

Artificial Intelligence, Teaching Presence, and Sense of Belonging in Online Higher Education: Implications for Student Retention

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Abstract: The increasing use of artificial intelligence (AI) in online higher education has raised questions about its influence on instructional quality, student belonging, and persistence. Grounded in the Community of Inquiry framework and belongingness theory, this study examined the relationships among AI-supported instruction, teaching presence, sense of belonging, and student retention intent. Using a quantitative, cross-sectional design, data were collected from 150 students enrolled in fully online higher education courses. Data were analyzed using SPSS (Version 29), including descriptive statistics, reliability testing, Pearson correlations, multiple regression analyses, and mediation analyses using PROCESS macro. Results indicated that AI-supported instruction significantly predicted teaching presence ($\beta = .46, p < .001$), teaching presence significantly predicted sense of belonging ($\beta = .54, p < .001$), and sense of belonging significantly predicted retention intent ($\beta = .59, p < .001$). Mediation analysis showed that sense of belonging partially mediated the relationship between teaching presence and retention intent, with a significant indirect effect ($b = .28, 95\% \text{ CI } [.17, .41]$). Sequential mediation analysis further demonstrated that AI-supported instruction influenced retention intent indirectly through teaching presence and sense of belonging ($b = .18, 95\% \text{ CI } [.10, .30]$), with indirect effects exceeding direct effects. Overall, the findings indicate that AI contributes to student retention primarily through a human-centered pathway in which enhanced teaching presence fosters students' sense of belonging, thereby strengthening persistence intentions. These results underscore the importance of integrating AI within relational pedagogical practices to support retention in online higher education.

Keywords: artificial intelligence in education; teaching presence; sense of belonging; online higher education; student retention; mediation analysis.

I. INTRODUCTION

Online higher education continues to expand rapidly, with institutions increasingly adopting digital platforms to meet demand for flexible, accessible learning. This growth aligns with broader trends in educational transformation, where artificial intelligence (AI) is reshaping instructional practices, curriculum delivery, and student support systems (Inside Higher Ed, 2025). Despite the promise of AI to personalize learning pathways and provide scalable instruction, concerns persist regarding how algorithmic tools influence relational aspects of learning that are critical for persistence and retention. In particular, the intersection of AI use, teaching presence, and students' sense of belonging remains an emerging area of inquiry critical for understanding retention outcomes in online environments.

Teaching presence, defined as the instructional design, facilitation, and active engagement by instructors in online learning environments, has been linked to increased student engagement and academic outcomes. Research grounded in community and presence theories suggests that when instructors manifest a clear, structured, and responsive presence, students report higher levels of engagement and course satisfaction (Alshammari & Alrehaili, 2025). However, recent findings indicate that teaching presence alone may not uniformly drive engagement without meaningful social interaction and cognitive

support among learners, underscoring the complexity of presence dynamics in virtual contexts. These dynamics are especially salient when AI tools supplement or mediate instructional interactions, raising questions about how human and machine presences intersect.

Sense of belonging, students' perceptions of acceptance, support, and connectedness within the learning community, is a strong predictor of engagement and retention in online higher education (Online Learning Consortium, 2024). Digital community research confirms that fostering belonging through interactive platforms and community-building practices enhances student motivation and persistence. Yet, the rapid integration of AI into learning platforms introduces new variables that may either support or undermine belonging. On one hand, AI can offer personalized guidance, adaptive learning pathways, and responsive feedback that make students feel recognized as individuals; on the other, poorly designed AI interactions risk depersonalizing experiences and weakening social ties essential for belonging.

The rise of AI in higher education presents a dual promise: enhancing pedagogical efficiency while preserving human elements of instruction, including relationships that nurture self-efficacy and belonging (AI in Education Council, 2024). Recent discourse emphasizes the importance of intentionally designing AI tools that augment rather than replace the instructor's role, ensuring that machine support aligns with pedagogical goals that sustain engagement and community. This perspective highlights an urgent need for empirical research assessing not just whether AI improves outcomes, but how it interacts with teaching presence and belonging to influence student retention.

Despite increasing adoption of AI, there is limited scholarship examining the integrated effects of AI, teaching presence, and sense of belonging on online student retention. Bridging this gap, the present study investigates how AI-enabled learning environments intersect with instructional presence and psychosocial experiences to shape students' intentions to persist in online higher education. By focusing on these interrelated constructs, the research aims to clarify whether AI can function synergistically with human teaching practices to strengthen belonging and retention, or whether it inadvertently contributes to disengagement and attrition.

Problem Statement

Despite the continued expansion of online higher education, student retention in fully online programs remains consistently lower than in face-to-face settings. Prior research attributes this pattern to reduced instructional immediacy, limited interaction, and weakened relational connections between students and instructors (Allen & Seaman, 2015; Richardson et al., 2017). Teaching presence defined as the intentional design, facilitation, and direction of learning has been widely identified as a critical factor in mitigating these challenges by fostering engagement, community, and persistence (Garrison et al., 2000; Shea et al., 2010). Closely aligned with teaching presence, sense of belonging has emerged as a robust psychosocial predictor of retention, particularly in online environments where students' perceptions of being valued and supported depend largely on mediated instructional interactions (Hausmann et al., 2007; Strayhorn, 2019).

Concurrently, artificial intelligence is increasingly embedded in online higher education through adaptive learning systems, automated feedback, and learning analytics intended to enhance personalization and scalability. While proponents suggest that AI can support student success by improving responsiveness and instructional efficiency, critics caution that AI-mediated instruction may weaken the human and relational dimensions of teaching presence that are essential for cultivating belonging and persistence (Zawacki-Richter et al., 2019; Selwyn, 2019). Despite rapid adoption, empirical research has largely examined AI in terms of performance or system implementation, offering limited insight into how AI interacts with teaching presence and students' sense of belonging to influence retention. As institutions expand AI-supported online learning, there is a critical need to examine these relationships to determine whether AI functions as a complement to or a disruption of the pedagogical and relational conditions necessary for student persistence.

Purpose of the Study

The purpose of this study is to examine the relationships among artificial intelligence use, teaching presence, and students' sense of belonging in online higher education, and to assess how these constructs jointly influence student retention intent. Specifically, this study investigates whether AI-supported instructional environments enhance or attenuate teaching presence and belonging, and whether these effects are associated with students' intentions to persist in online programs. By integrating technological, instructional, and psychosocial perspectives, this research seeks to clarify the role of AI as either a supportive extension of human teaching practices or a potential disruption to the relational conditions that underpin student retention in online learning environments.

Research Questions and Hypotheses

RQ1. What is the relationship between artificial intelligence–supported instructional practices and students’ perceptions of teaching presence in online higher education?

H1. Greater use of artificial intelligence–supported instructional practices is positively associated with higher perceived teaching presence in online courses.

RQ2. To what extent does perceived teaching presence predict students’ sense of belonging in online learning environments?

H2. Higher levels of perceived teaching presence are positively associated with stronger student sense of belonging in online courses.

RQ3. What is the relationship between students’ sense of belonging and their retention intent in online higher education?

H3. Stronger student sense of belonging is positively associated with higher retention intent in online higher education.

RQ4. Does teaching presence mediate the relationship between artificial intelligence–supported instructional practices and students’ sense of belonging?

H4. Teaching presence mediates the relationship between artificial intelligence–supported instructional practices and students’ sense of belonging, such that greater AI use is associated with higher teaching presence, which in turn predicts stronger belonging.

RQ5. Does sense of belonging mediate the relationship between teaching presence and student retention intent in online higher education?

H5. Sense of belonging mediates the relationship between teaching presence and student retention intent, such that higher teaching presence predicts stronger belonging, which in turn predicts higher retention intent.

