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Building Resilience among Pre-Service Teachers in the Digital Era: Examining the Role of Technological and Psychological Predictors

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ABSTRACT

In the context of rapid technological advancements, fostering resilience among pre-service teachers has become increasingly critical. This study explores the impact of attitude toward artificial intelligence (AI) on resilience, with a particular focus on the mediating roles of cognitive flexibility, hope, and mindful attention awareness. Utilizing a descriptive research design, data were collected from a sample of 300 pre-service teachers enrolled in Bachelor of Education programs across various government and government-aided colleges in Punjab, selected through simple random sampling. The study employed standardized instruments, including the Attitude Toward Artificial Intelligence Scale (Mukherjee & Dasgupta, 2024), Cognitive Flexibility Inventory (Dennis & Vander Wal, 2010), Hope Scale (Snyder et al., 1991), Mindful Attention Awareness Scale (Brown & Ryan, 2003), and the Resilience Scale (Brown & Rayan, 2003). Correlation analysis indicated significant positive relationships among all variables. Path analysis further confirmed the significant direct effect of AI attitudes on resilience. Mediation analysis revealed that cognitive flexibility, hope, and mindful attention awareness significantly mediated the relationship between attitude toward AI and resilience. These findings underscore the importance of both technological and psychological predictors in developing resilience among pre-service teachers in the digital era. The study offers implications for teacher education programs aiming to enhance psychological adaptability and technology integration.

Keywords: Resilience, Attitude Toward Artificial Intelligence, Cognitive Flexibility, Hope, Mindful Attention Awareness.

INTRODUCTION

In the evolving landscape of 21st-century education, technology is reshaping the way teaching and learning occur. For pre-service teachers, the integration of artificial intelligence (AI), digital platforms, and data-driven educational tools introduces both opportunities and psychological challenges. As these future educators navigate their professional training, they face growing expectations to remain adaptive, technologically proficient, and mentally resilient. Resilience—the capacity to withstand, adapt to, and recover from adversity—is increasingly recognized as a key psychological trait that supports teacher effectiveness, well-being, and long-term commitment to the profession (Gu & Day, 2013).

The digital era, while fostering innovation and efficiency, has brought about unprecedented stressors such as techno-complexity, digital overload, and concerns over job identity due to the rise of AI-driven tools (Pedro et al., 2019; Li et al., 2023). Against this backdrop, understanding the technological and psychological predictors of resilience becomes vital for supporting pre-service teachers during their formative professional experiences. This study focuses on four key predictors—attitude Toward artificial

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intelligence, cognitive flexibility, hope, and mindful attention awareness—to explore how these factors contribute to the development of resilience among pre-service teachers.

Attitude Toward AI refers to an individual's perception, emotional response, and readiness to engage with artificial intelligence technologies in educational settings. It encompasses beliefs about AI's usefulness, trustworthiness, and potential to enhance or disrupt the teaching profession (Rane et al., 2023). A positive attitude Toward AI can ease technology adoption, promote confidence, and reduce stress, while negative attitudes may create resistance, anxiety, and perceptions of loss of control (Kumar, 2013).

Cognitive flexibility, on the other hand, is the ability to shift perspective or to switch between the different tasks (Clarke, 2024). It enables individuals to approach problems from multiple perspectives and make effective decisions (Elliott, 2024). It encompasses creativity, receptiveness to new ideas, and the ability to reconcile conflicting information effectively (Fuchs et al., 2023). It is the mental capacity to adapt thinking strategies and modify behavior in response to challenging or ambiguous situations (Dennis & Vander Wal, 2010), and plays a crucial role in AI-driven educational settings. For future educators, cognitive flexibility enables them to integrate conventional instructional techniques with artificial intelligence resources, for instance, employing automated assessment systems while maintaining control over lesson planning (George, 2023). This flexibility can help to reduce stress by encouraging individuals to reinterpret difficulties, such as perceiving AI as a supportive tool rather than a risk. As a result, cognitive flexibility may influence their capacity to develop innovative teaching strategies and navigate uncertainties linked to technological changes.

