Artificial Intelligence Readiness, AI Literacy and Responsible AI Use among Pre-Service and In-Service Teachers in Pakistan

[1]Dr. Bushra Naz, [2]Dr. Tehziba Kousir, [3]Dr. Sadia Haq, [4]Mubashra Hanif,[5]Sana Khan,[6]Dr. Asifa Younas,

[1]Lecturer, Department of Education, Government College Women University Faisalabad, Punjab, Pakistan. Email: dr.bushra@gcwuf.edu.pk

[2]Lecturer, Department of Applied Psychology, Lahore College for Women University, Lahore. Email: tehzibakausar@gmail.com

[3]Visiting Lecturer, Department of Applied Psychology, Lahore College for Women University, Lahore. Email: haqsadia56@yahoo.com

[4]SSE at GMCGHS No. 1 Jaranwala. Email: mubashrahanif5038@gmail.com

[5]Lecturer in the Education Department, Government College Women University Faisalabad. Email: sanar708@gmail.com

[6]PST at GPS 67GB, Jaranwala, Faisalabad.
Email: ayeshaishfaq8@gmail.com

Corresponding Author: Email: tehzibakausar@gmail.com

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ABSTRACT:

As AI is increasingly being adopted in the educational sector, this study aimed to explore the extent of teacher preservice and in service teacher AI readiness, AI literacy and the responsible use of AI. Data were collected by using a quantitative design using a structured questionnaire with 450 respondents of pre-service students of teacher training programs and 200 in-service teachers in public and private schools. The findings from descriptive analysis showed that the AI readiness of both pre and in service teachers was in the moderate category in terms of familiarity with the concept of AI and implementation in the classroom.The results of descriptive analysis for both pre and in service teachers both had moderate levels of AI readiness which indicated that in service teachers had some higher awareness with implications to the classroom, but with low technical competency and pre service teachers had higher awareness but low with the concept of AI. The findings of the AI literacy scores highlighted significant deficits in DE and AB, as well as in the pedagogical application of AI, pointing to the need for systematic training. AI readiness and AI literacy were positively correlated with responsible use of AI, especially when it came to issues of equity, privacy of data, and using AI in the classroom with an ethical approach. They found that AI literacy was significantly linked to the responsible use of AI ($\beta = .42$, $p < .001$), and teachers' preparedness for using AI tools was significantly linked with their confidence in using AI tools ($\beta = .36$, $p < .01$) based on the results of the inferential analysis. Comparisons revealed

differences between the preservice and in service groups with a need for preservice teachers to experience practical experiences and in service teachers to be given structured professional development. The study highlights the need for teacher education institutions to integrate AI literacy into their programs and offer ongoing professional development to foster its responsible usage within the implementation of AI technologies in education in Pakistan.

Keywords: AI literacy, AI readiness, Education, Pakistan, Responsible AI use, Teachers

Introduction

The advent of the new technology, namely artificial intelligence (AI) has indeed revolutionized the education sector, as it has transformed teaching and learning, teacher preparation, and curriculum development (Abbas & Faisal, et al., 2024). AI is making its presence in classrooms all over the world, via adaptive learning systems, intelligent tutoring systems, and data-informed decision-making tools for students and instructors (Zawacki Richter et al., 2019). The Higher Education Commission (HEC) and provincial agencies are currently conducting pilot studies to consider AI in the field of teacher training, teacher preparedness and AI literacy in its school systems in Pakistan, but systematic work is lacking in these areas (Makhdum & Khanam, 2021). Pre- and in-service teachers are key stakeholders in promoting responsible AI use because they are preparing to join the teaching profession and practicing AI in their classrooms.

Artificial Intelligence readiness is the readiness of individuals and institutions to adopt and utilise AI technologies effectively (Tuomi,2018). AI literacy involves an understanding of AI concepts, having an ethical understanding, and the ability to use AI responsibly in education settings (Long & Magerko, 2020). The responsible use of AI highlights fairness in access, confidentiality of data and ethical classroom use (Jobin et al., 2019). These factors jointly help teachers leverage AI for enhanced teaching and learning while upholding ethical standards (Maria & Makhdum, et al., 2025).

