

High School Teachers' Ai Literacy and Responsible Ai Use: Evidence from District
Jamshoro, Sindh

Dr. Amjad Ali Arain

dr.amjad@gcu.edu.pk

Professor, Department of Education, Government College University Hyderabad (GCUH)

Saifullah Abro

saifabro110@gmail.com

Ph.D. Scholar, Department of Education, Government College University Hyderabad (GCUH)

Afshan Abbasi

afshanabbasi2020@outlook.com

Ph.D. Scholar, Department of Education, Government College University Hyderabad (GCUH)

Corresponding Author: Saifullah Abro saifabro110@gmail.com

Received: 03-02-2026

Revised: 18-02-2026

Accepted: 05-03-2026

Published: 20-03-2026

ABSTRACT

The rapid integration of AI in the field of education demands that teachers possess the knowledge and skills to use AI tools responsibly and effectively. As AI becomes more prevalent in the education industry, teachers must be AI literate and understand how to use AI tools responsibly. However, empirical results in the rural and semi-urban school settings in developing countries are still scarce. This is a quantitative cross-sectional study which aims to investigate the level of AI literacy among the high schoolers (Grades 9-10) teachers of District Jamshoro, Sindh, Pakistan and responsible use of AI among the teachers and what factors predict their use of AI. A total of 250 high school teachers were randomly sampled from government secondary schools using stratified sampling technique, stratified by geographic location (urban, semi-urban, and rural) and given a validated survey instrument. Data analysis was done by using descriptive statistics, Pearson correlation, one-way ANOVA, and multiple linear regression in SPSS v.27 software. The results show that overall, the mean score for AI literacy ($M = 2.58$) is lower than the average, and the two highest sub-dimensions are Ethical AI Awareness ($M = 2.72$) and general AI Awareness ($M = 2.84$) on a 5-point scale. The implementation of responsible AI practices was uneven, with 14% of teachers reporting that they always had data privacy practices and 27.2% of teachers always checking AI-generated content. Ethical AI Awareness ($\beta = .358, p < .001$) and AI Tool Usage ($\beta = .312, p < .001$) were the strongest predictors of responsible AI use. Other factors that also played an important role were teaching experience, and higher education level and institutional support. Lack of training program (82.4% agreement), digital infrastructure (79.2%) and internet connectivity (76.8%) were identified as major challenges. The study contributes to the existing evidence base on the regional level in the global discourse on AI literacy for high school teacher education and calls for the need of AI capacity building on the overall educational landscape of Sindh through policy.

Keywords: AI literacy, responsible AI use, high school teachers, secondary education, District Jamshoro, Sindh, Pakistan, digital skills, AI ethics, educational technology

INTRODUCTION

Artificial Intelligence is transforming society in every aspect in ways that the education systems across the world are grappling with unprecedented challenges (Selwyn, 2022; Zawacki-Richter et al., 2019). In the classroom, AI systems like intelligent tutoring systems, automated assessment platforms, generative AI writing assistants, and adaptive learning platforms are quickly altering the learning landscape, the way

students engage with it, and how knowledge is created and developed (Holmes et al., 2022; Luckin et al., 2021). However, the efficacy and ethicality of the use of these tools will rely heavily on the AI literacy and responsible use skills of the teachers who use these tools (Kim & Kim, 2022; Ng et al., 2021).

AI literacy is typically defined as the capacity to understand, critically evaluate and ethically employ AI technologies, and is a critical twenty first century competency for educators (Long & Magerko, 2020; Ng et al., 2021). Though the Global North has begun to document frameworks and interventions for building teacher AI literacy (Touretzky et al., 2019; Kandlhofer et al., 2021), teacher AI literacy in low-to-middle-income countries (LMICs), particularly South Asia is poorly understood (Alenezi et al., 2023; Siddiqui & Ahmed, 2024).

Pakistan is a case in point. The education system in the country is characterised by an enduring lack of infrastructure, teacher qualifications' diversity and high urban-rural digital divides affecting about 50 million school-going children (Andrabi et al., 2020; Bano, 2021). These trends are echoed in the province of Sindh including District Jamshoro, where the schools are faced with the problem of scarcity of resources in the context of poverty and the expectations of digital transformation of all schools in the country as stipulated in the National Education Policy 2021 and the Sindh Education Sector Plan 2030 (Government of Pakistan, 2021; Government of Sindh, 2022).