Hope is a vital psychological resource that empowers individuals to pursue their goals with determination and optimism. It fosters a positive mindset, enabling individuals to envision attainable outcomes and actively pursue them with determination (Duncan et al., 2022). By promoting goal-directed thinking, hope encourages individuals to set meaningful objectives, develop strategic plans, and persist despite challenges (Snyder, 2002). This adaptive quality enhances resilience, allowing individuals to reframe setbacks as temporary obstacles and maintain motivation toward achieving desired outcomes. In the context of educational advancements, hope can empower future educators to face technological challenges with confidence, viewing new tools as opportunities to enhance their teaching practice rather than threats to their role (Ramdhane, 2024). For example, hopeful educators may actively seek professional development to improve their technological skills, promoting resilience against job-related stress (Wong, 2024). Hope is strongly linked to resilience (Unwin & Dickson, 2010), as it maintains motivation and reduces feelings of helplessness during periods of change.

Mindful attention awareness refers to the capacity to focus on the present moment with openness and without judgment (Brown & Ryan, 2003). This practice encourages individuals to remain attentive and aware, fostering emotional balance and mental clarity (Tsarkos, 2025). By promoting self-reflection and reducing distractions, mindful attention awareness enhances overall resilience and helps individuals respond thoughtfully to various life experiences (Palalas, 2018). In modern educational settings, mindfulness can support educators in handling techno-stress (technology-induced psychological strain), by promoting acceptance of digital advancements and easing worries about personal limitations, such as adapting to technological progress (The Tech flow, 2023). For aspiring teachers, mindful attention awareness may reduce feelings of overwhelm by fostering a stable outlook that values technology advantages while remaining anchored in fundamental teaching practices. This quality is especially important in dynamic, technology-focused contexts where continuous adjustment may lead to mental fatigue (Maarif et al., 2025).

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Resilience is the ability to bounce back from adversity, cope with stress, and maintain psychological resilience despite challenges. In teacher education, resilience is crucial for managing academic pressure, adjusting to technological changes, and building long-term commitment to the profession (Kamboj & Garg, 2021). It enables pre-service teachers to sustain motivation, engage effectively with new pedagogical tools, and develop adaptive teaching practices (Song, 2020).

Given the increasing role of AI and other technologies in educational spaces, there is a pressing need to identify the psychological strengths that can buffer stress and enhance resilience. While prior research has acknowledged the relationship between technology and mental health (Li et al., 2023; Kumar et al., 2021), limited studies have explored how cognitive flexibility, hope, and mindfulness mediate the impact of AI on resilience—especially in regional teacher education contexts like Punjab. This study aims to bridge this gap by examining these predictors to offer insights for policymakers and educators seeking to foster resilience among future teachers in the digital age.

THEORETICAL BACKGROUND AND LITERATURE REVIEW

Artificial intelligence has evolved as a revolutionary digital advancement in the education sector, significantly shaping the resilience of future educators. As documented by the Technology-Enhanced Learning and Resilience theory (Shao et al., 2021), attitude toward artificial intelligence-driven resources improve resilience by facilitating individualized instruction, minimizing mental strain, and advancing perceived competence. These effects contribute to heightened participation, diminished anxiety, and strengthened overall psychological resilience. AI systems, such as dynamic educational platforms, digital support agents, and AI-driven evaluation systems, possess the capacity to alleviate burdens, improve productivity, and deliver customized instructional strategies, thereby fostering beneficial effects on emotional stability and resilience (Wang et al., 2022; Li et al., 2023; Kashdan & Rottenberg, 2010). However, overdependence on AI may lead to heightened stress, increased anxiety, and feelings of disengagement, thereby adversely impacting emotional stability and resilience (Kumar et al., 2021). Furthermore, Valestegui et al. (2023) disclosed that attitude toward AI have a significant impact on resilience. A study by Li et al. (2023) revealed that AI-driven agents have a significant positive relationship with mental resilience. Similarly, significant correlations have been found between attitude toward AI and resilience among college students (Dain et al., 2020).