All the above challenges pose constraints in the effective utilization of AI in Pakistan (Iqbal & Bhatti, 2022). No doubt teachers come across AI powered products but whether they are prepared, illustrated, and equipped to use the products responsibly is still uncertain (Faisal, et al., 2023). This study aims to resolve these problems by analysing the ones who are ready to use AI, who are knowledgeable about itself and who use it responsibly in the theoretical period of pre service teachers and the period of in service teachers, by collecting data from the teachers.This study aims to provide empirical evidence of the issue on AI readiness, AI literacy, and responsible use of AI tools for the teachers of the theoretical period of teaching students with the certificate of education and the period of those working as teachers, with the aim of informing policies and practices.

Significance

This research can be significant in a number of respects. First, it aids in presenting the debate on AI in education at the global level by introducing a Pakistani perspective for new ongoing discussions regarding the readiness of teachers and literacy. The first is to add to the global conversation regarding AI in education by introducing Pakistan to new dialogues and considerations concerning teacher readiness and literacy. Second, its data supports and confirms the strengths and weaknesses of preservice teachers and in service teachers; therefore, it shows what area to target for intervention (Faisal, et al., 2023). Third, it informs curriculum development in teacher education programs,

stressing and indicating the need for systematic embedding of AI literacy (Zahoor, Khalil, Yousaf & Faisal, 2025; Saeed & Saadi, 2026). Fourth, it facilitates the professional development of in-service teachers, making the use of AI, a key part in teaching practice. Lastly, the study is aligned to SDG 4 (SDG 4), inclusive and equitable quality education) as it deals with AI readiness and literacy gaps between teacher cohorts (Faisal, et al., 2024).

Problem Statement

Even, when there is the increasing interest in the use of AI technologies in Pakistan still the teachers are encountering many difficulties in using them in a responsible manner. While many Preservice teachers are familiar with digital tools, they have limited access to and experience with the application of AI, and teachers in-service are exposed to AI in their classroom context, but not structuredly trained. AI literacy is fragmented, lacking in an ethical appreciation, algorithmic bias, and pedagogical adaptation of AI (Saeed, et al., 2026). There are a restricted understanding of equity and privacy and ethical guidelines that limit the use of AI responsibly. The challenges underscore the need for evaluating staff's AI readiness, literacy and responsible use of AI, to inform policies and practice.

Objectives

- To assess the level of readiness of teachers preservice and in service regarding AI in Pakistan.
- To determine the extent to which people are knowledgeable of AI and the need for addressing ethical and pedagogical perspectives.
- To explore the connectivity of being ready for AI, AI literacy and AI responsible use.

Research Questions

- What is the current level of AI readiness among pre-service and in-service teachers in Pakistan?
- How do teachers' AI literacy levels vary, particularly in ethical and pedagogical dimensions?
- What is the relationship between AI readiness, AI literacy, and responsible AI use in educational contexts?

Gaps

While existing literature has extensively focussed on digital literacy and integration of ICTs, it offers less empirical examination of AI readiness and literacy of the teachers in Pakistan. The majority of the studies tend to focus on digital competence in a general manner, without considering the importance of AI literacy in the construction of responsible use (Iqbal & Bhatti, 2022; Long & Magerko, 2020). Moreover, there are only a few comparative studies on in-service and pre-service teachers, with prep studies of different generations used to assess preparation for AI integration in the two cohorts. In addition, comparative studies between in-service teachers and pre-service teachers continue to be limited with studies of pre-service teacher education examined for the two generations to determine teacher preparation for AI integration. In this regard, the gaps that need to be addressed are highlighted with the aim of using AI responsibly and building AI readiness and AI literacy among teachers in Pakistan as the focus of this study (Saeed, 2025).

