Journal of Research in Economics and Finance Management
ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
Volume 5, Issue 1, Page 85-104, June 30, 2026

ARTIFICIAL INTELLIGENCE READINESS AND STUDENTS' FINANCIAL LEARNING ENGAGEMENT: THE MEDIATING ROLE OF TEACHERS' DIGITAL FINANCIAL COMPETENCE

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ABSTRACT

While Artificial Intelligence, or AI, is transforming finance practice and finance education, developing institutions across regions vary in their readiness to apply AI. This study aims to analyze whether there is a correlation between AI readiness and students' financial learning engagement, and whether teachers' digital financial competence explains this correlation. The study was based on social cognitive theory, the technology acceptance tradition, and the technological pedagogical content knowledge framework and used an 18-item, 5-point Likert questionnaire in which 400 respondents (120 teachers, 280 students) from educational institutions were surveyed. Reliability for all constructs was impressive (Cronbach's $\alpha = 0.876$ to 0.904; overall $\alpha = .921$). Results from the correlation analysis showed that there was a strong positive correlation between AI readiness, teachers' digital financial competence, and financial learning engagement of students ($r = 0.587$ to 0.651, $p < 0.01$). Multiple regression showed that AI readiness ($\beta = .253$, $p < .001$) and teachers' digital financial competence ($\beta = .462$, $p < .001$) together explained 46.4% of the variance in engagement, $F(2, 397) = 171.90$, $p < .001$, with no multicollinearity concerns (VIF = 1.637). Hayes's PROCESS Model 4 mediation analysis with bootstrapping revealed that teachers' digital financial competence significantly mediated the relationship between AI readiness and engagement (a 53% mediation effect, 95% CI [0.198, 0.359]), with the direct effect remaining significant, suggesting a partial mediation effect. The results indicate that student engagement is increased primarily through the use of AI infrastructure and policies, provided that the teacher has the financial skills to leverage the technology. Teacher capacity building should be paired with investment in AI technology.

Keywords: Artificial Intelligence Readiness, Digital Financial Competence, Financial Learning Engagement, Teacher Competence, Mediation Analysis

1. INTRODUCTION

Financial transactions are no longer primarily conducted at the bank branches. It is becoming more commonplace for people to pay, save, borrow and invest money using mobile apps, digital wallets and algorithmic platforms, many of which are assisted by AI. This transformation is what Gomber et al. (2017) refer to as a "whole-of-financial-services revolution" and has altered what young people must learn to do to make good use of money. What was always known as financial literacy is now complemented by a digital twist, as it is a key factor in making sound economic decisions (Lusardi & Mitchell, 2014). In addition, students should be taught the

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definition of interest and risk, as well as how to utilize, assess, and question the digital tools used in making financial decisions.

Education systems are called upon to respond. AI use in education has increased greatly, including adaptive tutoring, automated feedback, learning analytics, and generative tool use (Zawacki-Richter et al., 2019), and the advent of large language models has introduced new opportunities and concerns (Kasneci et al., 2023). Governments have been called on by international organisations to make intentional and equitable efforts to prepare education systems for AI (UNESCO, 2021). This readiness to use AI, or AI readiness, as referred to here, is becoming a critical aspect of the learning environment of an institution and its people.

However, technology itself often fails to transform learning. Research spanning decades indicates that the impact of the use of educational technology is dependent on the teacher's knowledge, confidence and beliefs about its use, meaning educational technology is "as teachers use it, it works as they believe it does" (Ertmer & Ottenbreit-Leftwich, 2010, p. 37) and that as teachers learn and believe, they teach and act (Mishra & Koehler, 2006). For financial education, it means that an institution that is ready for AI could support students' readiness for AI only if teachers are ready for AI and able to convert the readiness into meaningful lessons. A concept that has been well defined in the literature and is directly tied to achievement is students' participation in the learning process, which is referred to as their behavioral, emotional, and cognitive investment in learning (Fredricks et al., 2004).

The current backdrop is apt: Sindh, Pakistan. New digital learning and curriculum reform are in the works, financial inclusion is a national priority, and youth are a significant portion of the population. Teachers' preparation for AI-enabled and digital financial teaching, however, is not uniform. This research investigates the potential relationship between AI readiness and the financial learning engagement of students and the potential mediating role of teachers' digital financial competence.