On the other hand, cognitive flexibility is the ability to shift thinking to new, unexpected, or challenging situations (Martin and Rubin, 1995). In the realm of attitude toward artificial intelligence, mental ability plays a pivotal role in facilitating the incorporation of advanced technological tools into educational methodologies and instructional strategies. Positive attitude toward AI can enhance cognitive flexibility by presenting individuals with varied problem-solving situations and encouraging adaptability (Chen et al., 2020). The Broaden-and-Build Theory of Positive Emotions (Fredrickson, 1998) suggests that practicing cognitive flexibility contributes to improved resilience by broadening thought-action repertoires, facilitating adaptive coping mechanisms, and strengthening psychological resilience. These collectively enhance emotional stability, reduce stress, and support overall resilience. Prior research by Kashdan and Rottenberg (2010) revealed that cognitive adaptability is positively correlated with emotional resilience. Additionally, Arslan and Allen (2021) disclosed that psychological flexibility positively correlates with subjective resilience among university students. Furthermore, Brewster et al. (2013) disclosed that cognitive flexibility significantly mediates the relationship between self-efficacy and resilience among bisexual people.

Moving to hope, it is a constructive mindset that inspires individuals to recognize their capacity and realize desired objectives through effective outcomes (Schmid and Lope, 2011). In this regard, attitude toward artificial intelligence can play a significant role in cultivating hope by providing tools that

improve goal setting, strategy development, and decision-making skills (Lopez et al., 2020). Building on this, Hope Theory by Snyder et al. (2002) suggests that hope promotes resilience by encouraging goal-driven cognition, inspiration, and determination. Individuals with elevated optimism are more likely to develop effective pathways to attain goals, sustain a positive outlook during adversity, and experience life fulfillment and holistic resilience. Empirical evidence further supports these insights. A study by Kartol and Soner (2022) found a positive relationship between dispositional hope and resilience among final-year college students. Macintyre et al. (2022) further disclosed that teachers with elevated levels of hope showed greater resilience. Similarly, Demirci (2020) revealed that social competence and hope fully mediated the relationship between resilience and school engagement among secondary school students.

Turning to mindful attention awareness, it refers to the state of being present in the moment with curiosity, acceptance, and openness (Brown and Ryan, 2003). This elevated level of awareness is particularly valuable in today's fast-paced technology-driven environment. Notably, artificial intelligence tools, such as mindfulness apps (e.g., Headspace, Calm, and Medito) and virtual reality environments, have been shown to enhance mindful attention awareness by providing guided meditation and relaxation techniques (Khoury et al., 2015). In the context of future educators, developing mindfulness is crucial for managing stress and maintaining emotional stability. The Mindfulness-to-Meaning theory (Garland et al., 2015) suggests that being present in the moment promotes resilience by encouraging cognitive reappraisal, reducing stress, and fostering positive emotions. This process not only reinforces adaptability and emotional control but also fosters long-term resilience. Previous research further supports these claims. For instance, a study by Huang et al. (2021) found that mindfulness mediates the impact of negative life experiences on resilience among college students. Furthermore, Brown and Ryan (2003) reported that mindful attention awareness significantly predicted resilience among students. Similarly, Hepburn et al. (2021) found a positive correlation between mindfulness, perceived stress, and resilience among university students.

H1: Attitude toward artificial intelligence significantly predict cognitive flexibility among prospective teachers.

H2: Attitude toward artificial intelligence significantly predict mindful attention awareness among prospective teachers.

H3: attitude toward artificial intelligence significantly predict hope among prospective teachers.

H4: attitude toward artificial intelligence significantly predict resilience among prospective teachers.

H5: Mindful attention awareness significantly predicts resilience among prospective teachers.

H6: Cognitive flexibility significantly predicts resilience among prospective teachers.

H7: Hope significantly predicts resilience among prospective teachers.

The above-discussed findings from the extant literature provide adequate evidence for the development of a theoretical framework (Figure 1). The framework posits that attitude toward artificial intelligence influence resilience both directly and indirectly through the mediating roles of cognitive flexibility, hope, and mindful attention awareness. Resilience, a complex construct, encompasses emotional balance, life satisfaction, and a sense of direction (Ryff, 1989). attitude toward artificial intelligence, as an external factor, are proposed to influence resilience by enhancing cognitive flexibility, nurturing hope, and strengthening mindful attention awareness.