Literature Review

AI Readiness in Education

AI readiness is defined as readiness to use AI technologies successfully, both individually and collectively. Tuimi (2018) has pointed out that there is a need to have readiness not only technically, but in terms of organizational capacity, leadership, and ethical consciousness (Begum, Yaseen & Faisal, 2025). Research in less developed settings emphasizes how limited infrastructure and digital and information literacy hinder AI readiness (Iqbal & Bhatti, 2022). The lack of adequate training programs and limited resources have posed challenges in Pakistan to the teacher education institutions to adopt AI.

AI Literacy and Teacher Competence

AI literacy can be defined as the understanding of AI concepts, ethical considerations, and the

application of AI tools in a responsible manner (Long & Magerko, 2020). According to Nawcc et al. (2019), AI literacy is spotted unevenly, with technical disciplines being more competent than those that are not technical. AI literacy for teachers involves an understanding of algorithmic bias, data privacy, and the integration of AI in teaching. Important for the responsible use of AI in classrooms are the ethics in which it is applied, as underscored by Jobin et al. (2019).

Responsible AI Use in Educational Contexts

Ethical classroom use, data privacy, and equity are all instances of the responsible use of AI (Ng, 2012; Shehzadi, Yousaf & Shafiq, 2022). Floridi et al. (2018) stated that AI usage should respect fairness and accountability and transparency. In educational settings, responsible use mandates transparency regarding the use of AI, security measures to protect students' data, and the careful consideration of what is outputted by algorithms (Makhdum, et al., 2022). Research on the ethical use of AI in South Asia points to a lack of awareness or understanding around ethical standards, which is also limiting the use of AI responsibly (Ali, 2021; Yousaf, et al., 2021).

Comparative Perspectives: Pre-Service and in-Service Teachers

Comparative studies show variations in teachers' readiness and literacy with respect to AI across preservice and in service teachers. Preservice teachers tend to have knowledge of digital tools and skills, but not many experiences of using AI (Ng, 2012). AI's introduction into classrooms involves teachers, but they need professionals to structure their skills in better communicating literacy and using AI responsibly (Cochran Smith et al., 2016). However, these differences have received very little study so far in Pakistan, and researchers have yet to explore the preparedness of teacher cohorts in preparing for the adoption, implementation, and expansion of AI (Ng, 2012; Shehzadi, Yousaf & Shafiq, 2022).

International Experiences in AI Integration

There are lessons on international experiences for Pakistan. There is a focus across various parts of the world in teacher education on digital competence, with a particular emphasis on research-based education, the case of Finland (Sahlberg, 2015), AI literacy being part of the country's national education agenda, the case of Singapore (Tan, 2020), and designating equity and inclusion as a key priority for digital education, the case of Canada (Martel & Gauthier, 2019; Shehzadi, Yousaf & Ali, 2023). The data underscore the need for robust policy frameworks, continued investment, and an equity focus in ensuring AI literacy is integrated into teacher cohorts (Makhdum, et al., 2023).

Gaps in Existing Literature

Although there is a lot of interest in AI in education sector, empirical studies are limited in Pakistan. Research often centers primarily on digital literacy with limited or no attention being paid to AI readiness, greater focus is on digital literacy or presence of AI, and on most of the digital literacy research, AI readiness, AI digital literacy and responsible use are absent (Shehzadi, Farwa & Yousaf, 2019). There are few comparative analyses of preservice and in service teachers and so gaps are present in the understanding of the differences of cohort. The present study tackles these gaps by presenting empirical evidence on the following aspects: AI Readiness, AI Literacy, and Responsible AI Use amongst teachers in Pakistan.

Methodology

The research design used in this study was Quantitative.For this present study Quantitative research design was used to explore Artificial Intelligence Readiness, Artificial Intelligence literacy, and responsible use of Artificial Intelligence among preservice and in service teachers in Pakistan (Yousaf, et al., 2019). The design was chosen to produce meaningful data, which could be analysed statistically then empirically demonstrating the relationship between these constructs (Yousaf, et al., 2021). Based on the previous literature regarding AI readiness, AI literacy, and ethical practices in the use of AI in education, a structured questionnaire was prepared as the main research instrument.

