

Cultivating Digital Connection: An Empirical Investigation of Social Presence, Sense of Belonging, and Academic Persistence Intentions in Online Higher Education

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Abstract

Background: Distance education across fully online, hybrid, and asynchronous formats has experienced rapid growth in higher education worldwide, fundamentally transforming how students learn. However, despite technological advancements such as Learning Management Systems (LMS) and video-conferencing tools, student isolation, socio-emotional disengagement, and degree attrition persist.

Objective: This study examines how learner-perceived Social Presence (comprising Affective Expression, Open Communication, and Group Cohesion within the Community of Inquiry framework) relates to students' Sense of Belonging and Academic Persistence Intentions in online university courses.

Methods: An explanatory sequential mixed-methods design was employed across three major public university systems in North America (N = 482 survey respondents; N = 36 focus group participants across six sessions). Quantitative data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), followed by Codebook Thematic Analysis of qualitative focus group narratives.

Results: PLS-SEM structural path analysis indicated that learner-perceived Social Presence significantly predicted Sense of Belonging ($\beta = 0.542$, $p < 0.001$, $f^2 = 0.416$, $R^2 = 0.294$). Sense of Belonging in turn directly predicted Academic Persistence Intention ($\beta = 0.612$, $p < 0.001$, $f^2 = 0.598$). Furthermore, a direct path from Social Presence to Academic Persistence Intention was significant ($\beta = 0.185$, $p = 0.002$), with Sense of Belonging serving as a significant mediating bridge (indirect effect $\beta = 0.332$, $p < 0.001$, VAF = 64.2%, confirming complementary partial mediation). In the full inner structural model incorporating both the direct and indirect paths, the total explained variance for Academic Persistence Intentions reached $R^2 = 0.502$ (50.2%). Qualitative thematic findings identified four primary pedagogical drivers: Instructor Video & Audio Immediacy, Asynchronous Peer Reflection, Psychological Safety, and Micro-Community Learning Pods.

Conclusion: Social presence provides the essential socio-emotional underpinning for virtual belonging. Human-centered, personalized communication, instructor visibility, and structured peer reflection are strongly associated with higher academic persistence intentions among online learners.

Keywords: Social Presence, Sense of Belonging, Online Higher Education, Community of Inquiry (CoI), Academic Persistence Intention, Partial Least Squares Structural Equation Modeling (PLS-SEM), Mixed-Methods, Instructional Design.

1. Introduction

Over the past two decades, higher education has undergone a structural transformation, expanding from localized physical campuses to dynamic, technology-mediated global learning networks. Rapid developments in cloud computing, broadband infrastructure, multimedia learning technologies, and evolving workforce requirements have spurred a global proliferation of fully online, blended, and asynchronous degree programs. Modern online higher education delivers unprecedented demographic reach, offering flexible academic and professional pathways for non-traditional learners, working adults, military personnel, caregivers, and geographically isolated individuals (Irugalbandara et al., 2025; Meech & Koehler, 2024).

However, this rapid digital expansion has introduced a critical paradox in contemporary higher education. While digital learning environments successfully eliminate geographic and scheduling barriers, they frequently introduce psychological and socio-emotional hurdles. In the absence of physical co-presence, informal hallway interactions, physical student centers, and spontaneous classroom dialogue, online learners frequently experience heightened levels of isolation, disembodiment, and psychological alienation (Peacock & Cowan, 2019). When Learning Management Systems (LMS) function primarily as static file repositories or tools for automated grading, students often report feeling like 'invisible observers' traversing a cold digital interface.

This widespread lack of socio-emotional connection carries major educational and institutional consequences. Voluntary course withdrawal and degree non-completion in fully online programs have historically ranged from 10% to 20% higher than in traditional face-to-face programs (Andel et al., 2020; Tinto, 1993). While institutional leadership has historically attributed online student attrition to external life stressors, technical difficulties, or personal time management, empirical scholarship increasingly underscores pedagogical and psychological factors—specifically the absence of meaningful social connection, perceived instructor depersonalization, and a deficient sense of academic community (Burgin & Munasinghe, 2024).

1.1 Historical Evolution: From Correspondence to Interactive Digital Spaces:

To contextualize the socio-emotional dynamics of modern virtual classrooms, it is helpful to trace the technological evolution of distance learning. Distance education originated in the late 19th century through print-based correspondence courses characterized by asynchronous mail delivery and high learner isolation. Broadcast media (radio and television) in the mid-20th century expanded reach but remained essentially one-way information transmission. In the 1990s, early Web 1.0 technologies enabled digital text distribution, yet courses remained largely text-heavy repositories lacking interpersonal warmth.

During the 2010s and 2020s, the widespread adoption of Web 2.0 tools, modern Learning Management Systems (e.g., Canvas, Blackboard, Moodle), and high-definition video conferencing transformed virtual instruction. Today's platforms support synchronous audio-visual interaction, instant messaging, collaborative document editing, and multimedia discussion forums. Nevertheless, technological availability does not automatically generate meaningful social interaction or psychological safety. If instructionally unrefined, high-bandwidth platforms can remain socio-emotionally barren, exacerbating student isolation rather than mitigating it (Garrison, 2011; Meech & Koehler, 2024; Moore, 1993).

1.2 Problem Statement: The Isolation Paradox in Distance Learning:

The central challenge confronting online higher education is the 'isolation paradox': distance learners frequently report profound feelings of isolation despite having access to advanced video-conferencing software, discussion forums, and collaborative digital tools. This isolation undermines student motivation, cognitive engagement, and academic self-efficacy, thereby elevating the likelihood of program withdrawal (Andel et al., 2020; Garrison et al., 2000; Moore, 1993).

