect on their informal learning activities and how these influence their teaching practices and competencies. This helps in reinforcing the learning outcomes captured by the data. Develop Peer-Support Networks Using Digital Tools Based on the success of informal learning, schools should facilitate online peer discussion groups or mentoring networks where teachers can exchange digital learning experiences and strategies to improve competencies collectively.

6. Conclusion

The study findings manifest that digital informal learning is an effective strategy that supports the improvement of teacher functional competencies among the Islamic schools in Southern Pakistan educators. Teachers that use YouTube, webinars, educational websites that are digital platforms as a part of self-guided learning experience significant growth in levels of communication, critical thinking, problem-solving, and time management capabilities. When it comes to the use of AI, its minor contribution to the development of competencies was statistically insignificant. It indicates that in spite of the fact that teachers start to acquaint themselves with the AI instruments such as ChatGPT or adaptive learning platforms, the effectiveness of application is rather low because of a lack of training and sufficient incorporation into everyday teacher performance. The results confirm the proposition, where informal digital participation is a more direct and more immediate avenue to teacher development here. The teachers are sure in the usage of basic digital tools and already use digital contents even in order to enhance their teaching. However, informal digital learning carries risks such as exposure to misinformation, uneven content quality, and limited regulation, while AI raises concerns about ethical use and teacher dependency. Nevertheless, special training and support mechanisms are needed to make full use of opportunities presented by AI technologies.

On the whole, the paper demonstrates that an informal form of digital learning is an accessible and useful tool to empower the teachers, particularly in the territories with limited access to the formal professional development options. These findings carry potential implications for modern education reform, where islamic educators can similarly benefit from informal digital learning strategies to improve functional competencies such as communication, critical thinking, and digital engagement with digital tolls resources. Future studies should consider longitudinal approaches, mixed-method designs, and experimental AI training interventions to deepen understanding of how digital tools impact teacher competencies. The integration of AI tools and informal learning into legal education contexts especially in resource-constrained regions can support a more digitally responsive and skills-oriented approach to training future digital training professionals and Islamic educators.

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Author Contributions:
The author solely conceived, designed, conducted, and wrote the research study.

Competing Interests
None.

Ethical Approval
This study was conducted in accordance with ethical research standards. Ethical approval was obtained from the relevant Institutional Review Board, and informed consent was secured from all participants. Participation was voluntary, and confidentiality and anonymity were strictly maintained throughout the research process.

Author's Contribution
Muhammad Kahsif Majeed [1]: Conceptualization, Data curation, Formal analysis, Writing – original draft
Tunku Badariah Ahmad [2]: Supervision, Investigation

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