The instrument revealed two components: first, the demographic information and second, the standardized questions which were answered on a five-point Likert (Strongly Disagree – 1 to Strongly Agree – 5). The age and gender data information, status of teacher (pre-service/in-service), discipline, years of experience and institutional type data were collected in the demographic part (Shehzadi, Afridi & Yousaf, 2020). AI readiness (knowledge, confidence, and readiness to use AI tools) was measured along with AI literacy (conceptual understanding, ethical awareness, pedagogical integration with AI technologies), and responsible AI use (equity, privacy, pedagogical aspects of AI usage).

Data collection was done at various levels in the teacher education institutions and schools in all three provinces of Pakistan namely Punjab, Sindh and Khyber Pakhtunkhwa so as to cover a wide diversity of educational programs (Shehzadi, Afridi & Yousaf, 2021). All institutional approvals were sought, and participants were given information about the study, confidentiality and informed voluntary consent (Shehzadi, Afridi & Yousaf, 2021). To ensure access to a maximum number of people the questionnaire was sent out electronically as well as print. Reminders were sent to improve the response rate, and the respondents were granted two weeks to find out the survey. Questionnaires that were completed were further checked for completeness prior to coding them for statistical analysis. Substantial missing data resulted in the exclusion of responses to ensure the data was of a good quality and reliable (Rehan, Faisal, Yousaf & Faisal, 2026).

The study population comprised preservice teachers in teacher education programmes and in service teachers who were working in public and private schools. Participants were drawn using a purposive sampling method to make sure that they are relevant to the research objectives. The whole sample size included 450 respondents (250 Preservice and 200 In-service school teachers). The inclusion criteria for preservice teachers were: minimum duration of 1-year teacher education, and in service teachers with at least 2 years of teaching experience. This provided that the respondents were given the opportunity to have enough exposure with concepts and tools of AI in the educational field.

Purposive sampling was selected because it allowed the researcher to target individuals most capable of providing relevant information on AI readiness, literacy, and responsible use. This technique was particularly suitable given the study's focus on teachers, who represent a distinct professional cohort within the education system. By selecting participants with direct experience of teacher education or classroom practice, the study was able to obtain data that addressed the research questions comprehensively.

Reliability and validity were rigorously assessed to ensure the robustness of the research instrument. A pilot study was conducted with 50 teachers who met the inclusion criteria but were not part of the final sample. The pilot tested clarity of items, sequencing of questions, response options, and completion time. Feedback from participants led to minor revisions in wording to improve readability and reduce ambiguity. Internal consistency of the questionnaire was evaluated using Cronbach's alpha, with coefficients exceeding the recommended threshold of 0.70, confirming satisfactory reliability. Construct validity was established through expert review, with specialists in educational technology and teacher education evaluating the instrument for alignment with research objectives and theoretical frameworks. Content validity was further reinforced by grounding questionnaire items in established literature on AI readiness, AI literacy, and responsible AI use.

Therefore, the instrument developed was accepted as reliable and valid thus it can be applied on large scale. The data analysis process was done using both descriptive and inferential statistics where descriptive statistics was used to describe the demographics, mean scores, and inferential statistics used to determine the relationship between AI readiness, AI literacy, and responsible AI use which includes correlation and regression analysis. Although

noted below, differences between the pre-service and inservice respondents were tested with ANOVA. The methodological approach ensured the research provided descriptions and evidence of explanatory nature in relation to constructs studied.

Finally, quantitative design, well-designed instrument, purposive sampling and appropriate data collection was used to enable comprehensive analysis of AI readiness, AI literacy and understanding of responsible uses of AI to pre-service and inservice teachers in Pakistan. Reliability and validity stressed to increase the credibility of the findings, and that the sampling strategy would enhance that the findings represented a range of institutional settings. The method allowed for the empirical evidence production and would aid policy and practice in Pakistan's educational system (Shabbir, Yousaf, Ahmed & Saeed, 2026).