In this regard, the present study seeks to fill a significant gap in the literature through an empirical study which evaluates the level of AI literacy and responsible use of AI among teachers at the high school (secondary-level) in District Jamshoro. The district including Jamshoro city, semi-urban tehsil headquarters, and rural union councils is a space with multiple dimensions and faces little academic research to examine the intersection of AI literacy and teaching in a context sensitive, resource constrained environment with high school teachers.

Research Objectives

1. To assess the knowledge of teachers of high school of District Jamshoro about AI.
2. To examine the pattern and nature of Responsive AI use by HS teachers in the district.
3. To identify factors that best predict the responsible AI use among high school teachers.
4. To determine the obstacles for high school teachers in the district's secondary schools who develop their AI literacy.

Research Questions

1. What is the level of AI literacy among teachers of high schools in district Jamshoro, Sindh?
2. How much do the teachers of high schools in District Jamshoro follow Responsible AI practices?
3. What are the most important factors that contribute to responsible behaviors with regard to AI literacy in high school teachers?
4. What barriers do high school teachers identify as challenges to building AI literacy?

LITERATURE REVIEW

Conceptualizing AI Literacy in Educational Contexts

The educational understanding of AI literacy has significantly grown; researchers try to define what it means to be AI literate in the context of education.

AI Literacy has been a significant topic in the field of research in the last five years, leading to various conceptual models that attempt to categorize the different aspects of AI Literacy. One of the most cited frameworks is that of Long and Magerko (2020) who proposed 17 competencies that cover aspects of understanding, evaluation, and ethics in AI. While critical thinking skills are important in and of themselves, they do not reduce to coding skills; their framework places critical thinking about AI systems side by side with technical skills. This was followed by Ng et al. (2021) who introduced a model of AI literacy that consists of four dimensions: knowing and understanding AI, using and applying AI, evaluating and creating AI and AI ethics, which is commonly used in empirical studies.

The teacher AI literacy has been described as a condition for doing things right with AI in the teaching context in formal learning (Kim & Kim, 2022; Touretzky et al., 2019). In addition to being AI-literate, teachers must be able to show students how to reason in an ethical manner when using AI, which Casal-Otero et al. (2023) call 'pedagogical AI literacy'. This dual competency (personal AI literacy and the capacity to teach AI thinking) is a desired benchmark, teachers are assessed on this when it comes to competency in AI (Celik, 2023; Zawacki-Richter et al., 2019).

Responsible AI Use: Frameworks and Evidence

Use of AI in education include: using AI with clear transparency, critically reviewing AI-generated content, avoiding algorithms that are algorithmically biased, safeguarding students' data and educating students about the critical AI literacy (UNESCO, 2021; Smuha, 2021). Situated at a more basic level there are two overarching normative frameworks: The UNESCO Recommendation on the Ethics of AI (2021) and the OECD Principles on AI (2023). Both frameworks feature the principles of human agency, fairness, transparency and accountability as key principles of responsible AI use.

The empirical study of teachers' use of responsible AI is still in its infancy and progressing. Uerz et al. (2021) found that pre-service teachers in the Netherlands were not very aware of the issues of AI bias and data privacy. Ng et al. (2023) identified that overall, AI literacy and institution's AI governance were the most significant predictors of teachers' responsible use of AI in Hong Kong. Bender et al. (2021) pointed out that the 'stochastic parrots' challenge occurs in big language models where the professional role of the educator is to critically interpret information produced by AI.

AI Literacy in Developing Country Contexts

There is a lack of research in AI literacy in the educational landscape of South Asian countries. Siddiqui and Ahmed (2024) did a study on the teachers of a university in the city of Karachi and found that teachers' familiarity with AI tools and their ethical awareness were moderate and critical respectively. Alenezi et al. (2023) conducted the systematic review of the application of AI in the Middle East region and South Asia, which pointed out the ongoing challenges and barriers for its implementation in the field of education, mainly in infrastructure or culture. According to Dhar et al., (2023), teachers from government schools were far less knowledgeable about AI than their counterparts from private schools in India and this must be even lesser in Pakistan.