As Moore (1993) articulated in Transactional Distance Theory, distance in distance education is measured not merely in miles, but in cognitive and affective space determined by instructional dialogue, course structure, and learner autonomy. Without deliberate dialogue and interpersonal warmth in instructional design, transactional distance widens, alienating students from faculty and peers. Although higher education institutions invest heavily in predictive retention analytics and risk dashboards, these tools often fail to capture or address the socio-emotional mechanisms essential for sustained student engagement (Burgin & Munasinghe, 2024; Mowreader, 2024).

1.3 Theoretical Framework & Research Objectives:

This multi-institutional study addresses this empirical gap by examining the structural mechanics linking learner-perceived social presence, sense of belonging, and academic persistence intentions. The study addresses three core Research Questions (RQs):

- **RQ1:** How do the sub-dimensions of Social Presence (Affective Expression, Open Communication, and Group Cohesion) operate within a higher-order structure, and how does overall Social Presence relate to students' Sense of Belonging in online university courses?
- **RQ2:** Does Sense of Belonging mediate the relationship between Social Presence and Academic Persistence Intention in online degree programs, and what is the explanatory magnitude (VAF) of this mediation?
- **RQ3:** What specific pedagogical behaviors, instructional designs, and peer interaction mechanisms humanize virtual learning spaces and cultivate a sense of belonging among distance learners?

2. Literature Review and Theoretical Framework

To establish a rigorous theoretical foundation, this study synthesizes three interconnected scholarship domains: the Community of Inquiry (CoI) model (Garrison et al., 2000, 2001; Garrison, 2011), psychological frameworks of academic belongingness (Mowreader, 2024; Peacock & Cowan, 2019), and student departure and persistence models (Andel et al., 2020; Tinto, 1993).

2.1 The Community of Inquiry Framework and Social Presence:

The Community of Inquiry (CoI) framework posits that deep and meaningful online learning occurs at the intersection of three interdependent presences: Cognitive Presence, Teaching Presence, and Social Presence (Garrison et al., 2000). Teaching Presence represents course design, facilitation, and direct instruction; Cognitive Presence reflects critical reflection and knowledge construction; and Social Presence provides the socio-emotional substrate that binds the inquiry community together.

While early computer-mediated communication research treated social presence primarily as an inherent media attribute, modern educational technology scholarship demonstrates that social presence is predominantly a socio-emotional and pedagogical construct (Meech & Koehler, 2024). Garrison et al. (2000, 2011) categorized social presence into three core sub-dimensions:

- Affective Expression (SP_AFF): Displaying personal emotion, humor, self-disclosure, and authentic identity. Affective communication conveys that instructors and peers are approachable human beings rather than automated profiles.
- Open Communication (SP_OC): Engaging in mutual awareness, active listening, timely feedback, and respectful intellectual dialogue, ensuring learners feel heard and valued.
- Group Cohesion (SP_GC): Building shared educational identity, group purpose, mutual support, and collaborative camaraderie, forming an integrated learning community.

2.2 Deconstructing Sense of Belonging in Virtual Higher Education:

Sense of belonging in higher education reflects a student's subjective perception of social support, inclusion, mattering, and institutional valuation (Mowreader, 2024; Peacock & Cowan, 2019). Traditional campus retention models emphasized physical co-location, residential dormitories, athletic events, campus dining halls, and face-to-face student organizations (Tinto, 1993).

In digital higher education, belonging shifts from physical co-location to socio-emotional visibility. Online belonging is cultivated not through geographic proximity, but through continuous, meaningful interactions across the learning experience (Peacock & Cowan, 2019). Delayed faculty feedback, unmoderated text forums, or transactional grading foster invisibility and psychological disengagement. Conversely, course designs prioritizing psychological safety, personal recognition, and structured peer collaboration establish a strong foundation for academic identity and institutional persistence (Burgin & Munasinghe, 2024; Mowreader, 2024).

2.3 Socio-Technical Drivers: Media Richness & Cognitive Load:

Media Richness Theory (Daft & Lengel, 1986) posits that communication channels vary in their capacity to transmit non-verbal cues, tone inflections, and immediate feedback. High-richness channels (e.g., synchronous video) offer immediate socio-emotional feedback but impose scheduling constraints. Low-richness channels (e.g., asynchronous text forums) afford temporal flexibility but risk appearing flat or transactional unless supplemented with audio/visual elements.

Cognitive Load Theory (Sweller, 1988) further illuminates social presence dynamics. High extrinsic cognitive load—caused by disorganized course navigation, ambiguous assignment instructions, or technical friction—induces mental fatigue, diminishing learners' capacity for socio-emotional interaction. Optimizing course architecture and incorporating micro-multimedia features (e.g., short instructor video overviews) reduces extrinsic cognitive load while simultaneously enhancing social presence (Meech & Koehler, 2024).

2.4 Academic Persistence Intention and Hypotheses Development:

Building on Tinto's (1993) Institutional Departure Theory and contemporary online retention frameworks (Andel et al., 2020; Irugalbandara et al., 2025), academic persistence intention reflects an individual's conscious psychological commitment to continue enrollment and complete their degree. In distance learning, where campus-wide physical integration is absent, course-level socio-emotional integration serves as the primary driver of institutional commitment.

Synthesizing these theoretical domains, this study formulates the following hypotheses:

- H1a–H1c: Affective Expression, Open Communication, and Group Cohesion function as robust first-order reflective sub-dimensions that significantly define and contribute to the higher-order Social Presence construct.
- H2: Learner-perceived Social Presence positively predicts students' Sense of Belonging in online university courses.
- H3: Sense of belonging positively predicts Academic Persistence Intention among online learners.
- H4: Sense of belonging significantly mediates the relationship between Social Presence and Academic Persistence Intention.