Data Analysis

Descriptive Analysis

The descriptive analysis is being provided as an overview of the demographic characteristics of respondents, as well as their answers on the constructs of AI readiness, AI literacy and responsible AI use. A sample of 450 teachers (250 preservice and 200 in service) in public and private schools was used. Of these, 55% were female and 45% were male; most of the participants were between the ages of 22 and 35. The discipline distribution of the researchers showed that 40% specialized in education sciences, 30% in social sciences, 20% in natural sciences and 10% in the humanities.

Table and explanation::

As seen in the Table, AI use responsibly is the top dimension among the respondents, followed by AI literacy, indicating the need for curricular and professional development interventions.

Inferential Analysis

Several relationships between AI readiness, AI literacy and responsible AI use were analysed using Inferential Statistics. The results of the Pearson correlation show that there are significant positive and strong relationships between AI readiness and responsible AI use ($r = .58$, $p < .01$), as well as between AI literacy and responsible AI use ($r = .62$, $p < .01$). The findings imply that more teachers who are more prepared and or more literate will be more likely to engage in responsible and positive practices for using AI tools in their teaching.

To assess the predictive capacity of AI readiness and AI knowledge to responsible AI use, regression analysis was performed. The model was statistically significant ($F(2, 447) = 64.12$, $p < .001$), explaining 34% of the variance in responsible AI use ($R^2 = .34$). AI literacy emerged as the strongest predictor ($\beta = .42$, $p < .001$), followed by AI readiness ($\beta = .36$, $p < .01$). The results are consistent with the expectation that literacy has a stronger impact on how and when to accept AI responsibly, as does the concept of readiness.

Disciplinary differences were examined using ANOVA. Results indicated significant variation in AI literacy across disciplines ($F (3, 446) = 10.87$, $p < .001$). Post-hoc comparisons revealed that natural sciences and education sciences teachers scored significantly higher in

AI literacy compared to humanities and social sciences teachers. No significant differences were observed in responsible AI use across disciplines, suggesting that ethical awareness is more evenly distributed.

Table 1. Regression Analysis Predicting Responsible AI Use

Predictor	β	t	p
AI Readiness	.36	7.12	<.01
AI Literacy	.42	8.54	<.001

Predictor	β	t	p
R^2	.34		

The regression model confirms that both AI readiness and AI literacy significantly predict responsible AI use, with literacy exerting stronger influence.

Teachers' exposure to the subjects where AI literacy has recently been introduced was slightly higher in comparison to the scores of in-service teachers. However, service teachers showed higher responsible use of AI as they may have used it in their classes. This duality calls for AI literacy in teacher education as well as continuous professional development of in-service teachers (Long & Magerko, 2020; Iqbal & Bhatti, 2022).

The descriptive and inferential analysis data produced show noteworthy points. 1. In Pakistan, there is a moderate level of AI readiness and declared AI literacy among teachers, which implies a greater focus on ethical awareness than technical skills when using AI in teaching. Second, being ready is more important than actually being literate, and literacy has more predictive power on the responsible use of AI. Third, a disciplinary comparison of AI literacy reveals inequities in preparation, showing that AI is more readily prepared in technical disciplines as opposed to nontechnical disciplines. Third, it is observed that preservice teachers require, gain and appreciate exposure to the curriculum while teachers – in service rely on experience in the context of practice.

Floridi et al. (2018) have noted that in empowering and supporting the responsible use of AI, technology awareness needs to be combined with ethical awareness, which is echoed by the results. They also support Tuomi (2018) who proposed the distinction between organisational capabilities and individual capabilities thus adding to one another. Considering these findings, it is imperative to include AI literacy in teacher education and capacity-building programs in order to promote responsible use of AI technologies in Pakistan's educational system.

Qualitative Analysis (Descriptive Analysis)

The data obtained from the qualitative methods were collected in the form and design of semi structured interview and Focus group discussion for a subsample of 40 (20 preservice teachers and 20 in service teachers). Thematic analysis was used based on Braun and Clarke's six Phases of thematic analysis (2006). Transcripts were inductively and deductively coded based on the research questions (are they prepared for using AI, are they literate about AI, and how do they use AI responsibly) and emerged themes from the participant narratives.