Problem Statement

Young people's financial literacy is low in many countries, and international assessments indicate that young people are not well equipped to make financial decisions (OECD, 2020). Financial education programs have the potential to boost knowledge and behavior, but the impact is highly contingent on the method of the program (Kaiser & Menkhoff, 2017). The challenge increases as the financial world goes digital; financial education must now cultivate students' skills in interacting with digital and AI financial tools.

Institutions are starting to invest in AI tools and digital infrastructure with the hope of improving learning. Research on AI in education, however, has been predominantly on technology, with little research attention given to teachers (Zawacki-Richter et al., 2019). While there is little empirical evidence on whether AI readiness is associated with higher student engagement in financial learning, even less evidence exists regarding the mechanism by which this might be the case. Specifically, the impact of teachers' digital financial competence as the link between AI readiness and student engagement has not been tested, particularly in a context like Sindh, where resources are scarce, and teacher training and development are inconsistent. If there is

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
Volume 5, Issue 1, Page 85-104, June 30, 2026

no evidence, policy will be made on technology that policymakers do not have the human capacity to make effective.

Study Objectives

The overall objective of this study is to explore the connection between the components of AI readiness, teachers' digital financial competence, and students' financial learning engagement. The following are the specific aims:

- To explore how prepared students are to learn about finance and the effect of that preparation.
- To study how prepared teachers are for AI and its impact on their digital financial competencies.
- To analyse how teachers' digital financial competence affects students' financial learning engagement.
- To investigate whether teachers' digital financial competence mediates the relationship between AI readiness and students' financial learning engagement.
- To suggest policy and institutional measures to strengthen financial education with the use of AI in Sindh.

LITERATURE REVIEW

Artificial Intelligence Readiness

Technology readiness is the tendency to adopt and implement new technologies for attaining objectives. Parasuraman (2000) has captured this idea in the Technology Readiness Index: a combination of the sense of discomfort or insecurity with optimism and innovativeness. There are personal and institutional aspects of AI readiness in education. From a personal perspective, it refers to knowledge of AI, the ability to use AI tools, confidence and openness toward AI. Karaca et al. (2021) operationalized the personal level as a readiness scale for students that measures cognition, ability, vision, and ethics; Ng et al. (2021) defined AI literacy as knowledge and understanding, using and applying, evaluating, and creating with AI ethically. At the institutional level, readiness encompasses infrastructure, access, policies and support.

AI readiness is important because AI tools can clearly be used to personalize learning, provide timely feedback, and assist teachers (Holmes et al., 2019; Luckin et al., 2016). Kasneci et al. (2023) stated that LLMs can support the learning process by practicing, explaining, and providing personalized support to learners, but suggested that it requires teachers' and learners' competencies. As part of a systematic review of AI acceptance, Kelly et al. (2023) identified that perceived usefulness, performance expectancy, and attitude have been consistently found to predict willingness to use AI. Readiness can thus be assumed to nurture the use of digital tools by teachers and student participation in learning.

Teachers' Digital Financial Competence

The quality of teachers is a significant factor in determining the quality of teaching and learning, and the achievement of students. Kunter et al. (2013) discovered that teachers' professional competence, such as knowledge of their subject matter and motivation, has an impact on the quality of their teaching and consequently on student development. Competence in digital settings encompasses the ability to use technology to enhance the content and pedagogy. Koehler and Mishra (2006) called this integrated knowledge technological pedagogical content knowledge (TPACK), and the European DigCompEdu framework outlines the digital competences required for teachers, ranging from professional engagement to empowering learners (Redecker, 2017).

In this study, digital financial competence is defined as a teacher's understanding of and capability in working with digital financial services and tools (mobile banking, digital payments, fintech, AI), and in the use of digital and AI tools to effectively teach financial literacy concepts. Ertmer and Ottenbreit-Leftwich (2010) found that teachers' knowledge, self-efficacy and beliefs influence whether they use technology in ways that are student-centered. Cognitive competence is more likely to lead to teachers thinking about creating practical and engaging lessons with a strong focus on topical relevance.

Students' Financial Learning Engagement

Engagement is considered to be a prerequisite for learning. Some research has defined school engagement as a multi-dimensional phenomenon with behavioral, emotional, cognitive and agentic dimensions, including student behaviors, interests, investment and the use of strategies and student proactivity in contributing to the process of schooling (Fredricks et al., 2004; Reeve & Tseng, 2011). In higher education, Kahu (2013) defined engagement as the product of a dialogue between the student and the teaching context. In this study, students' financial learning engagement reflects students' involvement in, interest in, and mental effort in learning financial concepts and skills.