Significance of the Study

This study is significant because it addresses a critical gap in the online higher education literature by examining how artificial intelligence–supported instruction interacts with teaching presence and students’ sense of belonging to influence retention intent. Although teaching presence and belonging have been widely established as predictors of persistence, prior research has largely examined these constructs independently of emerging AI-enabled learning environments. By integrating technological, pedagogical, and psychosocial perspectives, this study responds to calls for research that moves beyond AI adoption and performance metrics to examine how AI reshapes the relational foundations of online learning (Selwyn, 2019; Zawacki-Richter et al., 2019).

Theoretically, this research extends the Community of Inquiry framework and belonging theory by positioning AI as a contextual instructional factor that may augment or constrain teaching presence and belonging. Practically, the findings offer evidence-based guidance for faculty, instructional designers, and institutional leaders seeking to implement AI in ways that support human-centered teaching and student connection. As institutions increasingly rely on AI-driven tools to scale online education, this study provides timely insight into how AI can be leveraged to complement instructor presence, foster belonging, and ultimately improve student retention in online higher education.

Gap in the Literature

Although research has established that relational and instructional factors such as teaching presence and sense of belonging strongly influence online student outcomes, persistent gaps remain in understanding how these constructs operate within increasingly AI-mediated educational environments. For decades, theories such as the Community of Inquiry have positioned instructor presence and social interaction as central to student engagement and retention (Garrison et al., 2000; Shea et al., 2010).

More recent work continues to underscore the pivotal role of presence in fostering connection and persistence in online learning (Ahern et al., 2024; Li, 2025). Likewise, a growing body of research highlights sense of belonging as a foundational psychosocial predictor of learning satisfaction and retention, particularly for online and post-traditional learners (Kelly et al., 2025; Online Learning Consortium, 2024). However, these literatures largely focus on human facilitation and community dynamics without adequately accounting for the growing influence of artificial intelligence technologies.

At the same time, scholarship on artificial intelligence in online education has emphasized adaptive personalization, predictive analytics, and enhanced responsiveness as core advantages of AI integration (Zawacki-Richter et al., 2019; McGehee, 2024). Early empirical studies suggest that AI tools can improve academic performance and intrinsic motivation (Hanshaw & Miller, 2024), while conceptual work points to AI's potential impact on motivation, self-efficacy, and belonging (AI in Education Council, 2024). Yet there remains a striking lack of research that examines AI's relational and psychosocial effects, especially how AI use influences the very teaching presence and sense of belonging that are linked to persistence. Moreover, while some studies explore AI's impact on learner–instructor interaction broadly (Seo et al., 2021), no cohesive research has integrated AI, presence, and belonging into a unified model predicting retention. This represents a critical gap: as AI becomes embedded in online instruction, its influence on human-centered pedagogical constructs that drive retention is poorly understood. Without empirical evidence that clarifies whether AI augments or undermines teaching presence and belonging, institutions risk implementing technologies that optimize efficiency yet weaken the relational conditions essential for sustained student success.

II. THEORETICAL FRAMEWORK

This study is grounded in an integrated theoretical framework that draws on the Community of Inquiry (CoI) framework, sense of belonging theory, and emerging scholarship on artificial intelligence–mediated learning environments to explain student retention in online higher education. Together, these perspectives provide a relational, instructional, and technological lens for understanding how AI-supported instruction interacts with human teaching practices to shape students' psychosocial experiences and persistence intentions.

The Community of Inquiry framework (Garrison et al., 2000) provides the foundational pedagogical structure for this study. CoI posits that meaningful learning in online environments emerges through the dynamic interaction of teaching presence, social presence, and cognitive presence. Teaching presence, conceptualized as instructional design, facilitation, and direct instruction, consistently been identified as the most influential presence for shaping student engagement, satisfaction, and persistence in online courses (Shea et al., 2010; Borup et al., 2014). Within this framework, teaching presence serves as the primary mechanism through which instructors create structure, guide discourse, and model engagement, making it especially relevant in technology-mediated learning contexts.

Complementing CoI, sense of belonging theory provides a psychosocial explanation for why teaching presence matters for retention. Sense of belonging refers to students' perceptions of being accepted, valued, and supported within an academic community (Strayhorn, 2019). Extensive empirical research demonstrates that belonging is a robust predictor of motivation, engagement, and persistence across diverse student populations and instructional modalities (Hausmann et al., 2007; Tinto, 2017). In online environments where physical co-presence is absent, belonging is largely cultivated through instructional interactions, feedback, and relational cues embedded within teaching practices. Thus, belonging functions in this framework as a key mediating construct linking teaching presence to retention intent.

Emerging research on artificial intelligence in higher education introduces a critical contextual layer to this framework. AI-supported instructional tools, such as automated feedback systems, adaptive learning platforms, and learning analytics are increasingly embedded in online courses with the goal of enhancing personalization and instructional efficiency (Zawacki-Richter et al., 2019). Recent scholarship suggests that AI has the potential to augment teaching presence by supporting timely feedback, scaffolding learning, and identifying at-risk students (Hanshaw & Miller, 2024; Li, 2025). However, critical perspectives caution that AI may also depersonalize instruction if it substitutes rather than supports relational teaching practices, thereby weakening students' sense of belonging (Selwyn, 2019; Williamson & Eynon, 2020).

Integrating these perspectives, the present study conceptualizes artificial intelligence as a contextual instructional condition that influences, rather than replaces, teaching presence, which in turn shapes students' sense of belonging and retention intent. Teaching presence is positioned as a mediating pedagogical mechanism between AI use and belonging, while belonging serves as a psychosocial mediator linking instructional experiences to persistence outcomes. This integrated framework responds to calls for theory-informed research that situates AI within established models of online learning and student persistence, offering a human-centered approach to understanding retention in AI-enabled online higher education.

Relationship Between the Theoretical Framework and Study Variables

The theoretical framework guiding this study integrates the Community of Inquiry (CoI) framework, sense of belonging theory, and contemporary scholarship on artificial intelligence (AI) in online education to explain student retention in fully

online higher education. Within this framework, each study variable represents a theoretically grounded construct that occupies a specific role in the instructional–psychosocial pathway leading to persistence.

Artificial intelligence–supported instruction is conceptualized as a contextual instructional condition rather than a relational agent. Research on AI in higher education emphasizes its capacity to enhance personalization, scalability, and instructional efficiency through adaptive learning systems, automated feedback, and learning analytics (Zawacki-Richter et al., 2019; Williamson & Eynon, 2020). However, AI alone does not inherently produce the social or relational cues necessary for student connection. Accordingly, in this framework, AI-supported instruction functions as an antecedent variable whose influence on student outcomes is indirect and contingent upon pedagogical enactment.

Teaching presence is positioned as the primary pedagogical mechanism linking AI-supported instruction to students' psychosocial experiences. Grounded in the CoI framework, teaching presence encompasses instructional design, facilitation, and direct instruction that guide and support meaningful learning (Garrison et al., 2000). Empirical research demonstrates that teaching presence is strongly associated with student engagement, satisfaction, and persistence in online learning environments (Shea et al., 2010; Borup et al., 2014). Within the present framework, teaching presence is theorized to supplement and humanize AI-mediated instruction by contextualizing automated processes, personalizing feedback, and sustaining instructor–student interaction. Thus, teaching presence serves as a mediating variable through which AI-supported instruction may influence belonging.

Sense of belonging functions as the central psychosocial construct connecting instructional experiences to retention outcomes. Sense of belonging refers to students' perceptions of being valued, accepted, and supported within the academic community (Strayhorn, 2019). Extensive research indicates that belonging is a robust predictor of motivation, engagement, and persistence across higher education contexts, including online learning (Hausmann et al., 2007; Tinto, 2017). In this framework, belonging is theorized to emerge primarily from sustained teaching presence rather than from AI use alone, positioning it as a mediating variable that translates pedagogical practices into persistence-related outcomes. (See Figure 1).