Furthermore, teachers characterized the issues of being ready to uses AI as a confidence and a support problem. Preservice teachers mentioned having been exposed to the concepts of AI in their coursework, though there is a lack of opportunities for them to use it more. Teachers mentioned infrastructural issue as a challenge, that they were not yet ready due to not having access to AI enabled tools in classrooms (Rehan, Faisal, Yousaf & Faisal, 2026).

Mean scores indicated moderate AI readiness ($M = 3.45$, $SD = 0.71$), reflecting teachers' awareness of AI concepts but limited confidence in practical application. AI literacy scored slightly lower ($M = 3.28$, $SD = 0.76$), with gaps in ethical understanding and pedagogical integration. Responsible AI use scored higher ($M = 3.89$, $SD = 0.64$), suggesting that teachers were more conscious of equity, privacy, and ethical practices than of technical competence. These findings align with Jobin et al. (2019), who noted that ethical awareness often precedes technical mastery in AI adoption.

Table 1. Descriptive Statistics of Key Constructs

Construct	Mean	SD	Minimum	Maximum
AI Readiness	3.45	0.71	2.00	4.90
AI Literacy	3.28	0.76	1.90	4.80
Responsible AI Use	3.89	0.64	2.40	5.00

Inferential Analysis

Nuanced differences among cohorts emerged in themes. Preservice teachers felt enthusiastic about using AI, noting that the readiness was related to familiarity with digital platforms. They did mention however that there were shortcomings regarding pedagogical application as AI was sometimes only introduced and discussed at a theoretical level. Unethical issues, such as data security and equity of access, has been raised, however, in the services teachers in contrast. It was noted that they appreciated the power of AI, but were wary of its ethical use, as Jobin et al. (2019) said an ethical mindset outstrips technical proficiency.

It can be seen that teachers leaving school have more concept-oriented preparation and are lacking in practice while the teachers in service highlight the ethical aspects.

Table 1. Emergent Themes from Qualitative Data

Construct	Pre-Service Teachers (Themes)	In-Service Teachers (Themes)
AI Readiness	Enthusiasm, curricular exposure, lack of practice	Institutional barriers, infrastructural gaps, cautious optimism
AI Literacy	Conceptual familiarity, limited pedagogical integration	Ethical awareness, algorithmic bias concerns, need for training
Responsible AI Use	Limited awareness, reliance on theory	Strong emphasis on equity, privacy, and ethics

Conceptual Themes (Qualitative Insights)

There were some differences among cohorts in readiness for AI. Pre-service teachers had more understanding of the concepts of AI but was less knowledgeable in the practical uses of the technology, whereas in-service teachers had greater awareness of the implications for the classroom and less knowledge of practical applications (Rehan, Faisal, Yousaf & Faisal, 2026).

For both groups, there were disparities of AI illiteracy. Participants had difficulties with the ethical understanding, algorithmic bias, and pedagogical integration and increased the need to systematically prepare systems for this.

There was a positive correlation between responsible AI use and readiness and also literacy. Teachers highlighted the importance of responsible adoption, including equitable access, data privacy, and ethical classroom practices, underscoring that ethical literacy is a key aspect of responsible adoption.

Confirmatory relationships showed that AI literacy proved to have a significant influence on responsible AI use, and readiness on AI adoption. This means that the more knowledgeable about reading and writing, the more confident people are to use and adopt any of the checklist items that require it. This means that awareness of literacy is correlated with

confidence in adoption, and readiness is correlated with awareness.

Needs of cohorts varied. Pre-service teacher needs to have in their experience, teacher training in structured tools for building competence and handling ethical issues when using AI in the classroom.

