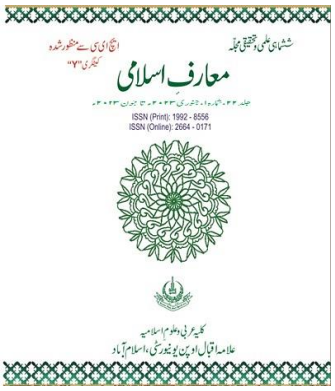


معارفِ اِسلامي Ma'ārif-e-Islāmī
eISSN: 2664-0171, pISSN: 1992-8556
Publisher: Faculty of Arabic & Islamic Studies
Allama Iqbal Open University, Islamabad
Website: https://ojs.aiou.edu.pk/index.php/jmi
Vol.24 Issue: 01 (January – June 2025)
Date of Publication: 25-June 2025
HEC Category, **Y**: (2024-2025)

https://ojs.aiou.edu.pk/index.php/jmi

Article	***The Role of AI and Informal Digital Learning in Strengthening Secondary Islamic Teacher Training in Southern, Pakistan***
Authors & Affiliations	1. **Muhammad Kashif Majeed** Ph.D scholar in Education, Department of Education, Faculty Curriculum Development IIUM International, Islamic University, Malaysia kashifmajeed.edu.my@gmail.com 2. **Dr. Tunku Badariah Ahmad** Professor, Department of Education, Faculty Curriculum Development IIUM International Islamic University, Malaysia tbadariah@iium.edu.my
Dates	***Received*** 12-02-2025 ***Accepted*** 12-05-2025 ***Published*** 25-06-2025
Citation	Muhammad Kashif Majeed and Dr. Tunku Badariah Ahmad, 2025. ***The Role of AI and Informal Digital Learning in Strengthening Secondary Islamic Teacher Training in Southern, Pakistan*** [online] IRI - Islamic Research Index - Allama Iqbal Open University, Islamabad. Available at: https://iri.aiou.edu.pk [Accessed 25 June 2025].
Copyright Information	***The Role of AI and Informal Digital Learning in Strengthening Secondary Islamic Teacher Training in Southern, Pakistan***
Publisher Information	Faculty of Arabic & Islamic Studies, Allama Iqbal Open University, Islamabad, Pakistan https://aiou.edu.pk/

Indexing & Abstracting Agencies

IRI(AIOU)	HJRS(HEC)	Tehqiqat	Asian Indexing	Research Bib	Atla Religion Database (Atla RDB)	Scientific Indexing Services (SIS)
IRI Islamic Research Index	HJRS HEC Journal Recognition System	تحقیقات	ASIAN Research Index	Academic Resource Index ResearchBib	ATLA Religion Database	SIS

The Role of AI and Informal Digital Learning in Strengthening Secondary Islamic Teacher Training in Southern, Pakistan

Abstract

This paper dwells on how Artificial Intelligence (AI) and informal digital learning may be implemented to improve the training of teachers at the secondary Islamic schools in the region of Karachi in Southern Pakistan, where the process of digital transformation remains at its initial stages. It is aimed at getting familiar with the knowledge of teachers and gender-related disparities in digital skills to assist in designing educationally inclusive training programs regarding current educational demands. Although the concept of AI and digital learning has been researched broadly in the field of general education, little has been discussed about its use in Islamic teacher training education, especially at the secondary level and in relations to gender-based approach. The study was evaluated the knowledge of secondary Islamic teachers regarding the AI and digital informal and the district of Kot Addu in Southern Pakistan. It also aims at examining the connection between the two factors as well as how they influence teacher training. The other objective is to compare knowledge and application difference on basis of gender and to identify higher and lower levels ones in Tehsils. There was an adoption of a quantitative research design. A total of the four Tehsils of District Kot Addu by name Kot Addu, Chowk Sarwar Shaheed, Dera Din Panah, and Mehmood Kot all the secondary Islamic school teachers came as the population. Stratified random selection of 450 teachers was done. Data were gathered based on a structured questionnaire and statistical tools utilized in analysis. The outcomes disclosed the disparities in AI and digital informal learning knowledge in terms of tehsil and gender differences. There was a high degree of correlation between the two variables. To enhance the digital skills of the Islamic teacher education, the findings give strong incentives to develop gender-sensitive training interventions.

Keywords: *Artificial Intelligence, Digital Informal Learning, Islamic Teacher Training, Gender Differences, Secondary Education, District Kot Addu.*

Introduction:

In today's rapidly evolving educational landscape, Artificial Intelligence (AI) and digital informal learning have emerged as transformative tools that can enhance teaching efficiency, engagement, and adaptability. For Islamic teacher training, especially at the secondary level, integrating such technologies is critical to bridging traditional pedagogy with modern instructional needs. As digital transformation gains momentum globally, its adoption in underrepresented and rural regions like Southern Pakistan becomes essential for inclusive and equitable education (UNESCO, 2021).