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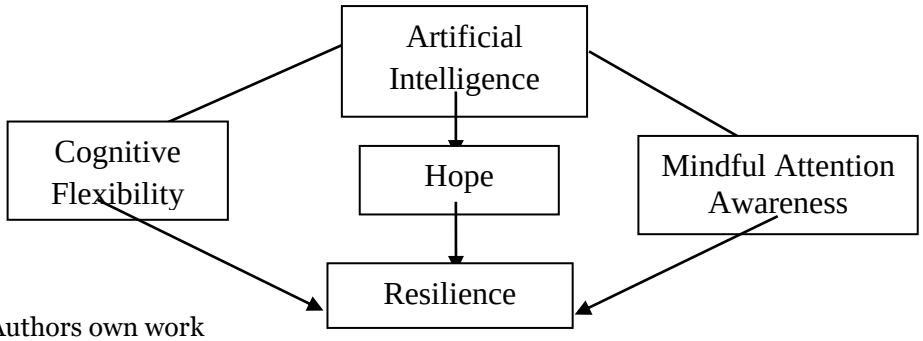
Figure 1 Theoretical Framework



Source: Authors own work

METHODOLOGY AND SAMPLING TECHNIQUE

The study employed a descriptive research method to examine the impact of artificial intelligence on resilience, with cognitive flexibility, hope, and mindful attention awareness as mediating variables. The sample comprised 300 prospective teachers pursuing a Bachelor of Education (B.Ed.) programme from government and government-aided colleges in the Punjab region. Respondents were thoroughly chosen through a simple random sampling technique to ensure equal inclusion and reduce selection bias. Recruitment encompassed personally communicating colleges and encouraging willing respondents. The sample was planned to represent the demographic diversity and educational background of the region, enhancing the generalizability of the results.

Data collection commenced after respondents were informed about the study's objectives, procedures and confidentiality measures. Informed consent was obtained to ensure voluntary participation, with clear communication that the data would be used exclusively for research purpose. The survey was administered online via Google Forms, resulting in 300 valid responses from a total of 500 received. Research tools used in the research included the Artificial Intelligence Scale by (Mukherjee and Dasgupta 2024), Cognitive flexibility Inventory by (Dennis and Vander Wal 2010), Hope Scale by (Snyder 1991), Mindful Attention Awareness Scale by (Brown and Rayan 2003), and Resilience Scale by (Brown & Rayan, 2003). Ethical guidelines were strictly followed, with all data securely stored and accessible only to the research team. Respondents were assured of their right to withdraw without any negative consequences.

Table 1: Demographic particular of the participants

Variables	Options	Number	Percentage
Gender	Male	88	29%
	Female	212	71%
Age	18-22	111	37%
	23-26	189	63%
Locale	Rural	143	47%
	Urban	157	53%

As shown in the Table, the sample consisted of 300 prospective teachers, with 71% identified as female prospective teachers and 29% as male prospective teachers. Age distribution shows that 37% were

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aged 18-22, while 63% were aged 23-26%. In terms of locale, 47% of prospective teachers resided in rural areas, whereas, 53% belonged to urban regions.