The teacher is a key player in engagement. Studies on teacher involvement, structure and autonomy have found them to be significant predictors of students' engagement throughout the school year, which in turn leads to increased teacher engagement (Skinner & Belmont, 1993). Hattie (2009) also discovered that teacher effects are among the most significant influences on student learning. The results here indicate that the impact of AI readiness on engagement may be highly dependent on teachers.

Connecting the Dots between AI Readiness, Teacher Competence, and Student Engagement

A chain of influence is indicated by the literature. Positive attitudes towards technology have been correlated with higher technology use (Davis, 1989) and technology acceptance (Parasuraman, 2000; Venkatesh et al., 2003). As institutions and individuals embrace AI, teachers have increased opportunities, support and motivation to develop their digital competence. Based on these, competent teachers design more complex and engaging learning contexts, which involve students in

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
Volume 5, Issue 1, Page 85-104, June 30, 2026

learning (Kunter et al., 2013; Skinner & Belmont, 1993). Additionally, AI readiness can make learning more participatory by providing students with adaptive and interactive tools (Holmes et al., 2019). All these arguments suggest that digital financial competence of teachers is an intervening variable and that AI readiness and engagement could be directly linked as well.

Research Gap

While the significance of AI readiness, teacher digital competence, and student engagement has all been noted, few studies have explored these three together. Research on AI in education has paid little attention to teachers as opposed to technologies (Zawacki-Richter et al., 2019), and in the field of financial education, little research has taken AI and teachers' digital financial skills into account, let alone specifically in Pakistan and Sindh. Not a single study, to the author's knowledge, has been conducted to evaluate the role of digital financial competence as a mediator between AI readiness and financial learning engagement of students. This study aims to fill this gap.

THEORETICAL FRAMEWORK

Social Cognitive Theory

Social cognitive theory (Bandura, 1986) views behavior as the product of reciprocal interactions between personal, environmental and behavioral factors. A key factor in this is self-efficacy, the self-confidence people feel in their ability to carry out a task (Bandura, 1977). In this study, AI readiness is an enabling condition of the environment and the individual, digital financial competence of the teachers is a capability and efficacy factor, and students' engagement is the behavioral outcome. The theory is congruent with the concept of a ready environment to enhance teacher capacities that influence student behavior.

Technology Acceptance Model (TAM) and UTAUT

The literature suggests two models for the adoption of technology: The Technology Acceptance Model (TAM) (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), which describe perceived usefulness, ease of use, performance expectancy, and facilitating conditions. These positive perceptions and conditions are indicative of AI readiness. Teachers and students are more likely to embrace and utilize AI tools when they are ready for AI, fostering opportunities for competence building and meaningful learning.

Technological Pedagogical Content Knowledge (TPACK)

According to the TPACK framework (Mishra & Koehler, 2006), successful technology integration involves the teacher's ability to integrate technological, pedagogical and content knowledge. Access to technology is not enough; teachers need to understand how to use technology to teach specific content well. In this framework, the mediating role of teachers' digital financial competence is the most apparent, as it is AI readiness that offers the technological potential, while the teachers' integrated competence is what turns it into constructive financial learning.

CONCEPTUAL FRAMEWORK AND HYPOTHESES

The conceptual framework is given in Figure 1. AI readiness is the independent variable, teachers' digital financial competence is the mediator, and students' financial learning engagement is the dependent variable. The figure also includes estimated path coefficients from this study.

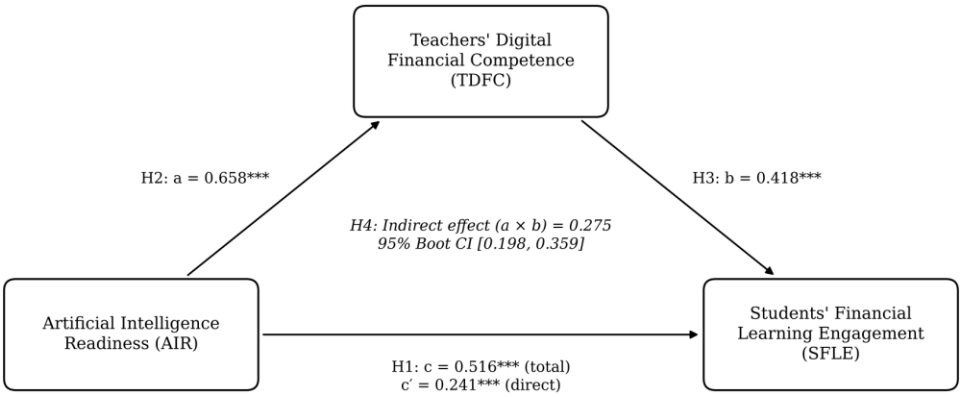


Figure 1. Conceptual framework and estimated mediation model

Note. Coefficients are unstandardized (Hayes's PROCESS Model 4, 5,000 bootstrap samples). *** $p < .001$.