Background

Digital technologies, such as those based on AI and informal learning tools, are redesigning the way in which teachers get access to professional development and instructional support (Luckin et al., 2016). Informal digital learning means the informal, self-guided use of digital sources, including the use of YouTube, webinars, and online forums, to acquire educational knowledge and skills. The digital tools may be especially helpful during the

teacher training in those areas where formal resources are scarce. That said, the secondary Islamic schools in Pakistan tend to be conventional in their practices and the ways they incorporate AI and informal learning are unstudied and restricted.

Problem Statement

Nevertheless, teachers of the Islamic domain in the rural areas of Pakistan and especially in District Kot Addu, have yet to be exposed under proper training and avenues of AI and digital learning. They have little knowledge on how to use these technologies in their pedagogical practices. In addition, there is a worsening challenge of gender-ratio digital gaps and somewhat lopsided distribution of knowledge tehsil wise. It lacks the empirical evidence known as to determine the extent of knowing about Artificial Intelligence (AI) and digital informal learning that is known more or less well between, in order, which tehsil in District Kot Addu, among secondary Islamic teachers. Also, there is a poor grasp of gender disparities in this knowledge. Both of these aims the research study, to compare tehsil wise and gender-wise level of knowledge, and identify training of need specific program to boost the use of AI and to acquire digital informal learning skills in these teachers.

Research Gap

Although several studies have explored AI and digital learning in general education contexts, there is a lack of research focusing specifically on Islamic teacher training at the secondary level. Little is known about how AI and informal learning intersect in the rural Pakistani context, especially considering gender disparities and tehsil-level differences.

Evidence

UNESCO (2021) emphasizes the urgent need to equip educators with 21st-century digital skills, particularly in developing countries. Research by Holmes et al. (2021) indicates that digital learning improves teacher performance and learner outcomes, while gender-sensitive approaches are critical for equitable access. However, the absence of localized data leaves educational stakeholders unequipped to design evidence-based training programs in regions like Southern Pakistan.

Local Context

District Kot Addu, located in Southern Punjab, Pakistan, includes four major Tehsils: Kot Addu, Chowk Sarwar Shaheed, Dera Din Panah, and Mehmood Kot. These areas are characterized by varying levels of infrastructure and digital access. Islamic secondary schools in this district often lack professional development opportunities, especially those involving advanced digital tools. Gender disparity in digital engagement is also a significant issue due to socio-cultural constraints.

Paper Aim

This study aims to assess the level of knowledge among secondary Islamic school teachers in District Kot Addu regarding AI and informal digital learning. It explores gender-based differences and tehsil-wise variations, identifies the relationship between AI and digital informal learning, and highlights the need for targeted, inclusive teacher training programs.

Objectives of the study

- To assess the teacher's knowledge about AI in district kot addu southern pakistan.

- To assess the teacher's knowledge about Digital informal learning in district kot addu southern pakistan.
- To analyze the relationship between AI and Digital informal learning in district kot addu southern pakistan.
- To assess the comparison between gender based knowledge about AI Digital informal learning and in district kot addu southern pakistan.

Research Questions of the study

- What is the teacher's knowledge about AI in district kot addu southern Pakistan.
- What is the teacher's knowledge about Digital informal learning in district kot addu southern Pakistan.
- What is the relationship between AI and Digital informal learning in district kot addu southern Pakistan.
- What is the comparison between gender-based knowledge about AI Digital informal learning and in district kot addu southern Pakistan.

Literature review

Artificial Intelligence in Education

Artificial Intelligence (AI) is increasingly shaping the future of education by automating administrative tasks, offering personalized learning experiences, and enhancing the teaching process through smart tutoring systems and predictive analytics (Holmes et al., 2021). AI has proven to be a powerful tool in education for improving teaching effectiveness and student outcomes. Its integration into teacher training allows for the development of data-driven instruction methods and real-time feedback (Luckin et al., 2016). However, AI adoption in teacher education, particularly in religious or Islamic contexts, remains under-explored. Artificial Intelligence (AI):

AI refers to the simulation of human intelligence by machines, especially in learning, problem-solving, and decision-making in education. In teacher training, AI can support personalized learning and automated feedback systems.

Islamic teacher training programs have traditionally been text-based and teacher-centered. Integrating AI into such settings presents both opportunities and challenges. According to Ahmad and Khan (2020), there is a growing need to modernize Islamic educational practices without compromising religious values. AI can support teachers in content delivery, language translation (especially Arabic for Islamic studies), and adaptive learning for students with varied understanding levels.

Informal Digital Learning and Professional Development

Informal digital learning refers to self-initiated, non-institutional learning through digital tools such as YouTube tutorials, MOOCs, webinars, podcasts, and educational blogs (Eraut, 2004). For teachers, especially in low-resource settings, informal digital learning serves as a critical avenue for professional development. It enables continuous learning, self-paced exploration, and access to global pedagogical practices. According to Redecker (2017), digital informal learning improves teaching competencies and promotes lifelong The educators will be practicing non-conventional self-organized learning via digital mediums in terms of videos, blogs, podcasts, and communities. It helps the teachers to engage in the development of their career professionally outside the classroom.