MEASURES

The research tools used in this research were divided into two sections: demographic information and psychological variables. The first section gathered information on respondent's locale, age and gender. The second section assessed five variables: artificial intelligence, cognitive flexibility, hope, mindful attention awareness and attitude Toward AI. To measure attitude Toward AI, the Attitude Toward Artificial Intelligence Scale developed by (Mukherjee and Dasgupta 2024) was employed. This 30-item scale, designed on a 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree), evaluates four key dimensions: General understanding, Perceived Benefits, Concerns, and Applications. The scale demonstrated strong reliability (Cronbach's alpha = 0.832) and solid construct validity (0.679). Cognitive flexibility was measured using the Cognitive Flexibility Inventory by (Dennis and Vander Wal 2010). This 20-item scale follows a 7-point Likert scale format (1 Strongly Disagree to 7 = Strongly Agree) and assesses two dimensions: Alternative and Control. The CFI demonstrated strong test-retest reliability with a correlation coefficient of 0.81. To assess the participant's hope, the Hope Scale by Snyder et al. (1991) was used. This 1-item scale measures two components: Pathway thinking and agency thinking. Items are rated on a 8 point likert scale (1 = Definitely False to 8 = Definitely True), with total scores ranging from 8 to 64. The hope scale exhibited good internal reliability, with Cronbach's alpha values ranging from .74 to .84 for overall hope.

Mindful attention awareness was assessed using the Mindful Attention Awareness Scale by (Brown and Rayan 2003). This 15-item tool is rated on a 6-point Likert scale (1 = Almost Always to 6 = Almost Never) and measures dispositional mindfulness, where higher score indicates greater mindfulness. The MAAS demonstrated strong internal consistency, with Corbach's alpha value ranging from 0.77 to 0.91.

Lastly, resilience was evaluated using the Connor-Davidson Resilience Scale (2003). This 25-item scale, rated on a 5-point Likert scale. The total score for the CD-RISC-25 falls within the range of 0 to 100, where higher scores reflect higher resilience and lower scores indicate lower resilience. The CD-RISC demonstrates strong reliability, with test-retest correlations ranging from 0.70 to 0.88.

Additionally, Kaiser-Meyer-Olkin (KMO) values indicated sampling adequacy, while Bartlett's test confirmed significant correlations among all the variables. The detailed results are present in **Table 2.**

Table 2: reliability and validity of the data

Variable	Items	Cronbach's Alpha Coefficient	KMO	Bartlett's Test
Attitude Toward AI	30	0.830	0.794	0.000
Cognitive Flexibility	20	0.792	0.728	0.000
Mindful Attention Awareness	15	0.777	0.758	0.000
Hope	12	0.785	0.728	0.000
Resilience	25	0.810	0.706	0.000

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RESULTS

The analysis of the data underwent comprehensive statistical techniques, including descriptive statistics (mean, standard deviation, minimum and maximum), inferential analysis (correlation) and multivariate analysis (mediation). Descriptive statistics were employed to summarize the data, as presented in Table 3. To assess the relationship among variables, correlation analysis was conducted, with results reported in Table 4. Regression analysis was carried out to evaluate the forecasting role of the predictor variables on the outcome variable, as results presented in Table 5. Furthermore, mediation analysis was carried out to explore the impact and mediating role of variables in the relationships between variables. These techniques were employed to ensure a thorough understanding of the data. All the statistical techniques were conducted using SPSS (Statistical Package for Social Sciences) version 26 and AMOS (Analysis of Moment Structures) version 24 to ensure robust and reliable results.

Table 3: Descriptive statistics of the data

Statistical indicators	Attitude Toward AI	Cognitive Flexibility	Hope	Mindful Attention Awareness	Resilience
Mean	65.47	89.88	67.08	55.8	51.7
Std. Deviation	6.99	9.83	12.38	9.99	8.81
Minimum	50	56	12	30	29
Maximum	79	128	99	84	70

Table 3 presents the descriptive analysis of data. The mean score for artificial intelligence were 65.47, (SD = 6.99), ranging from 50 to79. Similarly, cognitive flexibility recorded a mean of 89.88 and a standard deviation of 9.83, with scores spanning from 56-128. The mean score for hope was 67.08 (SD = 12.38), ranging from 12 to 99. For mindful attention awareness, the mean was 55.8 with a standard deviation of 9.99, and scores varied between 30 to 84. Lastly, resilience had a mean score of 51.7 (SD = 8.81) with values ranging from 29 to 70.