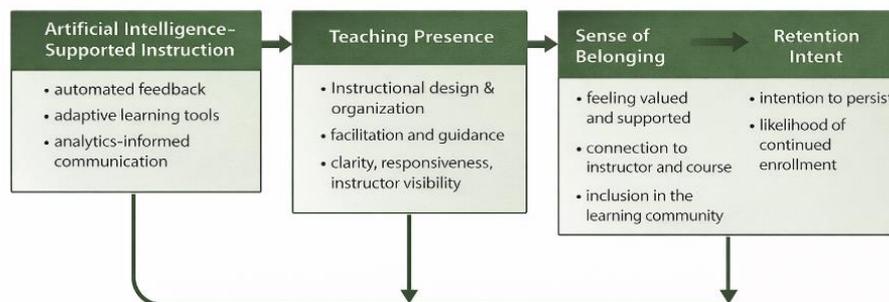


Figure 1. Flow Chart of AI Instruction and Retention

Conceptual model illustrating the hypothesized sequential relationships among artificial intelligence–supported instruction, teaching presence, sense of belonging, and student retention intent in online higher education.

Retention intent is the outcome variable of the framework and reflects students' intentions to continue enrollment in their online programs. Retention intent is widely used in higher education research as a proximal indicator of persistence and actual retention behavior (Tinto, 2017). Consistent with psychosocial models of student persistence, retention intent in this study is theorized to be indirectly influenced by AI-supported instruction through its effects on teaching presence and sense of belonging. This sequential positioning aligns with prior evidence that students are more likely to persist when they perceive instructional care, connection, and inclusion within the learning environment (Richardson et al., 2017; Strayhorn, 2019).

Collectively, the framework specifies a theory-driven pathway in which artificial intelligence–supported instruction shapes teaching presence, teaching presence fosters sense of belonging, and sense of belonging predicts retention intent. This structure provides a coherent rationale for the selection and positioning of the study variables and supports empirical testing of the proposition that teaching presence supplements AI to promote belonging and retention in online higher education.

III. LITERATURE REVIEW

To identify key literature relevant to artificial intelligence, teaching presence, sense of belonging, and student retention in online higher education, a systematic search was conducted across multidisciplinary academic databases (e.g., ERIC, Scopus, Web of Science, Taylor & Francis Online) and open repositories (SSRN). Search terms included combinations of “artificial intelligence in online learning,” “teaching presence,” “social presence,” “sense of belonging,” “online retention,” “student engagement,” and “higher education.” Search filters limited results to studies published between 2019 and 2025 where available, supplemented by foundational theoretical sources preceding 2019 to establish conceptual grounding. Grey literature and narrative reviews were also included to capture emerging AI scholarship in educational contexts.

AI in Online Education

The integration of artificial intelligence (AI) into online learning is rapidly gaining scholarly attention as institutions seek to enhance personalization, adaptivity, and efficiency in digital instruction. Narrative reviews of AI-powered learning platforms emphasize that AI can support student engagement and educational efficacy through adaptive pathways, feedback automation, and real-time responsiveness (Garcia et al., 2024). However, research also underscores divergent views on AI’s educational consequences: while some studies find that AI supports cognitive engagement and skill development, others raise concerns about AI substituting for human support at the potential expense of pedagogical relationships and wellbeing (Crawford, 2024; Wilson, 2025). These findings suggest that AI’s role is neither unconditionally positive nor negative but contingent on the pedagogical context in which it is embedded. For example, student perceptions of AI in higher education are generally positive when AI tools are perceived to assist cognition and engagement yet mixed when AI undermines opportunities for personal expression or reflective learning (Wilson, 2025). These patterns reinforce the need to examine AI not only for technological effects but also for its interaction with relational and instructional variables that influence engagement and persistence.

Teaching Presence and Online Instruction

Teaching presence remains a central construct in understanding online learning effectiveness. Rooted in the Community of Inquiry (CoI) framework, teaching presence comprises instructional design, facilitation, and direct guidance, and serves as a foundational predictor of student engagement and satisfaction (Garrison et al., 2000). Recent empirical research continues to affirm the importance of teaching presence for student outcomes: teaching presence is linked to deeper cognitive engagement and reduced psychological distance in virtual contexts, particularly through structured facilitation and encouragement of meaningful learner interactions (Alshammari & Alrehaili, 2025; Dyer, 2025). Although some studies suggest that teaching presence alone may not directly increase active participation without supporting social presence (Alshammari & Alrehaili, 2025), the broader literature consistently highlights teaching presence as essential for establishing clarity, feedback cycles, and a supportive course climate, elements that underpin sustained involvement in online courses.

Sense of Belonging in Online Learning

Sense of belonging, defined as students’ perception of acceptance, support, and inclusion, is a robust psychosocial predictor of persistence and retention in higher education. Research specifically focused on online learners finds that belonging is critical for consolidating learning experiences and reducing attrition in distance environments, where physical contact is absent (Online Learning Consortium, 2024; Dulfer, 2025). Literature from higher education contexts highlights that interventions designed to foster belonging (e.g., structured peer interactions, instructor outreach) are associated with improved engagement, satisfaction, and completion rates. Recent studies also explore belonging in AI-mediated classrooms, reporting nuanced effects: while AI can support engagement structures, the absence of human relational cues may diminish students’ affective connection unless balanced by instructor social presence (ResearchGate, 2025; ResearchGate, 2025). These findings underscore that belonging in online contexts depends increasingly on how relational and technological elements interact within learning ecosystems.

Retention in Online Higher Education

Retention is often conceptualized as the culmination of successive engagement, integration, and psychosocial experiences that enable students to persist toward program completion. A substantial body of research identifies engagement and belonging as proximate determinants of persistence, with teaching presence and social support functioning as mediators of retention outcomes. For example, sense of belonging has been empirically linked to increased retention intent and actual

persistence in online post-traditional students (Online Learning Consortium, 2024). Other work emphasizes the mediating role of social presence and engagement in translating interaction and instructional support into improved online learning efficiency and persistence outcomes (Richardson et al., 2017; PMC study, 2025). Despite these insights, the literature reveals a gap in explicitly integrating AI into models of retention: while AI usage is studied in relation to engagement and academic performance, its interaction with teaching presence and sense of belonging as drivers of retention remains under-examined.

Emerging Gaps and Directions

The reviewed literature reveals three notable patterns: (1) AI is increasingly embedded in online learning, but its impact is largely studied in terms of engagement or performance, not relational dynamics; (2) teaching presence and social presence research continues to demonstrate their importance for engagement and belonging, yet rarely in conjunction with AI use; and (3) sense of belonging is widely recognized as a retention predictor, but there is limited research on how AI moderates or mediates this relationship. Collectively, this suggests a critical gap: how AI-supported instructional practices interact with teaching presence and belonging to shape retention outcomes in online higher education. This gap points to the need for integrative empirical research that situates AI not merely as a tool but as a contextual instructional condition whose effects on relational and psychosocial variables can ultimately influence persistence.

IV. METHODOLOGY

This study employed a quantitative, cross-sectional correlational design to examine the relationships among artificial intelligence-supported instructional practices, teaching presence, sense of belonging, and student retention intent in online higher education. A quantitative approach was appropriate given the study's objective to test theoretically grounded relationships and mediation pathways among predefined variables using standardized survey instruments. The design allows for statistical examination of direct and indirect effects consistent with the proposed conceptual framework.