Based on the literature and theory reviewed above, the following hypotheses are proposed:

H_1: The relationship between students' financial learning engagement and AI readiness is significant and positive.

H_2: AI readiness has a strong positive correlation with teachers' digital financial competence.

H_3: The digital financial competence of teachers is significantly correlated with students' financial learning engagement.

H_4: The relationship between AI readiness and students' financial learning engagement is partially mediated by teachers' digital financial competence.

RESEARCH METHODOLOGY

Research Design

This study used positivist philosophy and deductive research, which aimed to test the hypotheses of the study, which were formulated based on prevailing theories. The measurements and the relationships between the variables were measured at a single time point, with the use of a quantitative, cross-sectional survey design.

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
Volume 5, Issue 1, Page 85-104, June 30, 2026

Population and Sample

The population comprised teachers and students from educational institutions in Sindh, Pakistan, where financial and business-related subjects are taught. There were 400 respondents: 120 teachers and 280 students. The inclusion of both groups enabled the study to reflect both sides of teaching and learning. A sample size of 400 is sufficient for regression and mediation analysis (Hair et al., 2019) and is recommended for a large population at the 95% confidence level (Krejcie & Morgan, 1970). A stratified convenience approach was taken to ensure representation of both teachers and students.

Instrument and Measures

The data were collected using a structured questionnaire. Demographic data (gender, type of respondent, age, and education) were recorded in the first part. The second part consisted of 18 items measuring the three constructs, with six items per construct on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). The dimensions of cognition, ability and vision, as outlined by Karaca et al. (2021) and the technology readiness concept of Parasuraman (2000), were adapted to form AI readiness items. The items for teachers' digital financial competence were adapted from the DigCompEdu framework (Redecker, 2017) and the TPACK framework (Mishra & Koehler, 2006), with a focus on digital financial content. Items regarding financial learning engagement were adapted from the dimensions of engagement that are described by Fredricks et al. (2004), namely the behavioral, emotional, and cognitive aspects of engagement. Pilot testing was carried out prior to the main survey by subject-matter experts.

Ethics and Data Collection

After the institutions gave their permission, questionnaires were administered online and in person. Participation was voluntary; the purpose of the study was explained to the participants, and anonymity and confidentiality were guaranteed. No personally identifying information was collected. To minimize common method bias (Podsakoff et al., 2003), procedural remedies were employed such as anonymity, separation of predictor and outcome items, and clear wording.

Data Analysis Techniques

The SPSS software program and PROCESS macro were used for analysis. Frequencies were used to describe the sample, descriptive statistics to summarize the variables and Cronbach's alpha was used to assess reliability (Nunnally & Bernstein, 1994) of the data, which was .70 or higher. Bivariate relationships were explored using Pearson correlation, and multiple regression was used to evaluate the combined effect of the predictors on engagement. The presence of multicollinearity was tested for by using the tolerance and Variance Inflation Factor (VIF). Mediation was tested with Hayes's PROCESS Model 4, with 5,000 bootstrapping resamples, and an indirect effect was considered significant if zero was not included in the 95% confidence interval (CI) (Hayes, 2022; Preacher & Hayes, 2008). Mediation type was categorized based on the classification of Zhao et al. (2010).

ANALYSIS AND INTERPRETATION

Demographic Profile

Table 1: Demographic Profile of Respondents (N = 400)

Demographic Variable	Categories	Frequency	Percentage (%)
Gender	Male	184	46.0
	Female	216	54.0
Respondent Type	Teachers	120	30.0
	Students	280	70.0
Age	18–25 years	245	61.3
	26–35 years	85	21.2
	36–45 years	45	11.3
	Above 45 years	25	6.2
Education	Undergraduate	245	61.3
	Graduate	100	25.0
	Postgraduate	55	13.7
Total		400	100.0

The female participants (54.0%) were slightly more numerous than the male participants (46.0%), as presented in Table 1. The distribution of the findings is fairly balanced, which reflects the opinions of both males and females and is in line with the increased enrolment and employment of women in education in Sindh.