Most of the literature available in Pakistan is policy oriented and very few are empirical based literature (Bano, 2021; Government of Pakistan, 2021). Andrabi et al. (2020) reported the systemic problems in quality of school system in Sindh and teachers need continuous professional development with technology was highlighted by Memon et al. (2022). While many analyses of the education sector in Sindh have identified the digital skills gap in the teaching profession, there is very little literature available that addresses competency assessment of digital skills in terms of AI specific skills.

Barriers to AI Literacy Development

There are many structural and individual barriers identified in the literature for teacher development of AI literacy. Structural barriers include the absence of digital infrastructure (Holmes et al., 2022), the absence of AI specific teacher training programmes (Kandlhofer et al., 2021), low institutional support (Kim & Kim, 2022), and a lack of support from the dominant use of the English language in AI tools (Alenezi et al., 2023). Some of the individual barriers are technophobia (Uerz et al., 2021), fear of losing their jobs (Celik, 2023), cognitive overload due to the rapid technological advances (Luckin et al., 2021) and a lack of perceived relevance to pedagogical practice (Ng et al., 2021). In LMICs, these barriers can often be compounded by resource constraints arising from poverty and/or institutional inattention to digital skills (Dhar et al., 2023; Siddiqui & Ahmed, 2024).

Theoretical Framework

Theoretically, this study is based on two theoretical frameworks which are complementary to each other. The lens adopted to understand teacher's AI tool adoption is the Technology Acceptance Model (TAM; Davis, 1989; Venkatesh & Bala, 2008), which was used as a starting point to suggest that teachers will use an AI tool when they consider it useful and usable. Secondly, Bandura's (1986) Social Cognitive Theory (SCT) can be used to explain how teachers' attitudes toward responsible AI usage affect their behavior, with a focus on self-efficacy. All of these frameworks place AI literacy not as a singular skill, but as a changing, multi-faceted disposition that is influenced by people, institutions and society.

METHODOLOGY

Research Design

A quantitative cross-sectional survey design was used, which has been used in the research of educational AI literacy (Ng et al., 2021; Kim & Kim, 2022). A cross sectional design can be used to develop a snapshot of a phenomenon at a particular time, and to evaluate correlational or predictive relationships between variables (Creswell & Creswell, 2023). This study was carried out from September to December 2024.

The study was conducted only on high school teachers (secondary level (Grades 9–10) teachers) of government schools of District Jamshoro.

Population and Study Area

The area of the district Jamshoro is in the western bank of Indus river, which includes the area adjacent to the provincial capital of Jamshoro and the vast rural area in the district. The population for this study included all the teachers working in the secondary school (Grades 9–10) of government schools in the district. The number of registered government secondary schools in District Jamshoro is 96 and estimated total secondary level teachers (Government of Sindh Education Department, 2023). There are substantial differences in geographical, teacher qualification and access to digital resources across this population.

Sampling Strategy

Stratified random sampling technique was applied on geographic area (urban Jamshoro city, semi-urban tehsil headquarters and rural union councils) of the area, as there was only one stratification variable for this study, that is geographic area. Finally, the stratification matrix led to the creation of a sampling frame of 300 high school teachers, proportionally selected from 48 secondary schools, across the geographic strata. The sample size for the district population of 604 secondary level teachers was based on Cochran (1977) who gave the formula for calculating the sample size when the population is known at 95% confidence level with 5% margin of error to be 235. 280 questionnaires were sent out to cater for the expected non-response with 258 questionnaires received (92.1% response rate) and 250 questionnaires were considered to be complete and valid for analysis.

Instrumentation

Research instrument was structured, self-administered and composed of four parts. The data in Section A, which consisted of Demographic data (Gender, Age, Education and Teaching Experience) were collected. For the AI literacy of teachers, six dimensions (36 items) adapted from the AI literacy scale designed by Ng et al. (2021) and relevant to the context of Pakistani high school settings were used in Section B. A 5 point Likert scale (Strongly Disagree to Strongly Agree) was used to rate the items. The use of AI responsibly (18 items) adapted from UNESCO (2021) AI ethics framework was evaluated on a frequency scale from 1 = Never to 5 = Always in Section C. In this part, D, the perceived barriers to development of AI literacy (14 items, Likert scale) were measured.