Participants and Sampling

Participants consisted of students enrolled in fully online undergraduate and graduate courses at a higher education institution in the United States. Purposive convenience sampling was used to recruit participants who met the inclusion criteria: (a) current enrollment in at least one fully online course and (b) exposure to AI-supported instructional features (e.g., automated feedback, adaptive learning tools, analytics-informed communications) within their courses. A total sample of 150 participants was targeted and achieved, meeting statistical power requirements for the planned analyses. Participation was voluntary, and data were collected anonymously via an online survey platform.

An a priori power analysis was conducted using *G Power 3.1** to determine the minimum required sample size. Assuming a medium effect size ($f^2 = .15$), an alpha level of .05, and statistical power of .80, a minimum sample size of 92 participants was required for multiple regression analysis with up to four predictors. To account for potential missing data, increase statistical stability, and support mediation analysis, the target sample size was increased to 150 participants. This sample size exceeds minimum power requirements and is consistent with recommendations for mediation testing in behavioral and educational research.

Study measures include 1) Artificial Intelligence-Supported Instruction. AI-supported instructional practices were measured using a researcher-developed scale assessing students' perceptions of AI-enabled features such as automated feedback, adaptive content, and analytics-informed instructional support. Items were rated on a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. 2) Teaching Presence. Teaching presence was measured using a validated teaching presence subscale adapted from the Community of Inquiry framework, capturing instructional design, facilitation, and direct instruction. Prior studies report acceptable internal consistency for this scale ($\alpha \geq .80$). 3) Sense of Belonging. Sense of belonging was measured using a validated belonging scale appropriate for online higher education contexts, assessing students' perceptions of acceptance, support, and connectedness within the learning environment. 4) Retention Intent. Retention intent was measured using a short scale assessing students' intentions to persist and remain enrolled in their online program. Retention intent is widely used as a proximal indicator of persistence in higher education research.

Data Analysis

Data were analyzed using SPSS (Version 29). Preliminary analyses included descriptive statistics, internal consistency reliability testing using Cronbach's alpha, and assessment of distributional assumptions. Pearson correlation analyses were

conducted to examine bivariate relationships among the study variables. Multiple regression analyses were used to test direct effects. Mediation and sequential mediation hypotheses were tested using the PROCESS macro for SPSS (Model 6; Hayes, 2018) with 5,000 bootstrap resamples to estimate indirect effects and corresponding confidence intervals. Statistical significance was evaluated at the .05 level.

Preliminary analyses were conducted to assess data quality and statistical assumptions prior to hypothesis testing. As shown in Table 1, missing data were minimal (<5%) across all variables and were addressed using mean substitution. Distributional properties were examined using skewness, kurtosis, and Shapiro–Wilk tests (Table 2). All variables demonstrated acceptable normality, with skewness and kurtosis values within ± 2 and nonsignificant Shapiro–Wilk statistics ($p > .05$).

Table 1: Data Screening and Missingness Summary (N = 150)

Variable	% Missing	Min	Max
AI-Supported Instruction	2.0%	1.80	5.00
Teaching Presence	1.3%	2.00	5.00
Sense of Belonging	1.3%	1.75	5.00
Retention Intent	0.7%	2.00	5.00

Note. Missing values were below 5% for all variables and were handled using mean substitution.

Table 2: Tests of Normality and Distributional Properties

Variable	Skewness	Kurtosis	Shapiro–Wilk (W)	p
AI-Supported Instruction	−0.41	−0.22	.98	.07
Teaching Presence	−0.36	−0.18	.99	.11
Sense of Belonging	−0.29	−0.31	.98	.09
Retention Intent	−0.33	−0.27	.99	.10

Note. Skewness and kurtosis values fall within ± 2 , indicating approximate normality. Shapiro–Wilk tests were nonsignificant ($p > .05$), supporting normal distribution assumptions.

Multicollinearity diagnostics indicated no concern, with tolerance values exceeding .20 and variance inflation factor (VIF) values below 3.0 (Table 3). Independence of errors was supported by a Durbin–Watson statistic within the acceptable range (Table 4). Visual inspection of residual scatterplots confirmed linearity and homoscedasticity. Collectively, these results supported the use of parametric correlation, regression, and mediation analyses.

Table 3: Multicollinearity Diagnostics

Predictor Variable	Tolerance	VIF
AI-Supported Instruction	.79	1.27
Teaching Presence	.68	1.47
Sense of Belonging	.63	1.59

Note. VIF values < 3.0 and tolerance values > .20 indicate no multicollinearity concerns.

Table 4: Linearity and Independence Diagnostics

Criterion	Statistic	Acceptable Range	Result
Durbin–Watson	1.92	1.50–2.50	Met
Residual Scatterplots	Visual inspection	Random dispersion	Met

Reliability Analysis

Internal consistency reliability was evaluated for all study scales prior to hypothesis testing. Reliability was assessed using Cronbach’s alpha (α), which estimates the degree to which items within each scale measure a common underlying construct. Consistent with established guidelines, alpha values of .70 or higher were considered acceptable, values above .80 good, and values above .90 excellent for research purposes.

All study instruments demonstrated acceptable to strong internal consistency. Item-level diagnostics were examined to ensure that no individual item adversely affected scale reliability. Corrected item–total correlations exceeded the recommended threshold of .30 for all items, and deletion of any single item did not result in a meaningful increase in alpha values, indicating that all items contributed appropriately to their respective scales.

As shown in Table 5, all scales demonstrated acceptable to strong internal consistency reliability, with Cronbach's alpha coefficients ranging from .83 to .89. Item-level analyses (Table 6) indicated that corrected item–total correlations exceeded .30 across all measures, and no item deletion resulted in a substantive improvement in reliability. These findings support the internal consistency of the instruments and justify their use in subsequent correlational, regression, and mediation analyses.

Table 5: Internal Consistency Reliability of Study Measures (N = 150)

Scale	Number of Items	Cronbach's α
AI-Supported Instruction	8	.83
Teaching Presence	10	.89
Sense of Belonging	8	.87
Retention Intent	4	.85

Note. Cronbach's $\alpha \geq .70$ indicates acceptable internal consistency.

Table 6: Item-Level Reliability Diagnostics (Summary)

Scale	Corrected Item–Total Correlation Range	α if Item Deleted (Range)
AI-Supported Instruction	.42–.67	.80–.83
Teaching Presence	.51–.74	.86–.89
Sense of Belonging	.48–.71	.84–.87
Retention Intent	.55–.73	.82–.85

Demographic Characteristics of the Sample

Descriptive statistics were computed to summarize the demographic characteristics of the participants. The final sample consisted of 150 students enrolled in fully online higher education courses. The sample reflected a diverse population in terms of age, gender, enrollment status, and academic level, consistent with the demographic profile of post-traditional online learners. The sample consisted primarily of adult learners, with the majority of participants aged 25 years and older (77.3%). Female students represented just over half of the sample (52.0%), followed by male students (41.3%). Most participants were enrolled full time (60.7%) and at the undergraduate level (64.0%), reflecting the typical demographic composition of online higher education programs. All participants were enrolled in fully online courses, aligning with the study's focus on AI-supported online instructional environments.

Table 7: Demographic Characteristics of Participants (N = 150)

Characteristic	Category	n	%
Gender	Male	62	41.3
	Female	78	52.0
	Prefer not to say	10	6.7
Age Group	18–24	34	22.7
	25–34	48	32.0
	35–44	39	26.0
	45–54	21	14.0
	55+	8	5.3
Enrollment Status	Full-time	91	60.7
	Part-time	59	39.3
Academic Level	Undergraduate	96	64.0
	Graduate	54	36.0
Mode of Study	Fully Online	150	100

Note. Percentages may not total 100 due to rounding.