There were 70.0% students and 30.0% teachers in the sample. This ratio is suitable since students are the primary beneficiaries of financial learning, and teachers will have an instructional perspective to evaluate digital financial competence. The inclusion of both groups provides a more comprehensive picture of the learning environment than would the inclusion of either group alone.

The age profile was young: 61.3% of respondents were 18 to 25 years old, 21.2% were 26 to 35, 11.3% were 36 to 45, and only 6.2% were older than 45. The high proportion of young respondents is due to the high proportion of students in the sample. It also plays a role in the study, as this generation is likely to know more about digital and AI tools and to be the most impacted by the digitalization of finance.

Of those in education, 61.3% were undergraduates, 25.0% were graduates, and 13.7% were postgraduates. The undergraduate proportion is similar to the student proportion in the youngest age group category, and the graduate/postgraduate proportion is mainly made up of teachers. The composition of the sample indicates that the range of educational levels is suitable for financial education.

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
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Descriptive Statistics

Table 2: Descriptive Statistics of Study Variables

Variable	N	M	SD
Artificial Intelligence Readiness	400	3.842	0.684
Teacher's Digital Financial Competence	400	3.716	0.721
Students' Financial Learning Engagement	400	3.925	0.653

Note. Variable measures were made on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

The mean scores on all three variables in Table 2 were above the scale midpoint of 3.00, suggesting generally high perceptions. The highest mean (M = 3.925, SD = 0.653) was obtained for students' financial learning engagement, indicating a high level of engagement, interest, and effort in financial learning. It also had the lowest standard deviation, which indicates that this perspective was fairly uniform among the respondents.

AI readiness was also high (M = 3.842, SD = 0.684), meaning that respondents felt confident in using AI tools in education in terms of knowledge, skills, and attitudes. The mean (M = 3.716) of the teachers' digital financial competence was the lowest, and its standard deviation (SD = 0.721) was the highest. This is positive, but it is the area where there is the most potential for improvement and where teachers may vary the most, indicating that training could mitigate these disparities.

Reliability Analysis

Table 3: Reliability Analysis: Cronbach's Alpha

Construct	Number of Items	Cronbach's α
Artificial Intelligence Readiness	6	0.891
Teachers' Digital Financial Competence	6	0.876
Students' Financial Learning Engagement	6	0.904
Overall Reliability	18	0.921

Note. Cronbach's alphas ≥ 0.70 are considered to be acceptable for internal consistency (Nunnally & Bernstein, 1994).

As can be seen in Table 3, all constructs were above the .70 criterion of Nunnally and Bernstein (1994). The Cronbach's alpha was .891 for AI readiness, .876 for teachers' digital financial competence and .904 for students' financial learning engagement. Scores above .80 and .90 indicate good to excellent internal consistency (Hair et al., 2019).

The overall 18-item scale had good internal consistency (alpha = .921). Engagement was the most reliable construct, with six items measuring the construct very reliably. The results match those reported in other scales and demonstrate that items within each scale may be combined into composite scores for the correlation, regression and mediation analyses that follow.

Correlation Analysis

Table 4: Pearson Correlation Analysis

Variable	1	2	3
1. AI Readiness	1		
2. Digital Financial Competence	0.624**	1	
3. Financial Learning Engagement	0.587**	0.651**	1

Note. N = 400. ** p < .01 (two-tailed).

As seen in Table 4, all three variables were significantly (p < .01) positively correlated. Teachers' digital financial competence was highly correlated with their readiness for AI (r = .624). This is a large effect, according to Cohen's (1988) guidelines, and indicates that environments that are more apt to AI have teachers with more digital financial competence.

In addition, students' financial learning engagement was strongly correlated with their AI readiness (r = .587), which supported H1 to a certain extent. The higher the readiness for AI, the more students participate and are interested in financial learning.

The highest correlation was found between digital financial competence of teachers and students' financial learning engagement (r = .651), which accounts for 42% of shared variance. This result confirms H3 at the bivariate level and draws attention to a high correlation between teachers' competence and student engagement. The pattern is consistent with the proposed mediation, since the concept of AI readiness is strongly related to both competence and engagement, while the concept of competence is closely related to engagement. The first indication of the absence of multicollinearity is that none of the correlations were greater than .80 (Hair et al., 2019).