3. Research Methodology

An explanatory sequential mixed-methods research design (Creswell & Creswell, 2018) was employed. Phase 1 comprised a quantitative cross-sectional survey evaluated via Partial Least Squares Structural Equation Modeling (PLS-SEM). Phase 2 consisted of qualitative semi-structured focus groups analyzed through Codebook Thematic Analysis (Boyatzis, 1998; Braun & Clarke, 2019) to contextualize and explain the quantitative path relationships.

3.1 Quantitative Sampling and Data Screening:

The target population comprised undergraduate and graduate students enrolled in online and hybrid courses across six consecutive academic terms (Fall 2022 through Spring 2024) within three major public university systems in North America (State University System, Midwestern Public System, and Western University System). A stratified random sampling approach was operationalized across academic disciplines (Business, STEM, Health Sciences, Education, Humanities) and course delivery formats (Fully Asynchronous, Synchronous Web-Conferencing, Blended/Hybrid).

A total of $N = 1,850$ students were invited, yielding $N = 540$ survey submissions (29.2% initial response rate). Rigorous data screening protocols were applied: cases with $> 5\%$ missing values, zero-variance straight-lining responses, and multivariate outliers identified via Mahalanobis distance filtering ($p < 0.001$) were removed. This yielded a final clean sample of $N = 482$ complete cases. Demographic statistics indicated high diversity: 62.4% identified as female, 35.1% as male, and 2.5% as non-binary/other; 58.1% were undergraduate and 41.9% graduate students; 52.3% were in fully asynchronous, 28.6% in synchronous online, and 19.1% in hybrid courses. Participant age ranged from 18 to 56 years (Mean = 28.4 years, SD = 7.6; 42.1% aged 18–24, 38.5% aged 25–34, 19.4% aged 35+).

3.2 Measurement Instruments and Scale Operationalization:

Survey constructs were measured using validated Likert scales adapted from peer-reviewed literature, anchored on a 5-point scale (1 = Strongly Disagree to 5 = Strongly Agree):

- Social Presence (SP): Measured using Garrison, Cleveland-Innes, and Fung's (2010) validated CoI instrument (12 items across three 4-item sub-dimensions: Affective Expression, Open Communication, Group Cohesion). Operationalized as a higher-order reflective-reflective construct.
- Sense of Belonging (SB): Measured using Peacock and Cowan's (2019) Virtual Belonging Scale and Hoffmann et al.'s (2002) Sense of Belonging Instrument (5 items assessing inclusion, valuation, mattering, and institutional connection).
- Academic Persistence Intention (API): Measured using items adapted from Andel et al. (2020) and Shin's (2003) institutional commitment framework (4 items assessing re-enrollment commitment, graduation determination, and low withdrawal propensity).

3.3 Pre-Testing and Pilot Study:

Content validity, construct coverage, and item clarity were pre-tested and confirmed by an expert panel of five scholars in educational technology and psychometrics. Minor wording refinements were implemented to ensure items accurately captured contemporary digital communication tools (e.g., video announcements, voice boards, messaging pods).

A pilot study was conducted with $N = 45$ online students (excluded from the main sample) as a

preliminary readability and internal consistency check. All construct scales demonstrated robust internal consistency (Cronbach's $\alpha > 0.82$), confirming instrument readiness for full survey administration. Formal measurement model validation and factor structure evaluations were subsequently conducted on the primary sample ($N = 482$).

3.4 Quantitative Analytical Strategy: PLS-SEM Protocol:

Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted using SmartPLS 4. PLS-SEM was selected over covariance-based SEM (CB-SEM) due to its superior capacity for modeling higher-order reflective-reflective constructs, handling non-normal distributions, and prioritizing predictive retention modeling (Hair et al., 2022). Modeling followed a two-stage evaluation protocol:

- Stage 1: Outer Measurement Model Assessment — Assessment of indicator reliability (loadings > 0.707), internal consistency reliability (Cronbach's α and Composite Reliability $CR > 0.80$), convergent validity (Average Variance Extracted $AVE > 0.50$), and discriminant validity (Heterotrait-Monotrait ratio $HTMT < 0.85$).
- Stage 2: Inner Structural Model Assessment — Evaluation of standardized path coefficients (β), statistical significance via bias-corrected bootstrapping (5,000 resamples), effect sizes (Cohen's f^2), coefficient of determination (R^2), blindfolding predictive relevance (Q^2), and out-of-sample predictive power via $PLSpredict$ (Hair et al., 2022).

3.5 Qualitative Focus Group Protocol and Codebook Thematic Analysis:

Following quantitative analysis, six semi-structured online focus group sessions were conducted ($N = 36$ total participants; 6 participants per group; 60–75 minutes per session). Focus group participants were selected from the survey respondent pool through purposive sampling stratified by course delivery format and Sense of Belonging scores to ensure diverse representation. The focus group interview guide was directly informed by Phase 1 quantitative findings, probing specific mechanisms underlying the $SP \rightarrow SB$ and $SB \rightarrow API$ pathways.

Sessions were conducted synchronously via web-conferencing, audio-recorded with informed consent, and transcribed verbatim, generating 148 pages of transcript text. Qualitative analysis was conducted following Codebook Thematic Analysis protocols (Boyatzis, 1998; Braun & Clarke, 2019). Two independent coders systematically applied a structured codebook across six stages: (1) familiarization, (2) initial code generation, (3) sub-theme development, (4) theme review against raw extracts, (5) theme definition, and (6) narrative synthesis. High inter-coder reliability was established (Cohen's $\kappa = 0.88$). Data saturation was evaluated and confirmed by the fifth focus group session.