Teachers at Islamic schools in Pakistan, however, are frequently exposed to few learning techniques because of infrastructure problems, poor digital literacy and social-cultural constraints, particularly that of women. In a paper by Chaudhry et al. (2020) it was reported that although the access to digital resources by urban teachers in Pakistan has become increasingly frequent, the same opportunity is unavailable to rural educators who fall short when it comes to access to training and systems of support.

Digital Competency Gender Based Differences

The aspect of gender is influential in digital access and competency in Pakistan. UNESCO (2021) claims that women in rural Pakistan have significant challenges in their ability to have access to technology and use it because of traditional gender roles, lack of transport, and social-cultural standards. These imbalances can be seen even in a case of teachers. In comparison to female teachers, male teachers tend to have more chances and feel confident to make use of digital tools (Shah & Saeed, 2019).

These gender differences may be compounded in Islamic school environment, which reduces the ability of female instructors to embrace and enjoy the innovations of AI and digital learning. This sort of digital gender gap requires addressing on the way to inclusive educational development. Southern Pakistan

The case study district, Kot Addu, Pakistan, is a district in Southern Punjab that has both urban and rural tehsils distributed in the area which have different degrees of digital infrastructure and support in education. In a recent local study by Abbas et al. (2022), it was indicated that access to ICT and training of teachers vary across the tehsils. There is little use of AI-driven digital informal learning during the training of teachers who mostly use traditional face-to-face courses or other outdated material published in book form.

The reason as to why the topic of research is relevant is that, the study will uncover the needs of specific teachers who teach Islam in secondary schools in this region. This study helps establish policy and training over local gaps in digital knowledge, particularly AI and informal learning. There are formal coursework and informal instructional approaches in teacher training that enhance both pedagogical and technological competence of teachers. The introduction of digital tools and AI into teacher preparation makes an educator ready to teach in a contemporary classroom.

Islamic Education: This is Islamic based education. The use of digital tools in the process of training Islamic teachers can be an effective way to modernize the imparting of traditionally presented content without intruding into the sacredness of the religious values. Gender Disparities: Gender inequality in education technology means having an unequal access and use of digital tools by men and women teachers, particularly, in rural areas, where culture restrains exposure of women to digital tools.

Research Gap

Even though there is a lot of literature written about AI in general education and the digital learning process, there is a lack of research projects on secondary Islamic teacher training in Pakistan. The data also does not exist on how can AI meet with informal digital learning in rural areas such as District Kot Addu and the power of gender to affect the accessibility and utilization to use these tools. This paper attempts to address these gaps by providing empirical data capable of providing direction in the reform of teacher education in religious schooling.

Methodology

The research study adopted a quantitative research design in a bid to objectively measure and analyse knowledge levels and relationships between Artificial Intelligence (AI) and informal digital learning among secondary Islamic school teachers in Kot Addu, District Southern Pakistan. Instead of looking at differences in digital knowledge and usage by tehsils and gender randomly, quantitative methods were selected in order to investigate the differences statistically (Sugiyono, 2018).

Participants were selected through the purposive sampling method and found in the form of secondary Islamic school teachers who were playing an active teaching role in the four tehsils of District Kot Addu. All the teachers working in Islamic secondary schools in the district were included in the population, and the sample of 450 teachers was used in order to have sufficient representation of every tehsil. Both private and public frequent and daily Islamic teachers were included; both genders were represented. The measurement of any of the variables was done using a structured questionnaire that was administered through Google forms to gauge the level of knowledge on an AI, usage of informal digital learning tools, and demographic factors, such as gender and location. The questionnaire consisted of closed-ended questions with a 5-points Likert scale rating, and the instrument was borrowed based on validated scales that were used in previous research papers on educational technology and online literacy. The test on a small number of respondents was done to improve the clarity and reliability of the items on a pilot test. According to the pilot modification, there was slight done to make it clear.

The last tool demonstrated a good reliability, and it was proved by Cronbach alpha. The SPSS (Version 22) was used to analyze data. The overall level of the knowledge of AI and informal digital learning was analyzed with the help of descriptive statistics. To analyze differences arising out of gender or tehsil by tehsil there were use of inferential statistics t-test and ANOVA. The correlation analysis also focused on establishing the relationship between AI knowledge and informal learning engagement by digital means. The use of this methodological approach allowed gaining an empirical evidence concerning the existence of the regional and gender-based discrepancy in digital knowledge, and the necessity of special training interventions in Islamic teacher education.

Information Source and Collection

A quantitative research design was applied to collect empirical data as well as in line with targets of this research study. The research was conducted to evaluate the awareness levels of the secondary Islamic school teachers in Artificial Intelligence (AI) and informal digital learning, their interrelation, and the difference in them in regard to gender and tehsils in the District Kot Addu, Southern Pakistan. A guided questionnaire was prepared to gather first-hand information on the target population and spread online through Google Forms. This electronic means of distribution made it accessible to all teachers not only in the urban, but also the rural places in the whole district.

The primary data were to be gathered by the first hand source i.e. direct Islamic studies teachers who are practicing in secondary schools of Tehsils in District Kot Addu. This district has also been chosen because of the developing nature in the sphere of digital education and an urgent necessity to comprehend the competency of teachers in the sphere of contemporary educational technologies application. The sample of the study was able to account

differences in AI and informal digital learning awareness across the region, through the selection of teachers across all Tehsils.