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
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Multiple Regression Analysis

Table 5: Multiple Regression Analysis (Dependent Variable: Students' Financial Learning Engagement)

Predictor	B	SE	β	t	p
Constant	1.124	0.184	—	6.109	< .001
AI Readiness	0.241	0.052	0.253	4.635	< .001
Digital Financial Competence	0.418	0.049	0.462	8.531	< .001

Note. B = unstandardized coefficient, SE = standard error, β = standardized coefficient.

Table 5 indicates that both predictors had significant positive effects when entered together on students' financial learning engagement. AI readiness had a significant effect ($B = 0.241$, $\beta = 0.253$, $t = 4.635$, $p < .001$); with teachers' competence held constant, increases in AI readiness are correlated with increases in engagement by 0.241 units.

Teachers' digital financial competence had a stronger effect ($B = 0.418$, $\beta = 0.462$, $t = 8.531$, $p < .001$). It has a standardized coefficient of almost twice that for AI readiness, which rates teacher competence as the more significant predictor of engagement. The constant $B = 1.124$, $p < .001$, has no practical meaning because it occurs when both predictors are at zero and is just needed for the model. Overall, these findings confirm H3 and provide evidence that AI readiness continues to have a direct impact on engagement even with the teacher competence factor controlled.

Table 6: Regression Model Summary

R	R^2	Adjusted R^2	F	p
0.681	0.464	0.461	171.902	< .001

Note. Predictors: AI readiness, teachers' digital financial competence. df = 2, 397.

Table 6 shows that the model was statistically significant, $F(2, 397) = 171.902$, $p < .001$. The multiple correlation ($R = 0.681$) shows that there is a strong correlation between the predictors and engagement. The combined scores of AI readiness and teachers' digital financial competence accounted for 46.4% of the variance in students' financial learning engagement ($R^2 = 0.464$). The adjusted R^2 value of 0.461 is nearly the same, indicating that the model is not inflated by the number of predictors and should have good generalizability. The effect size (Cohen's $f^2 = 0.87$) is very large according to Cohen's (1988) scale. The rest of the variance (53.6%) is attributable to other factors not included in the model, including student motivation, family background, and curriculum design.

Mediation Analysis

Table 7: Hayes PROCESS Macro Model 4: Mediation Analysis

Path	B	SE	t	p
AI Readiness → Digital Financial Competence (a)	0.658	0.045	14.622	< .001
AI Readiness → Financial Learning Engagement (c, total effect)	0.516	0.047	10.979	< .001
AI Readiness → Financial Learning Engagement (c′, direct effect)	0.241	0.052	4.635	< .001
Digital Financial Competence → Financial Learning Engagement (b)	0.418	0.049	8.531	< .001

Note. N = 400. Coefficients are unstandardized.

The mediation model paths are shown in Table 7. H2 was supported by AI readiness, which had a strong and significant effect on teachers' digital financial competence ($a = 0.658$, $t = 14.622$, $p < .001$). This is the highest coefficient in the model and indicates that readiness for AI is very closely associated with the development of teachers' digital financial capability.

The overall impact of AI readiness on students' financial learning engagement was statistically significant ($c = 0.516$, $t = 10.979$, $p < .001$) and was in support of H1. Including teachers' digital financial competence in the model, the effect of AI readiness decreased to 0.241, but remained significant ($c' = 0.241$, $t = 4.635$, $p < .001$). Teachers' competence, however, was a significant predictor of engagement ($b = 0.418$, $t = 8.531$, $p < .001$). The influence of AI readiness on engagement has been mediated by teachers' competence, as evidenced by the decrease in the path from AI readiness to engagement from 0.516 to 0.241.

Table 8: Bootstrap Results for the Indirect Effect

Indirect Path	Effect	Boot SE	Boot LLCI	Boot ULCI
AI Readiness → Digital Financial Competence → Financial Learning Engagement	0.275	0.041	0.198	0.359

Note. Bootstrap sample size = 5,000. LLCI and ULCI = lower and upper limits of the 95% confidence interval.

Table 8 reveals the indirect effect of AI readiness through teachers' digital financial competence on engagement as 0.275 (Boot SE = 0.041). The 95% bootstrap confidence interval was [0.198, 0.359], excluding zero, thus showing that the indirect effect was statistically significant (Preacher & Hayes, 2008). This means that H4 is supported.