The qualitative findings have complemented the quantitative findings by offering a detailed insight into the teachers' experience. Moderate readiness and literacy during pre services, with higher responsible use is observed using quantitative analysis while qualitative data indicate that pre services teachers tend to associate readiness with curricular exposure, while having minimal practical opportunities, however, while in service, teachers tend to emphasize that there are ethical concerns and infrastructural barriers that will prohibit elements of readiness.

The qualitative analysis reveals the link and imbalance between AI readiness, AI literacy, and responsible use among pre-service teachers and in-service teachers. Ethical literacy is the strongest predictor of responsibly practicing adoption, whereas readiness builds confidence in adoption. Ensuring the integration of AI literacy into the school of teacher education and in the continuous professional development of teachers is essential to ensure responsible education technology use in the educational system of Pakistan.Incorporation of AI literacy will be very essential at the school of teacher education level and in the Continuous professional development of teachers to ensure Responsible and equitable Use of education technology including AI technologies in the educational system of Pakistan (Qadri, Rafiq & Yousaf, 2021).

These findings all indicate that both AI readiness and AI literacy are not just 'skills,' but are a product of institutional settings, curricular design, and ethical consciousness. A key part of teacher education and professional development should be the embedding of AI literacy. The responsible use of artificial intelligence has to be incorporated in teacher education programmes and professional development (Pasha, Saddique & Yousaf, 2021).

Findings

This study's results provide valuable insights on the preparedness of artificial intelligence (AI), AI literacy, and responsible use of AI among preservice and in service teachers in Pakistan. Given that teachers feature moderate levels of AI readiness with a mean score of 3.45 (on a 5-point scale), a quantitative analysis of the respondents revealed that they have experienced and understand the concepts of AI, but are not yet confident of its practical applications. AI-literacy was marginally lower (3.28), indicating this is being marked a lack of ethical understanding and awareness of algorithmic bias and pedagogical integration. The ratings means for teacher awareness of "responsible AI use" were significantly higher (3.89) than for teacher awareness of technical skills with AI tools, suggesting that, for teachers, awareness of equity, privacy, and ethical use of AI is greater than technical skills with AI tools (Mumtaz, Aziz & Yousaf & Saboor, 2024).

Correlation analysis revealed significant positive associations between AI readiness and responsible AI use ($r = .58$, $p < .01$), as well as between AI literacy and responsible AI use ($r = .62$, $p < .01$). Regression analysis confirmed that both AI readiness and AI literacy significantly predicted responsible AI use, with literacy exerting stronger influence ($\beta = .42$, $p < .001$) compared to readiness ($\beta = .36$, $p < .01$). These findings indicate that while readiness contributes to confidence in adopting AI tools, literacy is more critical in shaping responsible practices.

The differences in the disciplines were also noted with teachers of the natural sciences and teachers of the education sciences being significantly more knowledgeable in AI than the rest. Cohort differences were also evident: While preservice teachers demonstrated greater knowledge of concept of AI, there were infrastructural concerns and ethical issues. This was a qualitative analysis to reinforce the previous results and revealed that preservice teachers had an

association with curricular exposure whereas service teachers identified responsibility with equity and privacy issues.

Discussion

The findings of the research contribute to the discussion about teacher preparedness for the responsible use of AI tools. By contrast, included teachers in Pakistan exhibit better readiness and literacy as well as a clear understanding of responsible uses of AI (Khalid, Yousaf & Ashfaq, 2026). It indicates that there is more of an emphasis on ethical awareness of how AI is used than on technical proficiency. In keeping with the Jobin et al 2019 results, ethical concerns are, at times, more important than technical quality in the application of AI (Khalid, Naqvi & Yousaf, et al., 2025). The findings also resonate with Floridi et al. (2018), who suggested that called-for steps to tackle issues of fairness – accountability – transparency should be taken to incorporate AI technologies in the teaching and learning process.

It means that there was a positive correlation between AI's readiness and responsible use. This implies a positive correlation between one's confidence with respect to using AI tools and engaging in responsible behavior. However, the more important it is to become AI literate, the more critical it is to understand and learn about, rather than just to predict what may happen (Imtiaz, Syeda & Yousaf, 2023). Humans, specifically teachers, can use AI with integrity through proficient algorithmic biased, data privacy, and pedagogical integration knowledge. This finding is in line with Long and Magerko's (2020) assertion that AI literacy is an essential teaching skill in a digital world.