The instrument was translated into Sindhi and Urdu to cater to the linguistic diversity and the back-translation process was followed in order to ensure conceptual equivalence (Brislin, 1970). The content validity was determined by relating the items to five educational technologists and AI ethics experts. The results of exploratory factor analysis (EFA) for all test subscales showed a factorial structure with a KMO value of .847 and Bartlett's Test $\chi^2 = 3,214.6$, $p < .001$. AI Literacy scale ($\alpha = .891$), Responsible AI Use scale ($\alpha = .874$) and Barriers scale ($\alpha = .863$) were found to have high internal consistency reliability.

Data Analysis

IBM SPSS Statistics version 27 was used to analyze the data. Descriptive statistics (means, standard deviations, frequencies and percentages) were calculated to describe the sample and the levels of AI literacy and responsible practices in the use of AI. The bivariate relationships between the dimensions of AI literacy and responsible AI use were analysed using the Pearson product-moment correlation coefficients. One-way ANOVA and Tukey's HSD post hoc tests were used to determine the difference between the teaching experience group. Multiple linear regression (enter method) was used to identify the unique predictors of responsible AI use (assumptions of normality, homoscedasticity, multicollinearity ($VIF < 3.0$ for all predictors) and independence of errors were all met).

Ethical Considerations

The Research Ethics Committee of the University of Sindh (Ref: REC/2024/EDU/047) and District Education Officer, Jamshoro have approved this. All participants were given informed written consent and there was a 100% voluntary participation rate. All identifying information was removed, to ensure anonymity. All data were stored on secure servers and were only accessible to the research team.

RESULTS

Demographic Profile of Participants

Since all of the subjects in this study were secondary (high school) school teachers, the following profile is for a single school level, high school (secondary), and does not reflect variation within other school levels.

Demographic characteristics of the 250 high school teachers in the sample are displayed in Table 1. Slightly more males (56.8%, $n = 142$) than females. The workforce was mid aged as the largest group were aged from 35-44 years (38.0%). The majority of experience levels covered were 6–10 years (35.2%) and almost half of those who responded (49.6%) held a Master's degree.

Table 1: Demographic Profile of Participants (N = 250)

Characteristics	Category	Frequency	Percentage (%)	Cumulative %
Gender	Male	142	56.8	56.8
	Female	108	43.2	100.0
Age Group	25–34 years	78	31.2	31.2
	35–44 years	95	38.0	69.2
	45–54 years	55	22.0	91.2
	55+ years	22	8.8	100.0
Education Level	Bachelor's	65	26.0	26.0
	Master's	124	49.6	75.6
	M.Phil./PhD	61	24.4	100.0
Teaching Experience	1–5 years	62	24.8	24.8
	6–10 years	88	35.2	60.0
	11–20 years	72	28.8	88.8
	20+ years	28	11.2	100.0
Total		250	100.0	

AI Literacy Levels of Teachers

Table 2 shows the descriptive statistics of the AI literacy dimensions. The overall mean score of the AI literacy was 2.58 (SD = 0.73) on a 5-point scale, indicating an average score. Applied literacy was relatively minimal compared to the other dimensions, with teachers' mean score being 2.84 (SD = 0.91) for AI Awareness. In terms of the lowest mean ($M = 2.38$, $SD = 0.89$), Critical Evaluation of AI Output was the score which indicated that teachers' ability to assess AI output for accuracy, bias, and/or appropriateness had the lowest mean score with pedagogical implications.