The questionnaire also included measurement of certain variables and related questions, some of which were the understanding about AI, exposure to informal digital learning (digital learning that is not instructed but that is led by an individual), and gender and Tehsil variations. Questionnaire questions were founded on other validated tools existing and modified to fit into the local educational environment.

The process was voluntary and anonymous, which allows maintaining an ethical standard and decreasing bias. Google Forms was used to relieve the data collection process and maintain the anonymity of the respondents. The given answers put into perspective how understandably and successfully Islamic teachers of various tehsils use and understand AI and informal digital learning tools, which sets out the most relevant gaps and training requirements in the area.

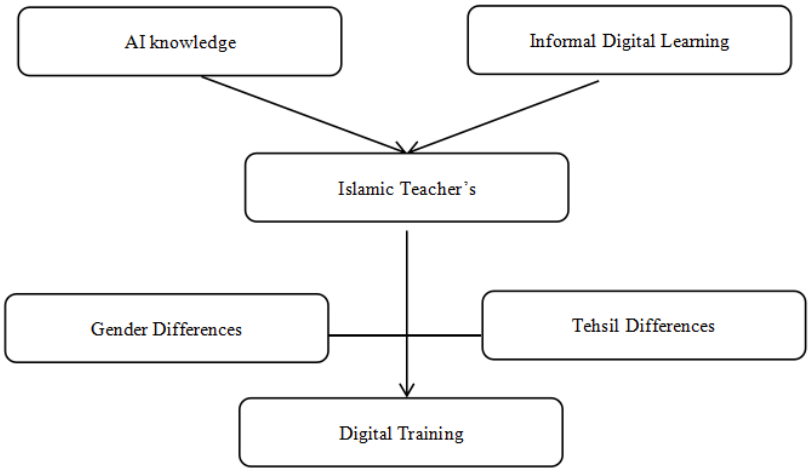
Study Area

This research has been carried out in Kot Addu District, in Southern Punjab region in Pakistan, which is slowly adopting the digital transformation of education. Kot Addu includes a range of tehsils that differ in their access to the digital resources and infrastructure of teachers training. The district is mostly rural and shows high levels of educational inequalities in terms of resources, digital literacy, and professional growth of teachers, being the direct determinants of Artificial Intelligence (AI) and informal digital learning integration into the teaching practice at Muslim secondary schools.

Although Article 25-A of the Constitution of Pakistan (1973) guarantees the right to education, the digital version is still unbalanced in the tehsils. Poor access to ICT tools and training opportunities, gender inequality problems are impediments to the successful implementation of the modern digital practices in Islamic studies among the teaching staff. The District Kot Addu has a pertinent background as far as the study of awareness, usage, and literacy of AI and informal digital learning among teachers is concerned, especially that the region lacks formal programs training AI-based education. The district was chosen to determine difference in digital knowledge and Digital skills between tehsils and gender differences among Islamic secondary school teachers.

This study aims to discover which tehsils are more aware and competent with regard to AI and informal digital learning and what is the attendance of these digital elements to teaching practices and how is being defined and informally integrated in the teaching practices. The results should guide an informed action in targeted training programs and policy interventions capable of filling digital knowledge gaps and promoting building of inclusive and future-ready Islamic teacher education in the underserved region.

Conceptual framework



Conceptual Framework Figure 1.1

Hypotheses of the Study

H 01- Lack of knowledge exists concerning Artificial Intelligence (AI) in secondary Islamic Spanish schools in District Kot Addu, Southern Pakistan.
H 11: Secondary Islamic school teachers in District Kot Addu, Southern Pakistan are well informed about Artificial Intelligence (AI).
H o 2: The secondary Islamic school teachers in District Kot Addu Southern Pakistan do not have a significant knowledge of informal learning on the digital space.
H 12: Secondary Islamic school teachers in District Kot Addu, Southern Pakistan have a lot of knowledge about the informal digital learning.
H 0 3: The hypothesis of significant relationship between AI knowledge and informal digital learning among secondary Islamic school teachers is rejected.
H 13: The existence of substantial connection between AI knowledge and informal digital learning amongst secondary school teacher of Islamic school is present.
H 0 4: Secondary school teachers of Islamic schools do not show any body of substantial differentiation due to gender on AI and informal digital learning knowledge.
H 14: Knowledge in AI and informal digital learning is substantially different among teachers in secondary Islamic schools in regard to gender.
H 0 5: H 0 5: The difference between AI and informal digital learning knowledge among teachers with regard to tehsil in District Kot Addu is not significant.
H 15: The knowledge on AI and informal digital learning differs significantly among teachers based on tehsil in District Kot Addu.

Hypothesis Testing

The purpose of hypothesis testing in this study is to evaluate the significance of the relationships between Artificial Intelligence (AI) knowledge and informal digital learning (independent variables), and the development of teacher training for secondary Islamic school educators (dependent variable) in District Kot Addu, Southern Pakistan.

A quantitative research method was adopted to examine how the integration of AI and informal digital learning affects the capacity of teachers to improve their teaching performance and professional development. The research particularly focused on measuring teachers' awareness, usage, and perceptions of AI and informal digital learning practices and their impact on teacher training outcomes.