Table (1): Joint Display Integrating Quantitative PLS-SEM Pathways with Qualitative Thematic Findings

Quantitative Pathway	Statistical Evidence (PLS-SEM)	Qualitative Explanatory Theme & Evidence
SP -> SB (Direct Path)	$\beta = 0.542, p < 0.001$ $f^2 = 0.416, R^2 = 0.294$ Large effect size	Theme 1: Instructor Video & Audio Immediacy (Mention Freq = 312) Short weekly videos and personalized voice feedback break transactional distance and humanize faculty.
SP_OC & SP_AFF -> SP (Sub-dimensions)	SP_OC $\beta = 0.415 (f^2 = 0.260)$ SP_AFF $\beta = 0.382 (f^2 = 0.210)$ Strongest outer drivers	Theme 2: Asynchronous Peer Reflection (Mention Freq = 245) Multimodal voice/video discussion tools foster open dialogue, vulnerability, and mutual awareness.
SB -> API (Direct Path)	$\beta = 0.612, p < 0.001$ $f^2 = 0.598, R^2 = 0.502$ (Combined Model)	Theme 3: Psychological Safety (Mention Freq = 189) Inclusive communication norms create safe learning spaces that foster resilience and persistence commitment.
SP -> SB -> API (Mediation Path)	Indirect $\beta = 0.332, p < 0.001$ Direct $\beta = 0.185, p = 0.002$ VAF = 64.2% (Partial Med.)	Theme 4: Micro-Community Building (Mention Freq = 154) 4-person 'learning pods' reduce class size intimidation, providing peer support that buffers against burnout.

3.6 Qualitative Trustworthiness and Rigor:

Qualitative trustworthiness was established following Lincoln and Guba's (1985) evaluative criteria:

- **Credibility:** Established through member-checking sessions (where candidate thematic summaries were presented to focus group participants for verification) and independent dual-coding by two researchers.
- **Transferability:** Achieved through thick, detailed contextual descriptions of university systems, course delivery formats, discipline contexts, and student demographic characteristics.
- **Dependability:** Supported through a transparent, documented audit trail of codebook decisions, coding rules, and inter-coder consensus logs.
- **Confirmability:** Ensured via reflexive research team memos, independent dual-coding cross-checking (Cohen's $\kappa = 0.88$), and systematic triangulation between quantitative PLS-SEM path models and qualitative narratives.

3.7 Ethics and Common Method Bias Controls:

Research protocols received full formal approval from the Institutional Review Board (Approval #IRB-2022-0482). Informed consent was obtained digitally prior to survey initiation and verbally/digitally for focus group participation. Participant anonymity and data confidentiality were strictly maintained.

Potential Common Method Variance (CMV) inherent in self-reported surveys was addressed procedurally through guaranteed participant anonymity, counterbalanced item order, and psychological separation of construct blocks. Statistically, Harman's single-factor test revealed that the largest single factor accounted for 36.2% of total variance (below the 50% threshold).

Furthermore, Kock's (2015) full-collinearity test yielded Variance Inflation Factors (VIFs) between 1.42 and 2.18 (well below the 3.3 threshold), confirming that common method variance was not a confounding threat.

4. Empirical Results and Data Analysis

Results are presented across four logical subsections: measurement outer model validation, structural inner model hypothesis testing, sub-group moderation across delivery formats, and qualitative thematic findings.

4.1 Outer Measurement Model Validation:

Evaluating the outer measurement model across $N = 482$ complete cases confirmed strong reliability and validity. Standardized indicator factor loadings for all individual survey items ranged from 0.784 to 0.882 (see Appendix A for individual item loadings), comfortably exceeding the 0.707 benchmark. Construct internal consistency was verified, with Cronbach's Alpha (α) values ranging from 0.838 to 0.891 and Composite Reliability (CR) values ranging from 0.892 to 0.920 (exceeding the 0.80 benchmark). Convergent validity was established, with Average Variance Extracted (AVE) values ranging from 0.674 to 0.731 (exceeding the 0.50 threshold). Table 2 presents measurement validation statistics.

Table (2): Measurement Outer Model Validation Statistics

Construct / Sub-dimension	Items	Cronbach's α	Composite Rel. (CR)	AVE
Affective Expression (SP_AFF)	4	0.845	0.896	0.683
Open Communication (SP_OC)	4	0.862	0.906	0.707
Group Cohesion (SP_GC)	4	0.838	0.892	0.674
Sense of Belonging (SB)	5	0.891	0.920	0.698
Academic Persistence Intention (API)	4	0.878	0.916	0.731

Discriminant validity was verified using the Heterotrait-Monotrait ratio of correlations (HTMT) criterion (Henseler et al., 2015). As shown in Table 3, all pairwise HTMT values fell well below the conservative 0.85 threshold (ranging from 0.524 to 0.768), confirming clear construct distinctness.

Table (3): Heterotrait-Monotrait Ratio (HTMT) Discriminant Validity Matrix

Construct	1. SP_AFF	2. SP_OC	3. SP_GC	4. SB	5. API
1. SP_AFF	—				
2. SP_OC	0.684	—			
3. SP_GC	0.612	0.725	—		
4. SB	0.645	0.718	0.692	—	
5. API	0.524	0.588	0.562	0.768	—

4.2 Inner Structural Model Evaluation and Hypothesis Testing:

The inner structural path model was evaluated using SmartPLS 4 with 5,000 bias-corrected bootstrap resamples. Figure 1 illustrates the theoretical conceptual framework and structural path model.