Table 4: Correlation analysis of the data

Variables	AI	CF	MAA	Hope	RES
AI	1				
CF	.991**	1			
MAA	.967**	.953**	1		
Hope	.966**	.950**	.998**	1	
REs	.989**	.976**	.962**	.962**	1
Note: **Correlation is significant at the 0.01 level					

The correlation analyses are presented in table 4, revealed significant positive relationship among variables. Artificial intelligence exhibited strong positive correlation cognitive flexibility (r = .991), mindful attention awareness (r = .967), hope (r= .966) and resilience (r = .989), all significant at the 0.01 level. Similarly, cognitive flexibility showed high correlations with mindful attention awareness (r = .953),

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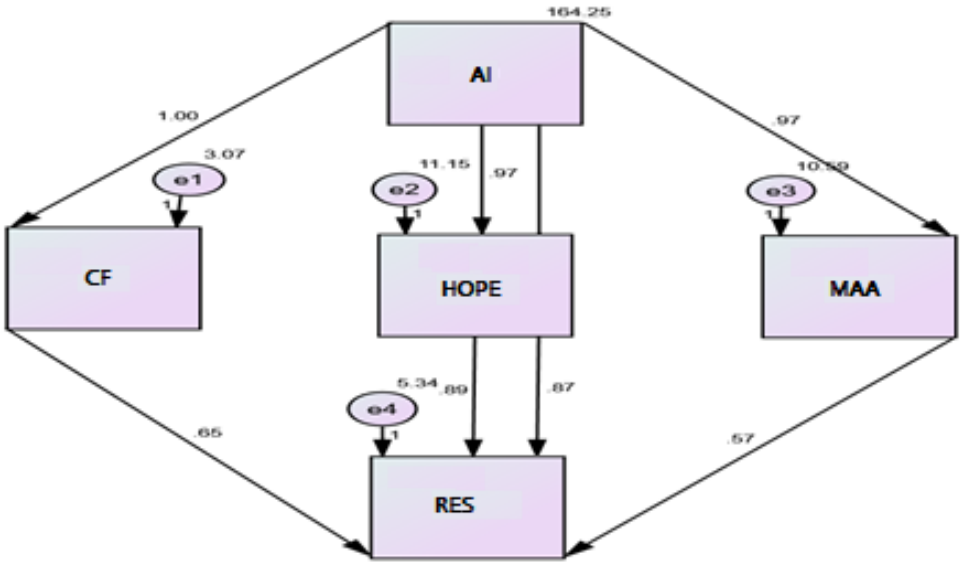
hope (r = .950), and resilience (r = .976) among prospective teachers. Additionally, mindful attention awareness strongly correlated with hope (r =.998) and resilience (r =.962). while hope also correlated significantly with resilience (r =.962).

Figure 2: Path diagram showing direct and indirect effects



Source: AMOs output

Hypotheses Testing Results (Path Analysis)

Figure 2 illustrates direct and indirect effects in which cognitive flexibility (CF) and attitude toward artificial intelligence (AI) jointly account for pre-service teachers' resilience (RES) via both direct and indirect pathways. CF exerts a unit-standardized influence on AI attitudes (β = 1.00, C.R. = 124.50), indicating that greater cognitive adaptability is mirrored by more favorable orientations toward AI. AI attitudes, in turn, strongly predict two key mediators—hope (β = .97, C.R. = 64.40) and mindful attention awareness (MAA; β = .97, C.R. = 64.60)—each of which contributes directly to resilience (hope → RES: β = .87, C.R. = 24.11; MAA → RES: β = .67, C.R. = 15.30). In addition, CF retains a substantial direct effect on resilience (β = .65, C.R. = 14.17), and AI attitudes also maintain an independent positive path to resilience (β = .87, C.R. = 37.96). Together, these paths account for nearly all systematic variance in resilience, with residual error terms (e1–e4) reflecting minor measurement-specific variance. Collectively, the model confirms that AI attitudes act as a potent conduit through which cognitive flexibility fosters psychological resources and, ultimately, resilience in pre-service teachers.