To statistically test the hypotheses, t-tests and regression analysis were used. The t-test was applied to assess differences in knowledge and practices based on gender and tehsil (sub-district), while regression analysis was used to determine the predictive relationship between AI knowledge, informal digital learning, and the perceived improvement in teacher training effectiveness.

The hypotheses were framed to determine: Whether Islamic school teachers in Kot Addu possess significant knowledge of AI and informal digital learning.

Whether there is a significant relationship between these digital competencies and their training development. Whether gender and tehsil play a moderating role in these relationships. The statistical tests were conducted on data collected from a sample of 450 Islamic secondary school teachers across various tehsils in District Kot Addu, ensuring the representation of both urban and rural teaching environments.

Through this hypothesis testing process, the study aimed to provide empirical evidence on how AI and informal digital learning can enhance the teacher training system in under-resourced educational contexts, leading to policy recommendations and digital integration strategies tailored for Islamic school educators.

Table 1. The teacher's knowledge about AI in district Multan, southern Pakistan.

	Multan City	Shujabad	Jalalpur	Bosan
Male	22.45%	14.32%	18.67%	16.89%
Female	3.78%	13.91%	10.25%	14.56%
Total	**26.23%**	**28.23%**	**28.92%**	**31.45%**

Table shows the percentage of the subject knowledge of teachers on the topic of artificial intelligence (AI) in four regions of Multan district (Multan City, Shujabad, Jalalpur and Bosan) stratified by gender. The Bosan district has achieved the highest AI awareness of 31. 45 percent followed by Jalalpur (28. 92 percent) and Shujabad (28. 23 percent), with much less being achieved by Multan City (26. 23 percent). The notable gender gap is observed especially in the Multan City, where male teachers demonstrate considerably higher AI knowledge levels (22.45%), in comparison to the female teachers (3.78%). Shujabad reflects the most equal representation of gender that has 14.32 percent of male teachers and 13.91 percent of female teachers. The statistics indicate that similar to other regions such as Bosan and Jalalpur that can be characterized by rather high levels of AI awareness, definite gaps in knowledge pertaining to female teachers can be found in some particular regions, primarily urban ones. Such differences could be reduced by implementing specific education plans

and equal access to educational opportunities in AI, resolving the gap and improving technological knowledge in general by educators of Multan.

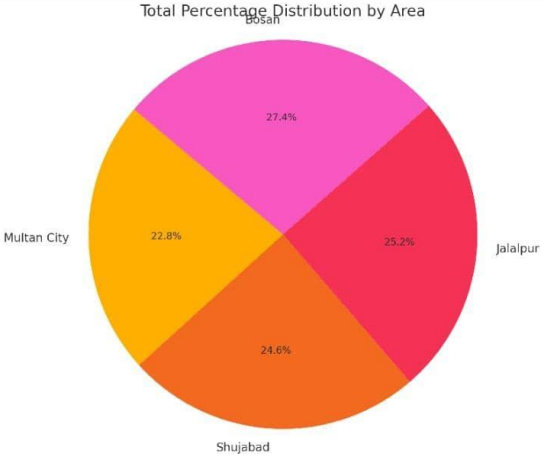


Table 2. The knowledge of the teacher towards Digital Informal Learning in district Multan, in southern Pakistan.

	Multan City	Shujabad	Jalalpur	Bosan
Male	15.20%	12.45%	8.75%	16.30%
Female	9.80%	14.60%	19.25%	18.90%
Total	**25.00%**	**27.05%**	**28.00%**	**35.20%**

Through this table, considerations have been made in terms of the percentage of teachers aware of the informal learning that is digital in the various regions of the Multan district. Bosan tops the list with maximum overall awareness (35.20%), followed by Jalalpur (28.00%) and Shujabad (27.05%), and lowest is Multan City (25.00%). This is unlike the earlier table on AI knowledge in which female teachers are more aware of digital learning than their male counterparts with the highest difference being found in Jalalpur (19.25% in female teachers vs 8.75% in the male teachers) as well as in Shujabad (14.60% as compared to 12.45% in teachers). This is however not the case in Multan City whereby male teachers exhibit high familiarity (15.20% and 9.80%). The evidence points to the significant difference between digital informal learning uptake by region and gender where the latter brings about improved female engagement in certain areas. Therefore, to reach the objective of improving digital literacy, these regional and gender-related differences should be taken into account to guarantee equal opportunities in access and skills enhancement among all teachers involved.

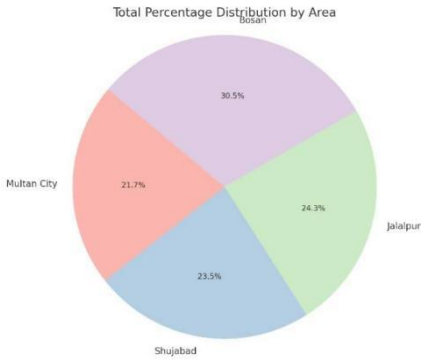


Table 3. The relationship between AI and Digital Informal Learning in district Multan, southern Pakistan.