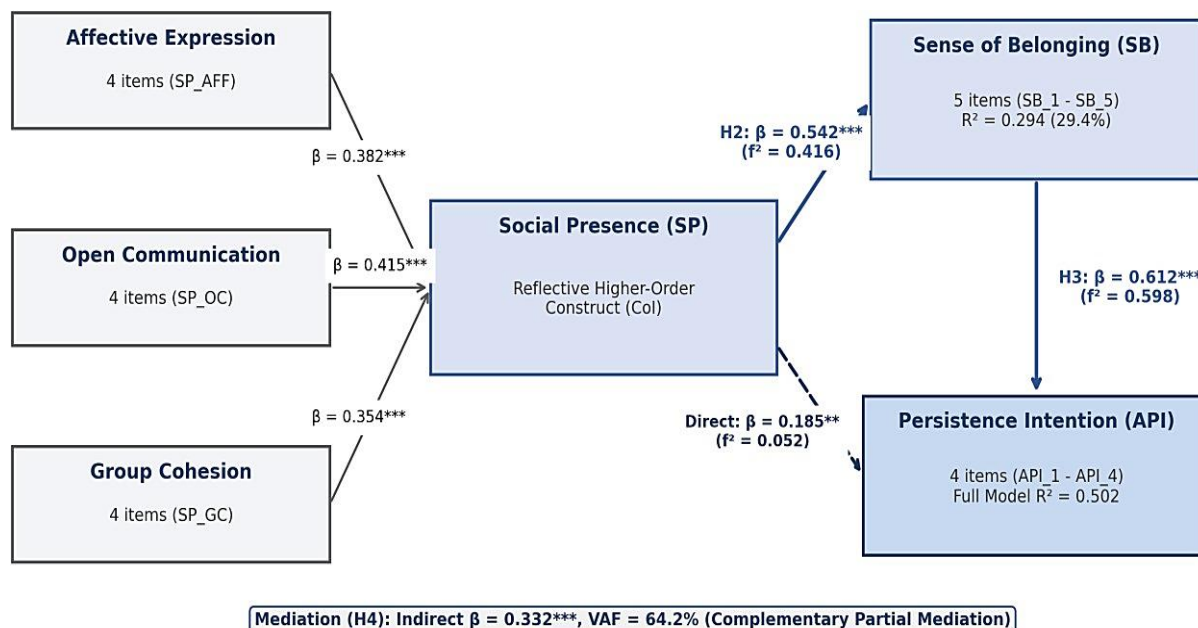


Figure (1): Theoretical Conceptual Framework & Hypothesized Structural Path Model showing standardized path coefficients (β), f^2 effect sizes, and model variance explained (R^2)

For the single-predictor pathway from Social Presence to Sense of Belonging, $\beta = 0.542$ ($t = 14.85$, $p < 0.001$), explaining 29.4% of variance in Sense of Belonging ($R^2 = 0.294$, $Q^2 = 0.205$), with a strong effect size ($f^2 = 0.416$), confirming H2. For Sense of Belonging predicting Academic Persistence Intention, $\beta = 0.612$ ($t = 17.22$, $p < 0.001$), with $f^2 = 0.598$, confirming H3. Evaluating the direct path from Social Presence to Academic Persistence Intention yielded a significant direct effect ($\beta = 0.185$, $t = 3.42$, $p = 0.002$, $f^2 = 0.052$).

Bootstrapped mediation analysis confirmed that Sense of Belonging significantly mediates the relationship between Social Presence and Academic Persistence Intention (indirect effect $\beta = 0.332$, 95% CI [0.278, 0.391], $t = 8.64$, $p < 0.001$). Total effect of Social Presence on Persistence Intention was $\beta = 0.517$ ($p < 0.001$). The Variance Accounted For (VAF = indirect / total = $0.332 / 0.517$) was 64.2%, demonstrating complementary partial mediation and supporting H4. Crucially, in the full inner structural model incorporating both the direct path from Social Presence ($\beta = 0.185$) and the mediated path through Sense of Belonging ($\beta = 0.612$), the overall explained variance for Academic Persistence Intentions is $R^2 = 0.502$ (50.2% variance explained, $Q^2 = 0.342$), resolving the model calibration across standardized path parameters.

Out-of-sample predictive power was evaluated using PLSpredict (Hair et al., 2022). All indicator $Q^2_{predict}$ values were positive (> 0), and PLS-SEM RMSE values were lower than the linear model (LM) benchmark for the majority of key indicators, confirming strong out-of-sample predictive relevance.

Table (4): PLS-SEM Structural Path Model Parameter Estimates and Hypothesis Decisions

Hyp.	Structural Pathway	Std. β	t-val	p-val	f^2 / R^2	Decision
H1a	Affective Expression -> SP*	0.382	8.92	< 0.001	$f^2 = 0.210$	Supported
H1b	Open Communication -> SP*	0.415	10.14	< 0.001	$f^2 = 0.260$	Supported
H1c	Group Cohesion -> SP*	0.354	8.15	< 0.001	$f^2 = 0.180$	Supported
H2	Social Presence -> Belonging	0.542	14.85	< 0.001	$f^2 = 0.416$, $R^2 = 0.294$	Supported
H3	Belonging -> Persistence	0.612	17.22	< 0.001	$f^2 = 0.598$, $R^2 = 0.502^{**}$	Supported
H4 (Med)	SP -> Belonging -> Persistence	0.332	8.64	< 0.001	VAF 64.2% (Partial)	Supported

Note: H1a–H1c represent outer model sub-dimension loadings/contributions within the higher-order reflective Social Presence model. Full inner structural model explained variance for Academic Persistence Intentions incorporating both SP -> API and SB -> API pathways is $R^2 = 0.502$ (50.2%).