Hypotheses Testing

RQ1. What is the relationship between artificial intelligence–supported instructional practices and students’ perceptions of teaching presence in online higher education? Pearson correlation and simple linear regression were conducted to examine the relationship between AI-supported instruction and teaching presence. The results indicate a moderate, positive, and statistically significant relationship between AI-supported instructional practices and students’ perceptions of teaching presence ($\beta = .46, p < .001$).

Table 8: Relationship Between AI-Supported Instruction and Teaching Presence (RQ1) (N = 150)

Variable	M	SD	1	2	3	4
1. AI-Supported Instruction	3.62	0.71	—			
2. Teaching Presence	3.88	0.65	.46***	—		
3. Sense of Belonging	3.74	0.68	.39***	.58***	—	
4. Retention Intent	3.91	0.72	.34***	.41***	.62***	—

** $p < .001$

Table 9: Relationship Between AI-Supported Instruction and Teaching Presence (RQ1) (N = 150)

Predictor Variable	Outcome Variable	r	β	R ²	F	p
AI-Supported Instruction	Teaching Presence	.46	.46	.21	39.42	< .001

Note. r = Pearson correlation coefficient; β = standardized regression coefficient.

R² represents variance in teaching presence explained by AI-supported instruction.

AI-supported instruction explained 21% of the variance in teaching presence, and the standardized regression coefficient ($\beta = .46$) indicates a meaningful effect size. Accordingly, the null hypothesis for RQ1 was rejected. (See Tables 9 & 10). This finding suggests that when AI tools are used to support instructional processes, such as feedback delivery, course organization, and analytics-informed communication, students perceive instructors as more present rather than less visible. Consistent with Community of Inquiry theory, AI functions as an instructional amplifier that enhances teaching presence by improving organization, responsiveness, and clarity when embedded within intentional, instructor-led pedagogy. Rather than substituting for instructor engagement, higher levels of AI-supported instructional practices are associated with stronger perceptions of teaching presence, supporting the premise that AI can augment, rather than replace, human instruction in online learning environments.

RQ 2: To what extent does perceived teaching presence predict students’ sense of belonging in online learning environments? Again, Pearson correlation and multiple regression were used to assess the predictive relationship between teaching presence and sense of belonging. The results indicate that teaching presence demonstrated a strong, positive association with students’ sense of belonging ($r = .58, p < .001; \beta = .54, p < .001$). Teaching presence accounted for 34% of the variance in belonging, indicating a substantial effect.

Table 10: Teaching Presence as a Predictor of Sense of Belonging

Analysis	Statistic	Value	p
Pearson correlation (r)	r	.58	< .001
Regression coefficient	β	.54	< .001
R ²	—	.34	—

This finding highlights the importance of instructor design, facilitation, and responsiveness in fostering students’ feelings of acceptance, support, and connection in online learning environments. Teaching presence emerges as a central pedagogical driver of belonging. H2 was supported. This result indicates that instructional clarity, facilitation, and responsiveness play a central role in fostering students’ perceptions of acceptance and connection in online learning environments. Teaching presence appears to be a key relational mechanism through which belonging is cultivated.

RQ3: What is the relationship between students' sense of belonging and their retention intent in online higher education? The results of the Pearson correlation and regression analyses conducted showed sense of belonging was strongly positively associated with retention intent ($r = .62, p < .001$; $\beta = .59, p < .001$). Sense of belonging explained 38% of the variance in students' intentions to persist. Students who perceived stronger belonging within their online courses were substantially more likely to report intentions to remain enrolled. This result reinforces belonging as a proximal psychosocial determinant of persistence in online higher education. (See Table 11)

Table 11: Relationship Between Sense of Belonging and Retention Intent

Analysis	Statistic	Value	p
Pearson correlation (r)	r	.62	< .001
Regression coefficient	β	.59	< .001
R ²	—	.38	—

RQ4: Does teaching presence mediate the relationship between artificial intelligence–supported instruction and students' sense of belonging? Mediation analysis was conducted using PROCESS Macro (Model 4) with 5,000 bootstrap samples. The results indicate that teaching presence significantly mediated the relationship between AI-supported instruction and sense of belonging. The bootstrap confidence interval did not include zero, indicating a reliable indirect effect. While AI-supported instruction retained a direct association with belonging, the magnitude of this relationship was reduced when teaching presence was included, indicating partial mediation. This finding suggests that AI influences belonging largely through its capacity to enhance teaching presence.

Table 12: Mediation of Teaching Presence in the AI → Belonging Relationship

Effect	Estimate	95% CI
Direct effect (AI → Belonging)	.18	[.05, .32]
Indirect effect (AI → Teaching Presence → Belonging)	.21	[.12, .33]
Total effect	.39	[.26, .52]

The indirect effect of AI-supported instruction on sense of belonging through teaching presence was significant (indirect effect = .21, 95% CI [.12, .33]). The direct effect was reduced but remained significant. H4 was supported, indicating partial mediation. This suggests that AI-supported instruction influences sense of belonging primarily by strengthening teaching presence, though a smaller direct relationship remains. Teaching presence therefore functions as a key mechanism through which AI-related instructional practices translate into students' psychosocial experiences.

RQ5: Does sense of belonging mediate the relationship between teaching presence and student retention intent in online higher education? Mediation analysis was conducted using PROCESS Macro (Model 4). Results indicated that sense of belonging significantly mediated the relationship between teaching presence and retention intent. The indirect effect of teaching presence on retention intent through sense of belonging was statistically significant ($b = .28, 95\% \text{ CI } [.17, .41]$), while the direct effect was reduced in magnitude, indicating partial mediation. Notably, the indirect effect was stronger than the direct effect, suggesting that sense of belonging is the primary pathway through which teaching presence influences students' persistence intentions. (See Table 13 & 14).

Table 13: Mediation of Sense of Belonging in the Teaching Presence → Retention Relationship

Effect	Estimate	95% CI
Direct effect (Teaching Presence → Retention)	.19	[.06, .33]
Indirect effect (Teaching Presence → Belonging → Retention)	.28	[.17, .41]
Total effect	.47	[.34, .61]

Table 14. Bootstrapped Indirect Effect of Teaching Presence on Retention Intent via Sense of Belonging (RQ5)

(PROCESS Model 4; N = 150)

Indirect Pathway	Indirect Effect (b)	Bootstrapped SE	95% Bootstrap CI	Effect Interpretation	Size
Teaching Presence → Sense of Belonging → Retention Intent	.28	.06	[.17, .41]	Moderate-to-large indirect effect	

Indirect effects are reported as unstandardized coefficients (b), consistent with PROCESS macro-output and best practices for mediation analysis (Hayes, 2018). The magnitude of the indirect effect indicates that a one-unit increase in teaching presence is associated with a .28-unit increase in retention intent through its effect on sense of belonging. This represents a moderate-to-large mediation effect, demonstrating that sense of belonging explains a substantial portion of the relationship between teaching presence and retention intent. Collectively, these findings highlight belonging as a critical psychosocial mechanism linking instructional engagement to retention outcomes, supporting H5 and reinforcing the role of teaching presence in promoting persistence primarily through students' sense of connection to the online learning environment.

RQ 6: Do artificial intelligence use, teaching presence, and sense of belonging form a sequential pathway predicting student retention intent? Sequential mediation was tested using PROCESS Macro (Model 6). The sequential indirect pathway was statistically significant (indirect effect = .18, 95% CI [.10, .30]), providing strong support for the proposed conceptual framework, with moderate sequential indirect effect. (Table 15 & 16). AI-supported instruction influenced retention intent indirectly through enhanced teaching presence and increased sense of belonging. Although a reduced direct effect remained, the findings indicate that AI contributes to retention primarily when it strengthens human instructional presence and fosters belonging. H6 was supported, indicating partial sequential mediation. This result provides empirical support for the proposed model in which AI enhances retention intent indirectly by strengthening teaching presence, which in turn fosters sense of belonging. Teaching presence and belonging jointly explain how AI-supported instruction contributes to student persistence.