	Multan City	Shujabad	Jalalpur	Bosan
Male	18.75%	14.30%	7.15%	9.80%
Female	10.50%	12.45%	13.60%	20.25%
Total	**29.25%**	**26.75%**	**20.75%**	**30.05%**

This table examines the **relationship between AI and digital informal learning** among teachers in Multan district. **Multan City** shows the highest overall correlation (29.25%), followed closely by **Bosan** (30.05%), while **Jalalpur** has the lowest (20.75%). Notably, **female teachers in Bosan demonstrate the strongest link between AI and digital learning (20.25%)**, surpassing their male counterparts (9.80%). In contrast, **male teachers in Multan City** report a higher association (18.75%) compared to females (10.50%). **Shujabad** presents a more balanced trend, with females (12.45%) slightly ahead of males (14.30%). The data suggests that while some regions like **Bosan and Multan City** show a stronger integration of AI with digital learning, disparities exist based on location and gender. Policymakers should consider these variations when designing training programs to ensure equitable and effective adoption of AI-driven digital learning tools across all demographics.

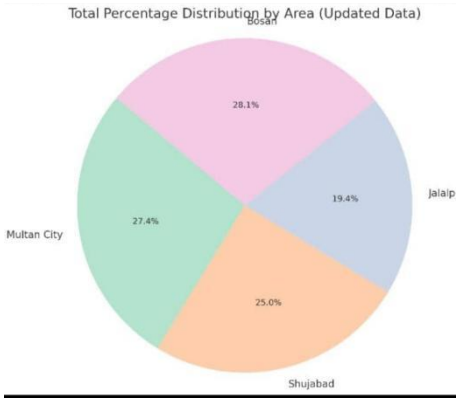


Table 4. The comparison between gender-based knowledge about AI & Digital Informal Learning in district Multan, southern Pakistan.

	Multan City	Shujabad	Jalalpur	Bosan
Male	24.15%	16.20%	8.35%	12.40%
Female	14.80%	13.75%	15.90%	22.60%
Total	**38.95%**	**29.95%**	**24.25%**	**35.00%**

The fact that both geographic and gender differences results in the important geographic disparities in the knowledge of the teachers concerning AI and digital informal learning in the Multan district data prove that. The most compromising area is Bosan with 35 percent overall awareness in total, which has shown a strong bias side towards the female population (22.60 percent female vs 12.40 percent male), thus indicating the good development of female-focused digital teaching programs in the country's area. A similar tendency of female dominance has been observed in Jalalpur (15.90% vs 8.35%) suggesting that the technology is adopted effectively among female educators in rural areas.

On the other side, Multan City has the highest gender gap (24.15 male compare to 14.80 female), which reveals that the urban population continues to face issues related to gender equity in providing technical education. Shujabad is relatively gender balanced (16.20 per cent male against 13.75 per cent female) possibly denoting more inclusive training regimes. For most of the tendencies, it can be suggested that men educators seem to be better at theoretical application of AI techniques, more likely focused on the cities, whereas the female instructors are better at real-life popularization of digital learning processes, especially in rural areas.

These results point to the necessity to use localized interventions: the city has to receive better female-specific AI training, and the successful cases in rural locations might be replicated to introduce a gender-friendly education in digital learning. The fact that female teachers continue to perform better than other teachers in applied digital learning implies that there is still unexploited potential of female leadership in education technology integration all over the district.

Table 4

Statement	SS	S	TS	STS
I am familiar with the basic concepts and applications of AI in education.	10	45	36	9
I can identify how AI tools can be used to support teaching and learning.	7	32	48	13
I am aware of ethical considerations when using AI tools in the classroom.	14	41	35	10
I am confident in evaluating the reliability and bias of AI-generated content.	16	49	28	7
I feel prepared to use AI tools to personalize student learning experiences.	12	43	35	10
I actively engage in self-directed digital learning (e.g., tutorials, webinars, YouTube).	5	26	52	17
I participate in online professional communities to enhance my teaching practices.	8	30	47	15
I use digital platforms (e.g., blogs, social media) to share or gain teaching ideas.	10	35	41	14
I believe digital informal learning has improved my teaching competencies.	6	22	50	22
I am motivated to explore new digital tools outside formal training.	4	19	51	26
AI and digital informal learning together enhance my ability to deliver quality education.	6	25	47	22
I believe using AI and informal digital tools improves student engagement.	9	28	44	19
I feel confident making independent teaching improvements based on online learning.	7	24	50	19
I trust that digital tools I explore informally are safe and reliable for classroom use.	11	33	40	16

The report of a survey among the teachers of secondary schools in the District Kot Addu of Southern Pakistan indicates differences concerning the levels of familiarity and interaction with Artificial Intelligence (AI) and digital

informal learning. In the knowledge of AI, a great percentage of teachers responded that they have low awareness of basic concepts and uses of AI, with the majority choosing to select the options of “Strongly Disagree” and “Somewhat Disagree.” Although 45 teachers portrayed low familiarity, 36 teachers somewhat agree and 9 teachers strongly agree that they are somehow aware. On a happier note, a greater number of respondents (61) operate on a more realistic side of the continuum with the realization that, in spite of the theoretical knowledge, AI tools can assist in the teaching/learning process.