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Table 5: Regression Results

Hypotheses	Relationships	Estimate	S.E.	C.R.	P Value	Decision
H1	Attitude Toward Artificial Intelligence → Cognitive Flexibility	.996	.008	124.5	***	Supported
H2	Artificial Intelligence → Mindful Attention Awareness	.969	.015	64.6	***	Supported
H3	Artificial Intelligence → Hope	.966	.015	64.4	***	Supported
H4	Attitude Toward Artificial Intelligence → Resilience	.873	.023	37.96	***	Supported
H5	Mindful Attention Awareness → Resilience	.566	.037	15.3	***	Supported
H6	Cognitive Flexibility → Resilience	.652	.046	14.17	***	Supported
H7	Hope → Resilience	.892	.037	24.11	***	Supported

Note: S.E- Standard Error, C.R- Critical Ratio, ***-<0.001

Source: AMOS Output

Table 5 revealed the path estimates, all of which reached statistical significance at $p < .001$, thereby supporting Hypotheses 1 through 7. Specifically, attitude toward artificial intelligence exhibited near-unity positive influences on cognitive flexibility ($\beta = .996$, C.R. = 124.50), mindful attention awareness ($\beta = .969$, C.R. = 64.60), hope ($\beta = .966$, C.R. = 64.40), and resilience ($\beta = .873$, C.R. = 37.96). These exceptionally large coefficients indicate that more favorable AI orientations strongly predict improvements in each psychological construct. Furthermore, the psychological strengths themselves significantly contributed to resilience: mindful attention awareness predicted resilience ($\beta = .566$, C.R. = 15.30), as did cognitive flexibility ($\beta = .652$, C.R. = 14.17) and hope ($\beta = .892$, C.R. = 24.11). The magnitude of these effects underscores the centrality of AI attitudes in shaping core cognitive and affective processes among pre-service teachers, and highlights the downstream importance of psychological resources in bolstering resilience. Collectively, these findings validate the proposed model and affirm the mediating and direct roles of AI orientations and mental-wellness constructs in fostering adaptive capacities in educator candidates.

DISCUSSION

The study explored the impact of attitude Toward artificial intelligence (AI) on resilience, with cognitive flexibility, hope, and mindful attention awareness as mediating variables among prospective teachers. Correlation analysis revealed significant relationships between attitude TowardAI and resilience among prospective teachers. These findings align with studies by Velastegui et al. (2023), Li et al. (2023), and Dai et al. (2020), which demonstrated that positive attitude toward AI are associated with improved mental health, well-being, and emotional regulation in students. The findings also resonate with the Technology-Enhanced Learning and Psychological Well-being theory (Shao et al., 2021), which suggests

that AI-assisted tools enhance resilience by fostering personalized learning, reducing cognitive overload, and enhancing motivation and engagement.

Positive correlations were also found between cognitive flexibility, hope, mindful attention awareness, and resilience among prospective teachers. These findings are consistent with prior studies (Arslan & Allen, 2021; MacIntyre et al., 2022; Huang et al., 2021), which demonstrated that higher cognitive flexibility enhances individuals' capacity to manage stress and adapt to changing conditions, that hope supports coping and perseverance, and that mindfulness contributes to self-regulation and emotional balance.

The theoretical underpinnings of these relationships are supported by several frameworks. The Broaden-and-Build Theory of Positive Emotions (Fredrickson, 1998) suggests that cognitive flexibility broadens individuals' momentary thought-action repertoires, allowing them to build adaptive emotional and psychological resources. Similarly, Hope Theory (Snyder et al., 2002) posits that hope enables individuals to generate and pursue meaningful goals, fostering long-term resilience. The Mindfulness-to-Meaning Theory (Garland et al., 2015) explains how mindfulness enhances resilience by facilitating cognitive reappraisal, reducing stress, and promoting positive emotions.

Path analysis revealed that attitude Toward AI has a significant positive effect on resilience. Mediation analysis further showed that cognitive flexibility, hope, and mindful attention awareness act as mediators in this relationship. These results reflect the complex mechanisms by which a positive orientation Toward AI may contribute to stronger adaptive capacities in future educators.