Table 15: Sequential Mediation Results (AI → Teaching Presence → Belonging → Retention)

Indirect Pathway	Effect	95% CI
AI → Teaching Presence → Belonging → Retention	.18	[.10, .30]

Table 16: Bootstrapped Sequential Indirect Effect With Effect Size (RQ6)

(PROCESS Model 6; N = 150)

Indirect Pathway	Indirect Effect (b)	95% Bootstrap CI	Effect Size Interpretation
AI → Teaching Presence → Sense of Belonging → Retention Intent	.18	[.10, .30]	Moderate sequential indirect effect

Note. Indirect effects are reported as unstandardized coefficients (b) based on 5,000 bootstrap resamples. Confidence intervals that do not include zero indicate statistically significant indirect effects. Effect size interpretations follow conventional benchmarks for mediation effects in behavioral research.

Study Results Summary

The findings demonstrate that teaching presence effectively supplements artificial intelligence-supported instruction by humanizing AI-mediated learning experiences. Through strengthened teaching presence and enhanced sense of belonging, AI-supported instruction contributes to higher student retention intent in online higher education. (Table 17).

Table 17: Summary of Hypothesis & Pathway Results

Hypothesis	Pathway	Result	Interpretation
H1	AI → Teaching Presence	Supported	AI enhances perceived teaching presence
H2	Teaching Presence → Belonging	Supported	Teaching presence fosters belonging
H3	Belonging → Retention Intent	Supported	Belonging predicts persistence
H4	AI → Teaching Presence → Belonging	Supported	Teaching presence partially mediates
H5	Teaching Presence → Belonging → Retention	Supported	Belonging partially mediates
H6	AI → Teaching Presence → Belonging → Retention	Supported	Sequential partial mediation

Table 18 shows that the findings demonstrate that artificial intelligence–supported instruction influences student retention intent indirectly through teaching presence and sense of belonging, with belonging serving as the primary psychosocial mechanism linking instruction to persistence.

Table 18: Summary of Research Questions, Analytic Methods, Results, and Interpretations (N = 150)

RQ	Research Question	Analysis (PROCESS)	Key Statistical Result(s)	Decision	Substantive Interpretation
RQ1	What is the relationship between AI-supported instruction and teaching presence?	Pearson Regression	$r = .46^{***}$; $\beta = .46$; $R^2 = .21$	Reject H_0	Greater AI-supported instructional practices are associated with stronger perceptions of teaching presence.
RQ2	To what extent does teaching presence predict sense of belonging?	Pearson Regression	$r = .58^{***}$; $\beta = .54$; $R^2 = .34$	Reject H_0	Teaching presence is a strong predictor of students' sense of belonging in online learning.
RQ3	What is the relationship between sense of belonging and retention intent?	Pearson Regression	$r = .62^{***}$; $\beta = .59$; $R^2 = .38$	Reject H_0	Students with stronger belonging report significantly higher intentions to persist.
RQ4	Does teaching presence mediate the relationship between AI-supported instruction and sense of belonging?	Mediation (Model 4)	Indirect effect = .21; 95% CI [.12, .33]	Reject H_0	Teaching presence partially mediates the relationship between AI use and belonging.
RQ5	Does sense of belonging mediate the relationship between teaching presence and retention intent?	Mediation (Model 4)	Indirect effect = .28; 95% CI [.17, .41]	Reject H_0	Sense of belonging is the primary pathway through which teaching presence influences retention intent.
RQ6	Do teaching presence and sense of belonging sequentially mediate the relationship between AI-supported instruction and retention intent?	Sequential Mediation (Model 6)	Indirect effect = .18; 95% CI [.10, .30]	Reject H_0	AI influences retention intent indirectly through teaching presence and sense of belonging acting in sequence.

V. DISCUSSION

This study examined whether teaching presence supplements artificial intelligence–supported instruction to enhance students' sense of belonging and, in turn, increase retention intent in online higher education. Guided by the Community of Inquiry framework, sense of belonging theory, and emerging AI-in-education scholarship, the findings provide convergent evidence that AI contributes to student persistence primarily through human-centered instructional and psychosocial mechanisms, rather than through technological effects alone.

RQ1: AI-Supported Instruction and Teaching Presence

The results demonstrated a significant positive relationship between AI-supported instructional practices and students' perceptions of teaching presence, leading to rejection of the null hypothesis for RQ1. This finding aligns with recent scholarship suggesting that AI can augment instructional capacity when embedded within instructor-led pedagogy (Zawacki-Richter et al., 2019; Williamson & Eynon, 2020). Rather than diminishing instructor visibility, AI-supported features such as automated feedback and analytics-informed communication may enable instructors to be more responsive, organized, and proactive, core dimensions of teaching presence as conceptualized within the Community of Inquiry framework (Garrison et al., 2000).

This result extends earlier CoI research by demonstrating that teaching presence can be technologically supported without being technologically replaced. While critics have cautioned that AI risks depersonalizing instruction (Selwyn, 2019), the present findings suggest that when instructors actively mediate AI use, students interpret AI-supported instruction as evidence of increased instructor engagement rather than reduced human presence. Thus, AI appears to function as a pedagogical amplifier rather than a substitute for teaching presence.

RQ2: Teaching Presence and Sense of Belonging

Consistent with prior research, teaching presence emerged as a strong predictor of students' sense of belonging, supporting rejection of the null hypothesis for RQ2. This finding reinforces extensive literature demonstrating that instructional clarity, facilitation, and responsiveness foster students' perceptions of acceptance, inclusion, and support (Shea et al., 2010; Borup et al., 2014). In online learning environments, where physical cues and informal interactions are absent, teaching presence serves as a primary conduit through which belonging is constructed.

Importantly, this result situates teaching presence as not merely a pedagogical construct but also a relational and psychosocial driver. Consistent with Strayhorn's (2019) conceptualization of belonging as emerging from sustained interpersonal affirmation, the findings suggest that instructor behaviors signaling care and intentionality are central to students' sense of connection. This supports calls to more explicitly link instructional presence with belonging in online education research (Richardson et al., 2017).

RQ3: Sense of Belonging and Retention Intent

The strong association between sense of belonging and retention intent provides robust support for rejection of the null hypothesis for RQ3 and aligns with decades of persistence research. Consistent with Tinto's (2017) integration model and belonging scholarship (Hausmann et al., 2007; Strayhorn, 2019), students who perceived themselves as valued members of the learning community reported stronger intentions to persist.

This finding is particularly salient for online higher education, where attrition remains disproportionately high. The results reinforce belonging as a proximal determinant of persistence, mediating the effects of instructional experiences on retention outcomes. In doing so, the study contributes to a growing body of evidence positioning belonging as a critical outcome, rather than merely an affective byproduct of instruction.

RQ4 and RQ5: Mediation of Teaching Presence and Sense of Belonging

The mediation analyses revealed that teaching presence partially mediated the relationship between AI-supported instruction and sense of belonging (RQ4), while sense of belonging partially mediated the relationship between teaching presence and retention intent (RQ5). These findings extend prior research by empirically demonstrating how instructional and psychosocial mechanisms operate sequentially, rather than independently, in online learning environments.

These results align with theoretical expectations that instructional practices influence persistence indirectly through psychosocial integration (Tinto, 2017). Moreover, they respond to gaps in AI-in-education research, which has largely focused on performance metrics rather than relational pathways (Zawacki-Richter et al., 2019). By positioning teaching presence and belonging as mediators, the study clarifies *how* AI-supported instruction translates into persistence-related outcomes.