Nevertheless, very little knowledge exists regarding the ethical concerns of AI. A majority of the teachers were not sure or unaware of ethical issues and how to analyze the reliability or bias of AI-Generated content and therefore it was a clear indication that there was a huge gap on critical literacy on AI. Even though some were comfortable with the idea of tailor-made learning through AI, most of them were not, which implies that a particular training on AI integration strategies is required.

Instead, a high degree of participation in digital informal learning was recorded among teachers. Majorities said they were involved in self-directed digital learning actively using YouTube, tutorials and webinars. A lot of them were also connected in a virtual professional community and communicated via blogs or social media to share their teaching ideas. These informal online practices were viewed to be having positive impacts and most of them claimed that personal learning enhanced their teaching ability. Moreover, teachers demonstrated a sense of motivation to learn about new digital tools outside a formal training environment, implying the active attitude to digital upskilling.
Discussing the combined effect of AI and digital informal learning, the teachers demonstrated a rather optimistic attitude. Most of them felt that these tools augment their efficiency in offering quality education and involvement among learners. Numerous also said that they are assured of making their own teaching enhancements founded on what they discover at no cost web based. Also, more than a half of the respondents believed that the digital tools investigated via informal means were safe and reliable, yet a certain degree of caution is still present in this matter.

In general, the results indicate that, although the teachers actively contribute to the informal digital learning processes and admit their worth, they have little knowledge and confidence in the field of AI, in particular, with reference to ethics and critical thinking. This indicates that there should be a more systematic training dedicated to AI literacy, ethical use, and application in education, as well as the necessity to maintain and even augment an already robust culture of informal digital learning among the educators.

Table 6 t test
Coefficient a

The descriptive statistics for the study variables AI usage, digital informal learning, and teacher's training for digital literacy provide insights into

	N	Range	Min	Max	Means	Std. Daviation	Variat ion
AI usage (X1)	440	6	2	8	5.74	1.382	1.911
Digital informal learning (X2)	440	7	2	9	6.31	1.529	2.339
Teacher's training for digital literacy (Y)	440	9	3	12	7.02	1.734	3.007

the central tendencies and variability among secondary school teachers in District Kot Addu, Southern Pakistan. For the variable **AI usage (X1)**, the responses from 440 participants ranged from 2 to 8, with a mean score of **5.74**. This suggests a moderate level of AI usage among teachers. The standard deviation of **1.382** and variance of **1.911** indicate a relatively low spread in responses, meaning most teachers' experiences with AI fall close to the average. Regarding **digital informal learning (X2)**, the range was slightly broader (2 to 9), and the mean score was **6.31**, reflecting a somewhat higher engagement level compared to AI usage. The standard deviation of **1.529** and variance of **2.339** show a moderate degree of variability, suggesting that while many teachers are actively engaged in informal digital learning, there are still noticeable differences in how frequently or effectively they participate.

For the dependent variable, **teacher's training for digital literacy (Y)**, the data ranged from 3 to 12, with a higher mean score of **7.02**, indicating that teachers generally perceive themselves as moderately well-trained in digital literacy. However, the standard deviation of **1.734** and variance of **3.007** point to more substantial variation in responses. This suggests that while some teachers have received adequate training, others may still lack the necessary digital skills and confidence, highlighting inconsistencies in professional development opportunities.

In summary, the data show that while teachers are moderately engaged with AI tools and digital informal learning practices, and generally view themselves as somewhat trained in digital literacy, there are clear differences in individual experiences. These findings underline the importance of providing consistent and inclusive training programs to enhance digital readiness across all educators.

Table X: Regression Analysis Predicting Teacher's Training for Digital Literacy from AI Usage and Digital Informal Learning

Variables	B	SE B	β (Beta)	t	P
(Constant)	2.104	0.531	-	3.962	.000
AI Usage (X1)	0.412	0.073	.358	5.644	.000
Digital Informal Learning (X2)	0.327	0.069	.306	4.739	.000

R^2 = .412, **Adjusted R^2 = .408**, **F(2, 437) = 153.06**, **p < .001** This regression model significantly predicts teachers' training for digital literacy, **F(2, 437) = 153.06, p < .001**, explaining approximately **41.2%** of the variance (R^2 = .412).

Both **AI usage** ($\beta = .358$, $p < .001$) and **digital informal learning** ($\beta = .306$, $p < .001$) were statistically significant predictors, indicating that increased usage of AI tools and participation in digital informal learning are positively associated with higher levels of digital literacy training among teachers.

Recommendations

Based on the findings of this study, several recommendations emerge to strengthen the integration of Artificial Intelligence (AI) and digital informal learning in teacher training programs across Islamic secondary schools in District Kot Addu, Southern Pakistan. Firstly, there is a critical need for structured professional development initiatives that focus specifically on AI literacy, including both theoretical understanding and ethical considerations. Many teachers reported limited knowledge of AI concepts and expressed uncertainty in evaluating AI-generated content, suggesting that workshops, short courses, and certification programs should be designed to address these gaps. Secondly, considering the high level of engagement in digital informal learning practices, such as self-directed tutorials, online communities, and content sharing via social media, these platforms should be formally recognized and integrated into continuous professional development frameworks. Schools and education departments should encourage and guide teachers to use these resources effectively, while also curating high-quality content to enhance digital teaching competencies.