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
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The indirect effect equals the product of paths a and b (0.658 × 0.418 = 0.275), and together with the direct effect, it accounts for the total effect (0.241 + 0.275 = 0.516). The indirect path makes up approximately 53.3% of the total effect. The mediation is partial, or in the terms of Zhao et al. (2010), 'complementary', because both direct and indirect effects are important and positive. Realistically, over half of the value of being prepared to use AI to enhance student engagement happens through teachers' digital financial competence, and the remainder happens directly.

Multicollinearity Assessment

Table 9: Multicollinearity Assessment

Predictor	Tolerance	VIF
AI Readiness	0.611	1.637
Digital Financial Competence	0.611	1.637

Note. VIF = Variance Inflation Factor.

As can be seen in Table 9, the tolerance values for both predictors were above the customary level of 0.1, and VIF values were below 10 and even below the more stringent value of 5 (Hair et al., 2019). In a two-predictor model, the same values would be expected, because both are based on the same correlation between the predictors (r = .624). These findings indicate that multicollinearity does not pose a problem, and the regression coefficients presented in Table 5 will be stable and therefore can be interpreted with confidence.

Summary of Hypothesis Testing

Table 10: Summary of Hypothesis Testing

Hypothesis	Path	Key Evidence	Decision
H1	AIR → SFLE	c = 0.516, p < .001	Supported
H2	AIR → TDFC	a = 0.658, p < .001	Supported
H3	TDFC → SFLE	b = 0.418, p < .001	Supported
H4	AIR → TDFC → SFLE	0.275, 95% CI [0.198, 0.359]	Supported (partial mediation)

Note. AIR = AI readiness; TDFC = teachers' digital financial competence; SFLE = students' financial learning engagement.

All four hypotheses were confirmed, and as shown in Table 10, the digital financial competence of teachers partially mediated the link between AI readiness and students' financial learning engagement.

DISCUSSION

The research in this study focused on understanding the relationship between AI readiness and financial learning engagement among students, as well as on investigating whether the relationship between the two is mediated by teachers' digital financial competence. The findings indicate that a positive relationship exists between the readiness to use AI and engagement, and that the relationship between AI and engagement is strongly mediated by teachers, because over half of the effect of AI on engagement goes through teachers.

The positive relationship between AI readiness and engagement (H1) is consistent with theories that AI tools can customize learning and increase engagement (Holmes et al., 2019; Luckin et al., 2016). It is also in line with the technology acceptance tradition, which stipulates that positive perceptions and facilitating conditions promote technology adoption (Davis, 1989; Venkatesh et al., 2003). Once students and institutions are ready for AI, students can gain more exposure to financial concepts with simulations, adaptive exercises, and digital tools to make abstract concepts real.

The significant impact of AI readiness on teachers' digital financial competence (H2) indicates that a prepared environment facilitates teachers' development. The results are in line with the social cognitive theory that states that environmental conditions affect capabilities and self-efficacy (Bandura, 1977, 1986), and with Ertmer and Ottenbreit-Leftwich (2010), who argued that access, support, and culture influence how teachers construct their knowledge and confidence in technology. Teachers have a greater ability to experiment with digital financial tools and to develop competence when there are AI resources and openness.

Teachers' digital financial competence had the largest impact in the model (H3). This reflects a vast amount of research that the competence of teachers influences teaching quality and student learning (Hattie, 2009; Kunter et al., 2013), and that teacher behavior influences student engagement (Skinner & Belmont, 1993). It also validates the fundamental premise of the TPACK model: technology is a better tool for enhancing learning when teachers can integrate it with content and pedagogy (Koehler & Mishra, 2006). This is probably due to the fact that competent teachers can link digital finance to students' lives, so that students are more active in their classes.

This study's primary contribution is the mediation result (H4) that was obtained. Overall, 53% of the impact of AI readiness on engagement was transmitted through teachers' digital financial competence. This result corresponds with the emphasis on the underutilized role of educators in their perspectives of AI in education (Zawacki-Richter et al., 2019), and resonates with Kasneci et al.'s (2023) warnings about the benefits of AI being dependent on the competencies of the educators who use it. Meanwhile, the remaining direct effect indicates that AI readiness also impacts students outside of the classroom, likely through direct access to digital tools. The partial mediation thus affords a balanced overview: technology matters, but teachers matter more.