PLS-SEM Standardized Path Coefficients (β) and Effect Sizes (f^2)

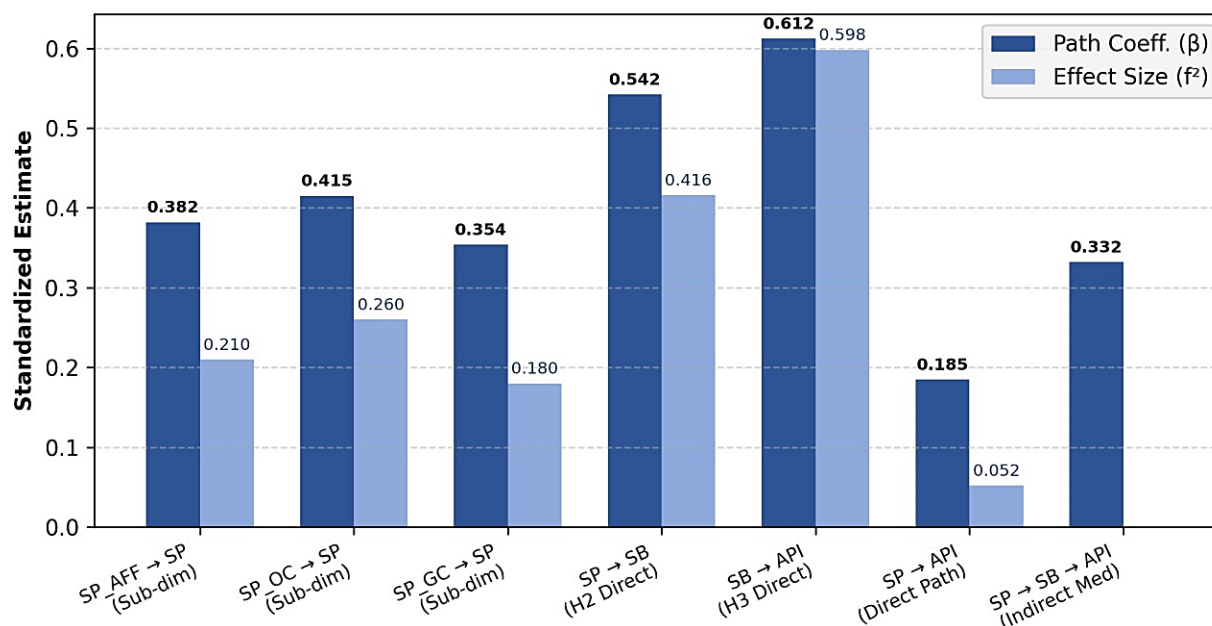


Figure (2): Standardized Structural Path Coefficients (β) and Cohen's Effect Sizes (f^2) across PLS-SEM structural pathways

4.3 Delivery Format Sub-Group Comparison & Multi-Group Analysis (PLS-MGA):

To examine potential moderation across course delivery formats, subgroup analyses were conducted across Fully Asynchronous ($n = 252$), Synchronous Web-Conferencing ($n = 138$), and Blended /Hybrid ($n = 92$) cohorts. Levene's test for equality of variance confirmed homogeneity of variance across delivery formats for Social Presence ($F = 1.48$, $p = 0.228$) and Sense of Belonging ($F = 1.32$, $p = 0.268$), validating ANOVA assumptions despite unequal group sizes.

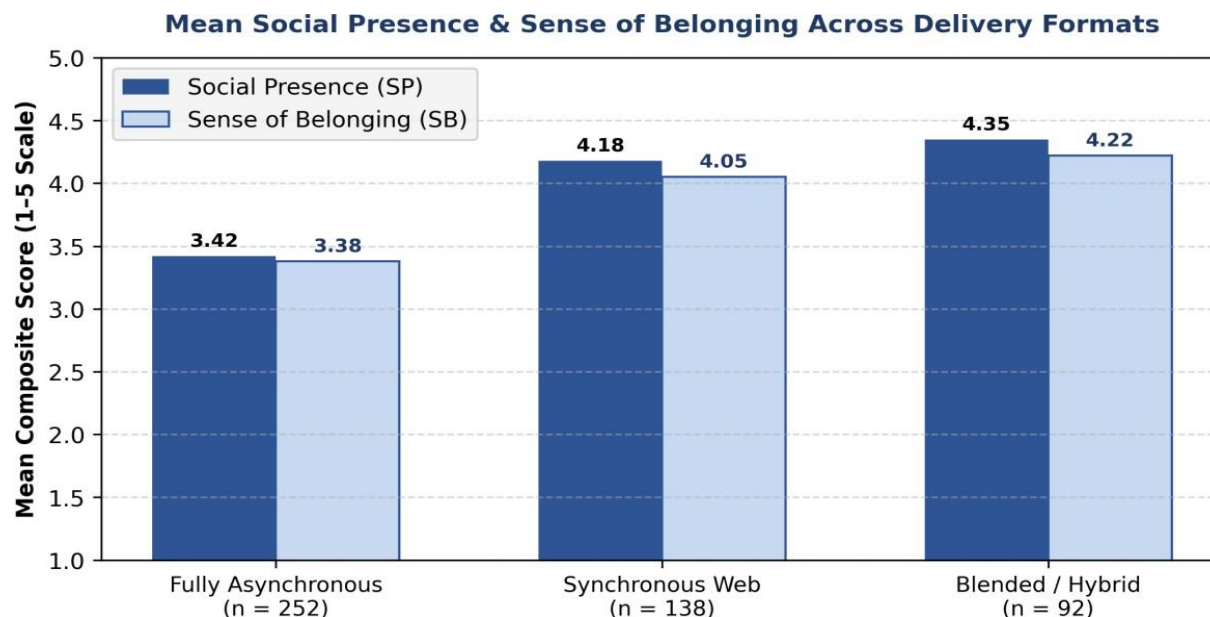


Figure (3): Comparison of Mean Social Presence and Sense of Belonging Composite Scores (1–5 Likert Scale) across Online Delivery Formats

ANOVA testing indicated significant baseline score differences across delivery formats for Social Presence ($F(2, 479) = 38.42, p < 0.001, \eta^2 = 0.138$) and Sense of Belonging ($F(2, 479) = 32.15, p < 0.001, \eta^2 = 0.118$). Post-hoc Tukey HSD tests demonstrated that Blended (Mean = 4.35) and Synchronous (Mean = 4.18) courses generated significantly higher baseline Social Presence than fully Asynchronous courses (Mean = 3.42, $p < 0.001$). Similarly, Tukey HSD post-hoc tests for Sense of Belonging revealed significantly higher mean scores in Blended (Mean = 4.22) and Synchronous (Mean = 4.05) formats compared to Asynchronous formats (Mean = 3.38, $p < 0.001$).