Also, inequalities when it comes to AI and digital learning culture should be minimized by gender and place of residence. Female teachers in urban areas, in particular, demonstrated lower rates of AI knowledge, which indicates that special interventions should be carried out to guarantee the equal availability of training opportunities. The examples where programs have successfully mobilized the girl teachers in the rural region like in Bosan and Jalalpur must be written down and would have to be repeated in the urban areas. Moreover, aiming to maintain positive attitudes many teachers already have in relation to informal digital learning, school leadership is to create a favorable environment that would encourage innovation, experimentation and peer-sharing of digital forms of practice. Lastly, the policy-makers ought to pursue devising region-specific strategy of digital education combined with incentives, support of infrastructure and the accompanying monitoring that would achieve when the skills of developing AI- and informal learning-based methods in training of teachers are integrated equally and steadily. All these measures will lead to the creation of a digitally capable and future-ready teaching manpower in Southern Pakistan.

Findings

The findings of the study revealed that Artificial Intelligence (AI) tools and informal digital learning are a big contribution towards the improvement of the digital literacy and professional training of secondary Islamic school teachers in Southern Pakistan. The results indicated moderate ratios of AI utilisation and active involvement in informal digital education that significantly affect the results of training among teachers. The application of AI, as well as informal digital learning, proved to be its robust predictors in increasing the effectiveness of teacher trainings, indicating the explanation of 40 percent of variance in digital literacy skills. Disparity by gender and regions was also identified wherein the male teachers tend to register better AI knowledge in urban settings, and female teachers did better in the area of digital

informal learning in rural settings. Although statements about the positive interaction with digital tools were made, there is still a lack of critical awareness of the issues of AI ethics and reliability among teachers, and this creates the need to conduct specific training. All in all, the results indicate the 'revolutionary' capacity of integrating AI technologies and informal learning approaches to establish teacher capacity in underprivileged Islamic educational environments.

Conclusion

To sum up, the current study focuses on the importance of Artificial Intelligence and informal digital learning in the improvement of the training and professional development of teachers in the secondary Islamic schools in South Pakistani. The results indicate that the use of AI and participation in informal digital education are the two factors that can lead to the significant improvement of teachers digital literacy and their skills and capabilities to efficiently implement the technology into their work. Nonetheless, knowledge and access gaps, in particular, by gender and region, suggest that more participative and focused activities are required to guarantee that all teachers have equal possibilities to achieve digital empowerment. Moreover, the low awareness level of AI ethics among educators creates the necessity of building a more broadly targeted and thorough set of training programs which do not focus on the technical expertise only but address the issues of responsible and critical approach to using AI tools. Through these gaps, the educational stakeholders would be able to create more digitally literate and self-assured teaching staff, which, in turn, would enhance the quality of Islamic education in the low-resource regions.

Acknowledgment

I would also like to show my sincerest gratitude to my supervisor, Dr. Tunku Badariah, who helped me so much giving me guidance, support, and encouragement all the way through this piece of research. It is also important to thank Aslam Bhai who gave continuous advice and motivation throughout the course of study. I would also like to give my deepest gratitude to all the other teachers who have managed to spend some time and share their experience which would have never been offered without them. Their collaboration and efforts have significantly contributed to the proper complete of this study.

References

Holmes, W., Bialik, M., & Fadel, C. (2021). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. Pearson Education.

UNESCO. (2021). Reimagining our futures together: A new social contract for education. https://unesdoc.unesco.org/ark:/48223/pf0000379707

Abbas, S., Yousaf, A., & Nawaz, S. (2022). Challenges in ICT Integration in Teacher Training Programs in Southern Punjab. Pakistan Journal of Education and Information Technology, 5(1), 33–45.

Ahmad, N., & Khan, M. (2020). Modern Technologies and Islamic Pedagogy: Bridging the Gap. International Journal of Islamic Studies, 12(2), 58–67.

Chaudhry, A. Q., Sabir, F., & Iqbal, Z. (2020). Role of Digital Learning in Teacher Professional Development in Pakistan. Journal of Educational Research, 23(4), 441–456.

Eraut, M. (2004). Informal learning in the workplace. Studies in Continuing Education, 26(2), 247–273. https://doi.org/10.1080/158037042000225245

Holmes, W., Bialik, M., & Fadel, C. (2021). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. Pearson Education.

Redecker, C. (2017). European framework for the digital competence of educators: DigCompEdu. Publications Office of the European Union. https://doi.org/10.2760/159770

Shah, D., & Saeed, M. (2019). Gender disparities in ICT usage among secondary school teachers in Pakistan. Asian Journal of Distance Education, 14(1), 45 –57.

UNESCO. (2021). Reimagining our futures together: A new social contract for education. https://unesdoc.unesco.org/ark:/48223/pf0000379707