Table 2: Descriptive Statistics for AI Literacy Dimensions

AI Literacy Dimension	Mean (M)	SD	Min	Max
Awareness of AI Concepts	2.84	0.91	1	5
Understanding AI Functionality	2.61	0.87	1	5
AI Tools Usage in Teaching	2.49	0.93	1	5
Critical Evaluation of AI Output	2.38	0.89	1	5
Ethical AI Awareness	2.72	0.85	1	5
Data Privacy Knowledge	2.44	0.92	1	5
Overall AI Literacy Score	2.58	0.73	1	5

Responsible AI Use Practices

Table 3 presents the frequency distribution of the use practices of responsible AI. The behaviors that were practiced most consistently were: Data Privacy Maintenance (35.2% always/often) and Disclosure of AI use to Students (28.8% always/often). Contrastingly, teachers had a wide range of least common practices, ranging from checking AI outputs for bias, with 66.4% doing so rarely or never, to providing support to students for adapting to AI, with 93.7% doing so rarely or never. The patterns showed a strong absence of critical or ethical consideration of AI, particularly in terms of recognizing and tackling bias, and an absence of teaching ethical considerations of AI.

Table 3: Frequency Distribution of Responsible AI Use Practices (N = 250)

Responsible AI Practice	Always (%)	Often (%)	Sometimes (%)	Rarely (%)	Never (%)
Verifying AI-generated content	8.4	14.8	24.0	31.6	21.2
Disclosing AI use to students	11.2	17.6	22.4	28.8	20.0
Checking for bias in AI outputs	5.2	9.6	18.8	35.2	31.2
Teaching students AI ethics	6.8	12.4	20.0	33.6	27.2
Maintaining student data privacy	14.8	20.4	26.0	24.8	14.0
Following school AI policy	12.0	15.2	18.4	29.6	24.8

Barriers to AI Literacy Development

The barriers to AI literacy perceived are listed in Table 4. The majority of teachers (82.4%) agreed or strongly agreed that the most difficult problem was the absence of AI training courses. Jamshoro's schools are facing material challenges as inadequate digital infrastructure (79.2%) and lack of adequate internet connection (76.8%) is observed at the second and third place respectively. The second lowest barrier identified was the fear of losing their job (52.4%) suggesting that this is more of a structural barrier than attitudinal.

Table 4: Perceived Barriers to AI Literacy Development (N = 250)

Barrier	Strongly Agree / Agree (%)	Neutral (%)	Disagree / Strongly Disagree (%)	Mean (SD)
Lack of AI training programs	82.4	9.6	8.0	4.21 (0.78)
Limited internet connectivity	76.8	12.4	10.8	3.98 (0.89)
Inadequate digital infrastructure	79.2	10.8	10.0	4.09 (0.84)
No AI-related curriculum guidance	71.6	16.4	12.0	3.87 (0.91)
Language barrier (English-medium AI tools)	68.0	14.8	17.2	3.71 (0.96)
Fear of job displacement	52.4	22.0	25.6	3.34 (1.02)
Low institutional support	74.0	14.0	12.0	3.94 (0.87)

Correlation Analysis

The Pearson correlation matrix of AI literacy dimensions and responsible AI use is given in Table 5. All correlations are significant at $p < .01$ level. The highest bivariate correlation with Responsible AI Use was found between AI Tool Usage ($r = .637$) and Ethical AI Awareness ($r = .698$), suggesting that the more ethically aware teachers were, and/or the more often they used AI tools, the more they used responsible AI. Further, Responsible AI Use showed a moderate-to-strong correlation with AI Awareness ($r = .584$ and $r = .612$ respectively), and AI Functional Knowledge ($r = .532$ and $r = .576$, respectively).

Table 5: Pearson Correlation Matrix: AI Literacy Dimensions and Responsible AI Use (N = 250)

Variable	1	2	3	4	5
1. AI Awareness	1.00				
2. AI Functional Knowledge	.618**	1.00			
3. AI Tool Usage	.543**	.591**	1.00		
4. Ethical AI Awareness	.472**	.508**	.463**	1.00	
5. Responsible AI Use	.584**	.612**	.637**	.698**	1.00
** $p < .01$ (two-tailed)					

Multiple Regression Analysis: Predictors of Responsible AI Use

The results from multiple linear regression analysis with the dependent variable Responsible AI Use are presented in Table 6. The overall model was statistically significant, $F(6, 243) = 48.76$, $p < .001$, and accounted for 54.8% of the variance in responsible AI use ($R^2 = .548$, Adjusted $R^2 = .533$). Ethical AI Awareness emerged as the strongest predictor ($\beta = .358$, $t = 4.608$, $p < .001$), followed by AI Tool Usage ($\beta = .312$, $t = 4.250$, $p < .001$) and AI Functional Knowledge ($\beta = .268$, $t = 3.493$, $p = .001$). Professional maturity (teaching experience) and higher education qualifications were also significant ($\beta = .128$, $p = .018$ and $\beta = .143$, $p = .033$, respectively), which indicates that modest effects of these factors exist and

confirm that responsible use of AI is modestly influenced by professional maturity and higher education qualification.