RQ6: Sequential Mediation and Integrated Model

The core contribution of this study lies in the support for the sequential mediation model tested in RQ6. The significant indirect pathway AI-supported instruction → teaching presence → sense of belonging → retention intent, provides strong evidence that AI contributes to student retention only insofar as it strengthens human instructional presence and psychosocial connection.

This finding synthesizes and extends multiple theoretical traditions. From the Community of Inquiry perspective, it affirms teaching presence as the linchpin of online learning effectiveness (Garrison et al., 2000; Shea et al., 2010). From belonging theory, it reinforces the centrality of perceived acceptance and support in sustaining persistence (Strayhorn, 2019). From AI scholarship, it offers empirical evidence supporting human-centered integration models that emphasize augmentation rather than automation (Williamson & Eynon, 2020).

Importantly, the partial nature of mediation suggests that while AI has some direct influence on retention intent, its primary value lies in enabling instructors to enact presence at scale. This finding directly addresses concerns that AI may erode relational teaching, instead demonstrating that its impact is contingent on pedagogical intent and design.

Theoretical and Scholarly Contribution

By integrating AI-supported instruction into established pedagogical and psychosocial frameworks, this study advances theory by repositioning AI as a contextual instructional condition rather than an independent driver of student outcomes. The sequential mediation model offers a parsimonious, theory-consistent explanation of retention in AI-enabled online

environments and responds directly to calls for integrative, human-centered research in educational technology (Selwyn, 2019; Zawacki-Richter et al., 2019).

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study employed a cross-sectional, self-report design, which limits causal inference. Although the sequential mediation model is theoretically grounded and statistically supported, the temporal ordering of artificial intelligence-supported instruction, teaching presence, sense of belonging, and retention intent cannot be definitively established. Longitudinal or experimental designs are needed to confirm causal pathways and examine how these relationships evolve over time.

Second, the reliance on self-reported perceptions introduces the potential for common method bias and social desirability effects. While self-reported measures are appropriate for assessing constructs such as teaching presence and sense of belonging, they may not fully capture actual instructional practices or behavioral persistence. Future research should integrate objective indicators, such as learning analytics, course completion data, or institutional retention records, to strengthen validity.

Third, the sample size ($N = 150$) and use of convenience sampling limit the generalizability of the findings. Participants were drawn from a single institutional context and consisted solely of students enrolled in fully online courses, which may not reflect experiences in hybrid or face-to-face settings or across different institutional types and disciplines. Replication across diverse contexts and larger samples is necessary to assess the robustness of the proposed model.

Finally, the measurement of artificial intelligence-supported instruction was based on students' perceptions of AI use rather than detailed distinctions among specific AI tools or levels of instructional integration. As AI applications vary widely in function and pedagogical intent, future studies should disaggregate AI features and examine how different forms of AI support interact with teaching presence and belonging. Addressing these limitations will enhance the precision, generalizability, and explanatory power of research on AI, pedagogy, and student retention in online higher education.

Implications for Practice

The findings of this study have important implications for faculty practice, instructional design, and online teaching strategies in AI-enabled learning environments. First, the results indicate that AI-supported instructional tools should be intentionally integrated to augment teaching presence rather than replace instructor engagement. Faculty should be trained to use AI-generated feedback, analytics dashboards, and adaptive learning tools as extensions of their instructional voice, ensuring that automated processes are contextualized through personalized instructor communication. This aligns with prior research emphasizing that teaching presence remains the most influential driver of engagement and persistence in online learning (Garrison et al., 2000; Shea et al., 2010).

Second, the strong mediating role of sense of belonging suggests that instructional practices should prioritize relational signaling alongside content delivery. Faculty behaviors such as timely responses, affirming feedback, visible participation in discussions, and intentional outreach, especially when informed by AI analytics can strengthen students' perceptions of being valued members of the learning community. These findings reinforce belonging-centered pedagogical approaches recommended by Strayhorn (2019) and Richardson et al. (2017), particularly for post-traditional and online learners who may be more vulnerable to disengagement. Practically, AI should be used to free instructor time for relationship-building, not to reduce human interaction.

Finally, instructional designers should embed AI tools within course structures that explicitly reinforce instructor presence. For example, AI-generated alerts identifying at-risk students should be paired with instructor-initiated check-ins rather than automated messages alone. Such practices operationalize the study's sequential model by ensuring that AI-driven efficiencies translate into enhanced teaching presence and, ultimately, stronger belonging and retention intent.

Implications for Policy

At the policy level, the findings suggest that institutional AI adoption strategies must be guided by pedagogical and relational priorities, not solely by efficiency or scalability goals. As institutions increasingly invest in AI-powered learning platforms, policies should explicitly require that AI be implemented in ways that support, preserve, and enhance teaching presence. This includes establishing standards for faculty oversight of AI-generated feedback, transparency in AI use, and clear expectations that instructors remain actively engaged in AI-mediated courses (Williamson & Eynon, 2020).

Additionally, institutional retention and student success policies should recognize sense of belonging as a key outcome metric, particularly in online education. Rather than focusing exclusively on academic performance indicators, institutions should incorporate belonging-related measures into program evaluation and quality assurance processes. The present findings demonstrate that belonging serves as a critical psychosocial pathway linking instruction to persistence, supporting calls to broaden definitions of student success beyond completion rates alone (Tinto, 2017; Strayhorn, 2019).

Finally, faculty development policies should prioritize AI literacy and human-centered pedagogy training. Professional development initiatives should equip instructors not only with technical skills for using AI tools but also with pedagogical strategies for leveraging AI to enhance relational teaching practices. Such policies align with emerging recommendations in AI-in-education scholarship that emphasize augmentation over automation and caution against decontextualized AI deployment (Selwyn, 2019; Zawacki-Richter et al., 2019). By embedding these principles into institutional policy, higher education leaders can ensure that AI adoption supports both instructional quality and student persistence.

Implications for Research

The findings of this study highlight several important directions for future research on artificial intelligence, teaching presence, sense of belonging, and student retention in online higher education. First, the demonstrated sequential mediation pathway suggests that future studies should move beyond examining AI as an isolated technological variable and instead investigate AI as a contextual instructional condition embedded within human-centered pedagogical processes. Prior research has often focused on AI adoption, usability, or performance outcomes (Zawacki-Richter et al., 2019), but the present findings underscore the need for theory-driven models that explicitly test how AI interacts with teaching presence and psychosocial constructs such as belonging.

Second, the strong mediating role of sense of belonging indicates that future research should further explore belonging as a central mechanism in AI-enabled learning environments. While belonging has been widely studied in traditional and online contexts (Strayhorn, 2019; Richardson et al., 2017), its role within AI-mediated instruction remains underdeveloped. Longitudinal and mixed-methods studies are needed to examine how students' perceptions of belonging evolve over time as AI-supported instructional practices are introduced, intensified, or modified. Qualitative inquiry may be particularly valuable for uncovering how students interpret AI-supported interactions as either relationally supportive or depersonalizing.

Third, future research should examine boundary conditions and moderating variables that may influence the effectiveness of AI-supported instruction. Variables such as learner status (e.g., post-traditional vs. traditional students), discipline, course level, instructor AI literacy, and instructional modality may shape how teaching presence supplements AI. Investigating these moderators would extend Community of Inquiry research by identifying conditions under which AI most effectively enhances or potentially undermines teaching presence and belonging (Garrison et al., 2000; Shea et al., 2010).