Interestingly, mindful attention awareness demonstrated a significant negative path coefficient in relation to resilience. This suggests that in certain contexts, heightened mindfulness may be associated with increased self-focus or rumination, potentially undermining emotional stability. This aligns with Kriakous et al. (2020), who caution that excessive mindfulness without proper guidance might lead to over-engagement with distressing thoughts or heightened sensitivity. These findings provide a nuanced understanding of how attitude TowardAI, combined with psychological strengths such as flexibility and hope, contributes to the development of resilience in prospective teachers.

PRACTICAL IMPLICATIONS

The findings of this study underscore the necessity of reorienting teacher education programs to address the dual demands of technological integration and psychological preparedness in the digital era. To cultivate resilience among pre-service teachers, institutions must adopt curricula that harmonize AI literacy with psychological skill development. Structured training modules should introduce future educators to AI-driven pedagogical tools, emphasizing their ethical application in lesson planning, assessment, and personalized instruction. Concurrently, resilience-building components—such as workshops on cognitive adaptability, mindfulness practices, and goal-oriented hope strategies—should be embedded to equip teachers with mental frameworks for navigating technological uncertainties. This integrated approach ensures that pre-service teachers develop not only technical proficiency but also the emotional agility to adapt to evolving classroom dynamics.

Educational frameworks can draw inspiration from global models that blend technological and psychological training. For instance, initiatives that pair AI tool demonstrations with reflective exercises on stress management offer replicable templates for fostering adaptability. Institutions should collaborate with policymakers to13 secure funding for such programs, prioritizing equitable access to AI resources and mental health support across urban and rural settings. Partnerships with EdTech organizations could further enhance training by providing subsidized access to adaptive learning platforms and mindfulness

applications, ensuring that socioeconomically disadvantaged cohorts are not excluded from digital advancements.

Ethical considerations must remain central to these efforts. Teacher education programs should address concerns such as algorithmic bias, data privacy, and the potential for AI to exacerbate existing inequities. By integrating discussions on digital ethics into coursework, pre-service teachers can critically evaluate the role of technology in education while advocating for inclusive practices. Additionally, resilience-building interventions should be culturally contextualized to resonate with diverse learner backgrounds, acknowledging regional variations in technological access and pedagogical traditions.

Ultimately, these recommendations advocate for a holistic pedagogical paradigm that bridges technological fluency with human-centered emotional development. By nurturing educators who are equally adept at leveraging AI tools and managing psychological challenges, institutions can foster a generation of teachers capable of sustaining innovation, equity, and well-being in 21st-century classrooms.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Despite the valuable insights offered by this study, several limitations must be acknowledged. First, the cross-sectional design restricts the ability to infer causality between attitude TowardAI, the mediating psychological constructs, and resilience. Longitudinal studies would be beneficial in establishing temporal precedence and causative pathways among these variables. Second, the sample was drawn from a specific demographic of prospective teachers, which may limit the generalizability of the findings to other educational or cultural contexts. Future research should consider more diverse and representative samples, including in-service teachers and participants from varying socio-cultural backgrounds, to enhance external validity.

Moreover, the reliance on self-report measures may have introduced response biases, such as social desirability or common method variance. Employing mixed-methods approaches or incorporating objective assessments of resilience and digital competency could yield a more comprehensive understanding of these constructs. Additionally, while the study identified a surprising negative relationship between mindful attention awareness and resilience, it did not explore potential moderating variables that may explain this outcome. Future investigations could examine whether factors such as levels of mindfulness training, emotional regulation skills, or contextual stressors influence the direction and strength of this relationship. Experimental or intervention-based research could also explore how targeted training in mindfulness, cognitive flexibility, and AI literacy can be integrated to enhance resilience among educators, thereby informing the development of empirically grounded teacher education programs.

CONCLUSION

The study establishes an attitude Toward AI as a significant contributor to resilience among prospective teachers, operating through mediating factors like cognitive flexibility, hope, and mindful attention awareness. By integrating insights from technology-enhanced learning and positive psychology, the study presents a novel framework that emphasizes the importance of harmonizing AI integration with human-centered emotional development. Ensuring ethical considerations such as data privacy and equitable access will be crucial in building sustainable and inclusive models for AI-enhanced teacher education.

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