Table 6: Multiple Regression Analysis: Predictors of Responsible AI Use (N = 250)

Predictor Variable	B	SE B	β	t	p
Constant	0.412	0.187	—	2.203	.029
AI Awareness	0.214	0.063	.231	3.397	.001
AI Functional Knowledge	0.248	0.071	.268	3.493	.001
AI Tool Usage	0.289	0.068	.312	4.250	<.001
Ethical AI Awareness	0.341	0.074	.358	4.608	<.001
Teaching Experience (yrs)	0.091	0.038	.128	2.395	.018
Education Level	0.112	0.052	.143	2.154	.033
R ² = .548, Adjusted R ² = .533, F(6, 243) = 48.76, p < .001					

ANOVA: AI Literacy by Teaching Experience

The results from a one-way ANOVA showed that there were statistically significant differences between the teachers' groups in overall AI literacy scores, $F(3, 246) = 18.42, p < .001$ (Table 7). The teachers with 1-5 years of experience ($M = 2.31$) had scores that were statistically lower than those of the teachers with 20+ years of experience ($M = 2.92$) and the teachers with 11-20 years of experience ($M = 2.79$) in both cases (Tukey's HSD post hoc tests $p < 0.05$). This is somewhat paradoxical, but makes sense based on the professional networks, institutional experiences and informal learning gained by more experienced teachers.

Table 7: One-Way ANOVA: AI Literacy Scores by Teaching Experience (N = 250)

Teaching Experience	N	Mean	SD	F	p
1–5 years	62	2.31	0.68		
6–10 years	88	2.54	0.71		
11–20 years	72	2.79	0.74	18.42	.001
20+ years	28	2.92	0.69		
Total	250	2.58	0.73		

DISCUSSION

Low AI Literacy: A Call for Structural Intervention

AI literacy scores in this study ($M = 2.58/5.00$) are lower than the scores of other teachers who teach in similar environments in developing countries. Similarly, Siddiqui and Ahmed (2024) obtained similar mean scores of literacies of AI among the university teachers in Karachi and Dhar et al. (2023) found also

low level of AI literacy in the government school teachers in India. The pattern indicates that lack of AI literacy is not limited to a local issue but a systemic issue in the government education system in South Asia.

The high score levels on the AI Awareness dimensions suggest a "surface familiarity" interpretation, where teachers in HS have a limited awareness of AI as a construct, primarily via media, or through informal peer conversations, but lack the formal training to take this awareness and apply it to their teaching (Kim & Kim, 2022; Ng et al., 2021). The 'knowing-doing gap' between declarative and procedural knowledge of AI is reminiscent of the gap in research on technology integration more generally (Fullan & Langworthy, 2014).

Responsible AI Use: Compliance Without Competence

The responsible AI use data reveal that contrary to what you might expect, teachers demonstrated some understanding of responsible AI norms, but were not very consistent in following them. The higher data privacy maintenance rate (35.2% always/often) could be due to a lower degree of ethical concerns about AI, and established institutions that think more about data privacy than AI. The very low rates of embedding the more profound aspects of responsible use of AI (with 14.8% always/often for AI bias checking and 19.2% always/often for AI ethics teaching) highlight that the deeper levels of responsible use of AI have not yet been embedded.

This finding aligns with the findings of Uerz et al. (2021) where compliance is more about AI being used in the classroom than competency. The implications are huge because if teachers don't verify AI-generated content often and, less frequently, teach ethical concerns to their students, they are unlikely to be creating the next generation of critically AI-literate citizens, as the National AI Policy (Government of Pakistan, 2022) aims to do.