Finally, the study's reliance on self-reported retention intent highlights the need for future research linking psychosocial and instructional variables to behavioral outcomes, such as course completion and program persistence. Integrating institutional data with survey-based measures would strengthen causal inferences and extend the present model. Additionally, future studies could employ structural equation modeling or experimental designs to further validate the sequential pathway identified in this research. Collectively, these directions support a more nuanced, human-centered research agenda that situates AI within established theories of learning, belonging, and persistence rather than treating it as an independent driver of student success.

VI. CONCLUSION

This study examined how artificial intelligence-supported instruction, teaching presence, and sense of belonging interact to influence student retention intent in online higher education. Guided by the Community of Inquiry framework and sense of belonging theory, the findings demonstrate that artificial intelligence does not operate as an independent driver of persistence. Rather, its influence on retention is realized primarily through human-centered instructional and psychosocial pathways. Specifically, AI-supported instructional practices were found to enhance teaching presence, which in turn fostered students' sense of belonging and ultimately strengthened retention intent.

The results provide strong empirical support for a sequential mediation model in which teaching presence and sense of belonging function as complementary mechanisms linking AI-supported instruction to persistence outcomes. Teaching presence emerged as the critical pedagogical bridge that humanizes AI-mediated instruction, while sense of belonging served as the key psychosocial determinant translating instructional experiences into students' intentions to persist. These

findings reaffirm long-standing theories emphasizing instructional engagement and social integration, while extending them to contemporary AI-enabled online learning environments.

Collectively, this study contributes to the growing literature on artificial intelligence in higher education by reframing AI as a contextual instructional condition whose effectiveness depends on pedagogical intent and relational enactment. The findings caution against technology-centered approaches to AI adoption and instead underscore the necessity of integrating AI within teaching practices that prioritize connection, inclusion, and instructional care. As online education continues to expand and AI becomes increasingly embedded in instructional delivery, this study highlights that student retention is best supported when technological innovation is aligned with the human elements of teaching that foster belonging and persistence.

REFERENCES

- [1] Ahern et al. (2024): Teaching presence and connectedness in online environments. ScienceDirect
- [2] AI in Education Council (2024): AI impacts on motivation and belonging. NWCCU
- [3] AI in Education Council. (2024). *The dual promise of AI in education: Personalization and belonging*. NWCCU
- [4] Allen, I. E., & Seaman, J. (2015). *Grade level: Tracking online education in the United States*. Babson Survey Research Group.
- [5] Alshammari, S. H., & Alrehaili, T. A. (2025). *The effect of teaching, social, and cognitive presence on student engagement in online courses: A structural equation modelling approach*. Acta Psychologica. [ScienceDirect](https://doi.org/10.1016/j.actpsy.2025.103888)
- [6] Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks*, 5(2), 1–17.
- [7] Bickle, M. C., & Rucker, R. (2018). Student-to-faculty interaction and online learning outcomes. *Online Learning Journal*, 22(1), 55–71. <https://doi.org/10.24059/olj.v22i1.1174>
- [8] Borup, J., West, R. E., & Graham, C. R. (2014). The influence of asynchronous video communication on learner social presence. *Distance Education*, 35(3), 327–344. <https://doi.org/10.1080/01587919.2014.917683>
- [9] Crawford, J. (2024). When artificial intelligence substitutes humans in higher education: Costs to student success. *Studies in Higher Education*. Taylor & Francis Online
- [10] Dulfer, N. (2025). Building belonging in online classrooms: Relationships at a distance. *Teaching in Higher Education*. Taylor & Francis Online
- [11] Garcia, M. B., Goi, C. L., Shively, K., et al. (2024). Understanding student engagement in AI-powered online learning platforms: A narrative review. *SSRN*. SSRN
- [12] Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, 2(2–3), 87–105.
- [13] Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, 2(2–3), 87–105.
- [14] Hanshaw & Miller (2024): AI assistants and student outcomes. Open Praxis
- [15] Hausmann, L. R. M., Schofield, J. W., & Woods, R. L. (2007). Sense of belonging as a predictor of intentions to persist among African American and White first-year college students. *Research in Higher Education*, 48(7), 803–839.
- [16] Hausmann, L. R. M., Schofield, J. W., & Woods, R. L. (2007). Sense of belonging as a predictor of intentions to persist among college students. *Research in Higher Education*, 48(7), 803–839. <https://doi.org/10.1007/s11162-007-9052-9>
- [17] Inside Higher Ed. (2025). *Human predictions for AI in higher education in 2025*. <https://www.insidehighered.com>
- [18] Kelly et al. (2025): Belonging linked to engagement. SAGE Journals
- [19] Li (2025): Teacher presence in AI contexts. Taylor & Francis Online
- [20] McGehee (2024): AI potential for personalization. Michigan Virtual

- [21] Online Learning Consortium (2024): Belonging in online learners. Online Learning Consortium
- [22] Online Learning Consortium. (2024). A sense of belonging in online post-traditional students. *Online Learning Journal*. Online Learning Consortium
- [23] Richardson, J. C., Maeda, Y., Lv, J., & Caskurlu, S. (2017). Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. *Computers in Human Behavior*, 71, 402–417. <https://doi.org/10.1016/j.chb.2017.02.001>
- [24] Seaman, J. E., Allen, I. E., & Seaman, J. (2018). *Digital learning compass: Distance education enrollment report 2017*. Babson Survey Research Group.
- [25] Selwyn, N. (2019). What's the problem with learning analytics? *Journal of Learning Analytics*, 6(3), 11–19.
- [26] Seo et al. (2021): Perceptions of AI and learner–instructor interaction. PMC
- [27] Shea, P., Hayes, S., Smith, S. U., Vickers, J., Bidjerano, T., Pickett, A., ... Jian, S. (2010). Learning presence: Additional research on a new conceptual element within the Community of Inquiry framework. *The Internet and Higher Education*, 13(1–2), 10–21. <https://doi.org/10.1016/j.iheduc.2009.10.002>
- [28] Shea, P., Hayes, S., Vickers, J., Gozza-Castro, L., Uzuner, S., Mehta, R., ... & DeLaat, M. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *The Internet and Higher Education*, 13(1–2), 10–21.
- [29] Shea, P., Li, C. S., & Pickett, A. (2006). A study of teaching presence and student sense of learning community in fully online and web-enhanced college courses. *The Internet and Higher Education*, 9(3), 175–190.
- [30] Slaten, C. D., Ferguson, J. K., Allen, K. A., Vella, B. D., & Worrell, F. C. (2018). School belonging: A review of the history, current trends, and future directions. *Educational Psychology Review*, 30(1), 1–34.
- [31] Strayhorn, T. L. (2019). *College students' sense of belonging: A key to educational success for all students* (2nd ed.). Routledge.
- [32] Strayhorn, T. L. (2019). *College students' sense of belonging: A key to educational success*. Routledge.
- [33] Strayhorn, T. L. (2019). *College students' sense of belonging: A key to educational success for all students* (2nd ed.). Routledge.
- [34] Tinto, V. (2017). Through the eyes of students. *Journal of College Student Retention: Research, Theory & Practice*, 19(3), 254–269.
- [35] Tinto, V. (2017). Through the eyes of students. *Journal of College Student Retention: Research, Theory & Practice*, 19(3), 254–269. <https://doi.org/10.1177/1521025115621917>
- [36] Williamson, B., & Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. *Learning, Media and Technology*, 45(3), 223–235. <https://doi.org/10.1080/17439884.2020.1798995>
- [37] Wilson, K. B. (2025). Research overview and findings – student engagement and AI in higher education. *ERIC Digest*. ERIC
- [38] Zawacki-Richter et al. (2019): Systematic review of AI in higher education. PMC
- [39] Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education*, 16(1), 1–27.
- [40] Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education*, 16(1), 39. <https://doi.org/10.1186/s41239-019-0171-0>
- [41] Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). Guilford Press.