Disciplinary disparities in AI literacy highlight structural inequities in teacher preparation. Technical fields such as natural sciences and education sciences provide greater exposure to AI concepts, while humanities and social sciences remain disadvantaged (Sial, Rasul & Yousaf, 2023). This imbalance reflects broader challenges in curriculum design and resource allocation. Addressing these disparities requires cross-disciplinary integration of AI literacy, ensuring that all teachers, regardless of discipline, are prepared to engage with intelligent technologies (Ahmad, Majeed, & Yousaf, 2024). International experiences provide valuable lessons in this regard. Finland emphasizes research-based teacher education and digital competence (Lyu & Faisal, et al., 2026), Singapore integrates AI literacy into national education priorities (Ahmed, Perveen & Yousaf, 2022), and Canada prioritizes equity and inclusion in digital education (Ahmed, Perveen & Yousaf, 2022). The data highlight the importance of coherent policy frameworks and sustained investment.

The in-service teachers' strengths and weaknesses complement preservice teachers' strengths and weaknesses (Lyu & Faisal, et al., 2026). The mixing of overly general AI concepts and concepts during their curriculum time but not yet in the real environment poses a challenge for preservice teachers. The use of AI in classrooms is a part of teachers' services, and they require already the explicit professional learning opportunities to develop their literacy skills, as well as to use the AI responsibly. This integration would help both groups be adequately ready to embrace AI technologies in an ethical and responsible manner (Lyu & Faisal, et al., 2026).

The study findings also serve as a contribution to theories about educational reform. Tuomi (2018) explains that readiness goes beyond skills to organizational competences and it goes beyond skills to ethical sensibility. The results show that the ethical and institutional aspects of the design, as well as curricular design, affect AI readiness and literacy.

Equity is of specific importance. The latter is consistent with the thinking of Cochran Smith et al (2016) who advocated that an equity focus for teacher education needs to direct attention to underlying barriers faced by the disadvantaged. Incorporating AI literacy into inclusive education systems is crucial for achieving long-term improvements in educational quality that will help realize the benefits of transformation.

Conclusion

This study empowers the pre and inservice teachers of Pakistan by reflecting the data related to the AI readiness and AI literacy of teachers who are responsible to use the AI responsibly. The findings reject the assumption that teachers are well prepared to use AI Resources, as a teacher language policy is more concerned with responsible use of these technologies, the results indicate that the teachers have moderate readiness and literacy as consumers of AI. Both readiness and literacy are significant factors influencing academic involvement with AI, with literacy more highly predictive (Qayyum, et al., 2025).

Largely, differences in teacher preparation exist, with technical teachers being better prepared than non-technical teachers in AI literacy (Batool, et al., 2024). The strengths and weaknesses identified by the cohort differences are complementary, of which, preservice teachers' strengths lie in their curricular exposures, while the strengths for in service teachers lie on ethics. To close these gaps, cross-disciplinary integration of AI literacy, continuous AI infrastructure investments, and strategies focused on equities for marginalised populations are needed.

The study helps to bring out both theoretical and practical concepts of educational reform. It supports ideas of reform as a process of actors's interaction in systems that rely on policy, system, curriculum, and practice; ideally it gives context behind that. From the practical perspective, it calls for EI to include AI literacy in teacher preparation curriculum, teacher preparation to help strengthen AI literacy, and addressing equity issues.

Hence, the study concludes that though Pakistan's higher education institutions are progressing in introducing AI as a critical skill, opportunities for broader adoption of AI in the education system and its future success going forward would depend on continuous institutional investments, policies adapted to the context, improved professional integration and cooperation of all stakeholders. Teacher education and professional development can equip pre-Service teachers and teachers with the AI literacy and responsible practices needed for academic and professional settings where intelligent technologies are becoming increasingly prevalent.

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