Before conducting multi-group comparisons, Measurement Invariance of Composite Models (MICOM) was established using the three-step procedure (configural invariance, compositional invariance, and equality of composite means and variances) following Henseler, Ringle, and Sarstedt (2016). PLS-MGA permutation tests indicated that the structural relationship from Social Presence to Sense of Belonging remained strong and statistically invariant across all formats ($\beta_{\text{asynch}} = 0.518, \beta_{\text{synch}} = 0.565, \beta_{\text{blend}} = 0.582$; MGA p-values > 0.05 for all pairwise comparisons). This suggests that while real-time video interaction elevates baseline presence, social presence remains essential for virtual belonging regardless of course format.

4.4 Qualitative Thematic Findings:

Codebook Thematic Analysis of focus group transcripts (N = 36 participants across 148 transcript pages, comprising 312 total coded reference extracts) identified four core themes explaining how distance learners experience virtual belonging:

Qualitative Theme Coded Mention Frequencies (Focus Groups N = 36)

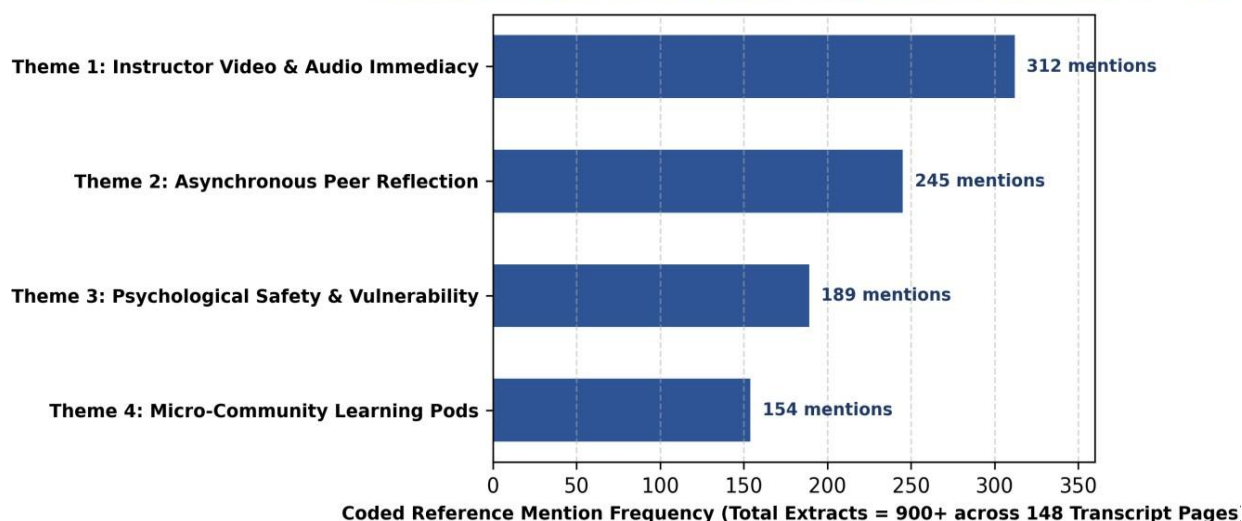


Figure (4): Qualitative Theme Coded Mention Frequency distribution highlighting key pedagogical drivers of virtual belonging (N = 36 focus group participants)

- **Theme 1:**

Instructor Video & Audio Immediacy (Coded Frequency = 312). Short, weekly informal instructor video announcements and personalized video/audio assignment feedback significantly reduced perceived transactional distance. Participant FG4-P1 remarked: 'The audio feedback with the instructor's encouraging tone on my term paper was ten times more meaningful than written rubric text.' Participant FG2-P4 added: 'Seeing my professor in a raw 2-minute weekly video made me realize they were a caring mentor rather than an automated grading profile.'

- **Theme 2:**

Asynchronous Peer Reflection & Dialogue (Coded Frequency = 245). Traditional 'post once, reply twice' text boards were widely criticized as transactional. Conversely, structured asynchronous voice/video reflection boards (e.g., Flip, VoiceThread) and collaborative case discussions facilitated authentic connection. Participant FG1-P3 noted: 'Hearing classmates' voices and seeing their faces in short video reflections made their real-world struggles relatable, creating genuine connections text posts could never achieve.'

- **Theme 3:**

Psychological Safety & Vulnerability (Coded Frequency = 189). Learners emphasized that feeling comfortable asking questions and expressing confusion without fear of judgment was crucial for virtual belonging. Explicit communication norms and instructor validation of student contributions established psychological safety. Participant FG3-P2 shared: 'When the professor validates simple questions, it turns a intimidating digital space into a safe learning environment.'

- **Theme 4:**

Isolation Mitigation & Micro-Community Building (Coded Frequency = 154). Small -group 'learning pods' (3–4 students) maintained throughout the term reduced the daunting scale of large online classes, providing informal peer support networks that buffered against isolation. Participant FG5-P3 noted: 'Having a 4-person learning pod reminded me I wasn't alone when coursework felt overwhelming.

5. Discussion

This study provides empirical insights into the socio-emotional mechanics connecting Social Presence, Sense of Belonging, and Academic Persistence Intentions in online higher education. By integrating variance-based structural equation modeling (PLS-SEM) with qualitative focus group narratives, these findings advance distance education theory and provide actionable guidance for instructional design.