The descriptive results provide a practical take. Of the three constructs, the mean was lowest and the standard deviation highest for teachers' digital financial

ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
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competence. It is also the best predictor of engagement, making it a promising point of intervention. Increasing teachers' competence would likely lead to higher engagement levels not just directly, but also as a result of the added value that institutions would derive from their investments in AI.

CONCLUSION

The study offers empirical evidence from Sindh, Pakistan, that demonstrates that the combined effect of AI readiness and teachers' digital financial competence accounts for almost half of the variance in financial learning engagement among students. Teacher competence was the strongest predictor of engagement, and AI readiness was correlated with teacher competence. The influence of AI readiness was partly mediated by teachers' digital financial competence, which accounted for over half of it. All these hypotheses were confirmed; the reliability of the measures was very good, and there was no problem with multicollinearity.

The main message is that, in the eyes of the student, the value of being ready for AI comes mostly from teachers. Investing in AI infrastructure will only offer some benefits unless there is substantial investment in digital financial skills for teachers. The capacity building of teachers must therefore be part of the education AI policy and not an appendage.

RECOMMENDATIONS

According to the results, the following recommendations are proposed to curriculum bodies, educational institutions and policymakers:

- Teacher professional development. Continuous, hands-on training on the use of digital financial tools and AI in teaching should be implemented in the provincial education system and institutions, leveraging frameworks like DigCompEdu and TPACK, as teacher competence emerged as the most significant predictor of engagement.

- Pair technology investment with teacher preparation. Any investment in AI tools and infrastructure should also provide for teacher preparation, as over half of the value of being ready to use AI flows through teachers.

- Reform of curriculum and textbooks. Curriculum and textbook authorities, including the Sindh Textbook Board, should include digital finance and AI literacy in financial education content and provide practical activities on the use of digital payments, mobile banking, and the responsible use of AI tools.

- Institutional AI readiness plans. AI readiness – including access, infrastructure, technical support, and ethical guidelines – should be a focus for institutions, and readiness benefits both teachers and students.

- Target competence gaps. Teachers' competences showed the highest variation; therefore, teacher competences need to be evaluated, and support should be given to those who need it the most.

- Partnerships with the financial sector. Some exposure to actual digital financial tools can be gained through cooperation with banks, fintech companies and financial literacy initiatives of the State Bank of Pakistan for teachers and students.

LIMITATIONS AND FUTURE RESEARCH

There are a number of caveats. First, the cross-sectional design does not enable causal inference. The mediation model was based on theory; however, it was not possible to determine the temporal order of the variables; a longitudinal or experimental design would provide more causal evidence. Second, non-probability sampling was employed in the collection of the sample from Sindh, which restricts the generalization to other provinces and countries. Third, all variables were collected using self-report from a single source, and this could have led to social desirability and common method bias despite efforts to minimize those (Podsakoff et al., 2003).

Fourth, teachers and students were analyzed as a single sample. Teachers' competence and students' engagement are, in principle, separate groups of characteristics and should be distinguished in future research, using matched data of teachers and students, and applying multilevel modeling to account for the nesting of students in classes. Fifth, the model accounted for 46.4% of the variance in engagement, suggesting that there are other factors contributing to engagement, including student motivation, prior knowledge of financial literacy, socioeconomic status and type of institution. These variables could be added in future studies; gender or urban–rural location could be tested as moderators, and public and private institutions could be compared.

SIGNIFICANCE OF THE STUDY

- **Theoretical significance.** The study takes into consideration social cognitive theory, the technology acceptance tradition and the TPACK framework to explain the relationship between AI readiness and student engagement. The existence of digital financial competence of teachers as a partial mediator illuminates how technology readiness reaches learners and brings a teacher-centred view to research on AI in education.

- **Practical significance.** Education departments, curriculum bodies, and educational institutions have clear evidence that teacher capacity needs to go hand-in-hand with AI investment, based on the findings. The findings can provide input to the design of teacher training, textbook and curriculum development in digital finance, as well as institutional AI strategies.

- **Contextual significance.** This study provides an empirical snapshot of the nexus of AI, digital finance, and education in Sindh, Pakistan, that is little documented in the region. The results can inform policy on financial inclusion and educational modernization in an area where these are national priorities.

AUTHOR NOTE

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ISSN (Print): 2959- 099X ISSN (Online): 2959-1007
Volume 5, Issue 1, Page 85-104, June 30, 2026

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