Ethical AI Awareness as the Pivotal Predictor

The regression finding of the strongest predictor of responsible AI use is Ethical AI Awareness ($\beta = .358$), which has a significant theoretical and practical implication. The findings suggest that there is a positive relationship between having a more developed ethical perspective on thinking about AI and the extent to which teachers will be using AI in a responsible way within the classroom. The argument of UNESCO (2021) which claims that ethics should be the cornerstone and not an "afterthought" of the integration of AI in education is being echoed here. Moreover, it aligns with the pedagogical AI literacy framework suggested by Casal-Otero et al. (2023), and in which ethical reasoning is the competency that is most predictive of responsible AI pedagogy.

Implications for Teacher Professional Development Designers: AI ethics should be a foundation of any AI literacy training program, and not be a standalone course. Ethical reasoning capacity development is likely to bring more dividends in responsible use of AI than in-situ teaching of AI tools.

Structural Barriers: Infrastructure Before Apps

The situation of the integration of AI advocates in Sindh is very depressing with the number of barriers pointed out during the barrier analysis. While attitudinal barriers (fear of displacement) are not the main challenge facing teachers in Jamshoro, the teachers are rather under-resourced and under-supported with the structural barriers being the key challenge. The findings agree with Holmes et al. (2022) who believe that AI in education may help to exacerbate educational inequality if there is no investment in infrastructure and capacities.

The finding of language barrier is of special interest (68.0% agreement). Teachers who are already teaching in Sindhi or Urdu are now facing a great problem as the majority of AI tools are using English language interface like ChatGPT, Gemini or Copilot. The importance of culturally and linguistically appropriate AI instruments in educational contexts in Pakistan is a critical research and policy question (Alenezi et al., 2023; Siddiqui & Ahmed, 2024).

Experience as an Asset

This ANOVA result – that more experienced teachers had higher AI literacy – is surprising, as is often assumed, that the younger generations are more technologically literate. However, the outcome could be linked to the confidence, peer learning networks and institutional relationship-building of more experienced teachers that could facilitate informal learning of AI literacy skills, rather than formal instruction (Bandura, 1986; Fullan & Langworthy, 2014). Importantly, the result is not experience taking the place of formal AI training, but rather, experienced teachers' social capital should be utilized as they become the AI literacy champions and peer mentors of the AP designers.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The current study is a systematic and empirically based one which reveals the image of AI literacy and responsible utilization among the teachers of high schools of District Jamshoro, Sindh. The results point to a picture of such a teaching team that they are aware of the existence of AI, but are not sufficiently equipped to use it responsibly, critically, and pedagogically. The main challenges to the development of AI literacy are structural barriers, especially the lack of formal training on AI, insufficient infrastructure, and connectivity. Ethical AI Awareness and AI Tool Usage are the strongest indicators of responsible AI practice; they provide an obvious opportunity for professional development intervention.

RECOMMENDATIONS

The following evidence-based recommendations are made based on the findings:

1. For all in-service government high school teachers, a programme of certification on AI Ethics, using AI tools and AI awareness should be developed in an AI Literacy Certificate Programme by Sindh Education Department.
2. Relying on investment first in artificial intelligence infrastructure, including district schools' reliable broadband connectivity, before mandating its use, as the Government of Sindh did and as USAID and World Bank and CSR initiatives aim for.
3. It is important for the developers of AI tools and policy makers to focus on developing AI tools in Sindhi and Urdu languages to address the language barrier for the majority of teachers to access AI tools.
4. School level AI use policies need to be developed and shared, with clear governance structures in place to support teachers to use AI responsibly, and reducing the uncertainty that has, to date, prevented the responsible use of AI.

5. Finally, there is a need for continued research to explore how AI literacy changes over time through longitudinal and/or mixed methods studies, and to understand the lived reality of teachers in environments with restricted resources.

LIMITATIONS

The findings of this study need to be interpreted in the light of some of the study limitations. The cross-sectional design does not make causal inferences. The sample is stratified and percentage distributed in the district but may not be representative of other district as well as other provinces. As the sample was limited to secondary (high) school teachers, the results are not representative of teachers at primary or higher secondary school settings where their AI literacy and responsible-use profiles may differ. Social desirability bias is a concern with the self-report measures. Additional investigation on performance-based literacy evaluation, follow up studies, and qualitative research and comparative studies between different school levels would add to and strengthen the findings of the current study.

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