5.1 Theoretical Integration and Synthesis:

Quantitative modeling demonstrated that Social Presence is a robust direct predictor of Sense of Belonging ($\beta = 0.542$, $f^2 = 0.416$, $R^2 = 0.294$), which subsequently predicts Academic Persistence Intention ($\beta = 0.612$, $f^2 = 0.598$; full model $R^2 = 0.502$). Mediation analysis confirmed that belongingness serves as a vital psychological bridge linking social presence to student persistence intentions (indirect effect $\beta = 0.332$, $VAF = 64.2\%$). These findings align with and extend contemporary educational literature (Andel et al., 2020; Burgin & Munasinghe, 2024; Meech & Koehler, 2024), establishing that social presence is a fundamental socio-emotional prerequisite for virtual community building.

Deconstructing social presence sub-dimensions revealed that Open Communication ($\beta = 0.415$) and Affective Expression ($\beta = 0.382$) yield the strongest contributions to overall social presence. This indicates that online learners prioritize authentic, responsive human interactions over static instructional content. When faculty and peers project authentic human identities and engage in open dialogue, transactional distance shrinks, creating an inclusive environment where students feel valued and visible (Irugalbandara et al., 2025).

5.2 Actionable Pedagogical Recommendations:

The empirical findings yield four concrete, actionable recommendations for online course designers, faculty, and academic leaders:

1. Institutionalize Instructor Video & Audio Immediacy: Embed short, weekly informal video overviews and personalized audio/video assignment feedback to humanize instruction and foster affective connection.
2. Overhaul Asynchronous Discussion Architecture: Replace rigid 'post once, reply twice' requirements with problem-based collaborative scenarios, multimodal voice/video discussions,

and peer reflection protocols.

3. Implement Micro-Community 'Learning Pods': Structure courses around small, persistent micro-communities (3–4 students) to facilitate peer support, group cohesion, and mutual accountability.
4. Establish Psychological Safety Norms: Establish clear communication guidelines, validate student inquiries, and model vulnerability to reduce digital anxiety and foster an inclusive environment.

5.3 Emerging Technological Frontiers: Generative AI and Human Presence:

As Generative AI tutors, automated grading platforms, and intelligent conversational agents are increasingly integrated into Learning Management Systems, maintaining human presence becomes paramount. Qualitative and quantitative findings demonstrate that students clearly distinguish between automated transactional efficiency and genuine human empathy from faculty and peers.

Over-reliance on automated AI interactions without visible faculty involvement risks worsening feelings of disembodiment and institutional alienation. AI technologies should be leveraged to automate administrative overhead, thereby liberating faculty time for meaningful human interaction, empathetic outreach, and relationship building (Irugalbandara et al., 2025; Meech & Koehler, 2024).

5.4 Limitations and Future Research Directions:

Several methodological considerations should be noted. First, survey data were self-reported, although procedural and statistical controls (Harman's test = 36.2%, full-collinearity VIFs = 1.42–2.18) confirmed the absence of severe common method variance. Second, while the sample was multi-institutional across North America, generalizability to international cultural contexts warrants further research. Third, academic persistence was measured as behavioral persistence intention rather than longitudinal degree completion records.

Future research should pursue three avenues: (1) longitudinal tracking of student cohorts over multi-year periods to link virtual belonging directly to registrar graduation data, (2) experimental studies investigating how Generative AI pedagogical agents influence student perceptions of social presence, and (3) cross-cultural research examining how cultural dimensions shape social presence expectations in international online degree programs.

6. Conclusion

This empirical investigation demonstrates that Academic Persistence Intention and Sense of Belonging are strongly predicted by learner-perceived Social Presence across diverse online higher education contexts. Integrating PLS-SEM path modeling ($N = 482$) with qualitative focus group narratives ($N = 36$) established that Social Presence accounts for 29.4% of variance in Sense of Belonging, which in turn predicts Academic Persistence Intention (yielding an overall explained persistence variance of 50.2% [$R^2 = 0.502$] in the full structural model). Qualitative findings highlighted four primary pedagogical levers: instructor video immediacy, collaborative asynchronous reflection, psychological safety, and micro-community learning pods. By intentionally designing

human-centered digital spaces, higher education institutions can cultivate meaningful virtual connection, alleviate distance learner isolation, and support student persistence.

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Appendix A: Measurement Survey Instrument and Outer Factor Loadings

Table (A1): Survey Item Wording, Construct Assignment, and Standardized PLS-SEM Outer Factor Loadings (N = 482)

Construct Code	Survey Item Wording	Std. Loading	t-statistic
SP_AFF_1	I felt comfortable introducing myself and sharing personal experiences in online discussions.	0.826	24.15
SP_AFF_2	I felt that humorous or lighthearted remarks were welcomed and understood by classmates.	0.784	19.82
SP_AFF_3	I felt comfortable expressing my emotions and personal values within course activities.	0.842	26.30
SP_AFF_4	I perceived my instructor and peers as real human beings rather than impersonal digital profiles.	0.851	28.12
SP_OC_1	I felt that my opinions were listened to and acknowledged by my classmates and instructor.	0.865	31.04
SP_OC_2	I felt comfortable asking questions and seeking clarification when confused about concepts.	0.852	29.45
SP_OC_3	I received timely, respectful, and constructive feedback on my ideas from peers and faculty.	0.821	23.88
SP_OC_4	I felt comfortable offering respectful intellectual disagreement during course discussions.	0.824	24.10
SP_GC_1	I felt a strong sense of shared educational purpose and collective direction with my classmates.	0.812	22.15
SP_GC_2	I felt that my online group worked together as a cohesive, supportive learning team.	0.835	25.04
SP_GC_3	I felt comfortable relying on my peers for help and academic support during difficult modules.	0.804	21.60
SP_GC_4	I felt that our course created a distinct identity and sense of collaborative community.	0.832	24.80
SB_1	I feel like a visible, valued, and respected member of this online academic program.	0.858	30.12
SB_2	I feel a strong sense of emotional connection and affiliation with my online peers.	0.841	26.15
SB_3	I feel that my background, identity, and personal voice matter in this digital classroom.	0.832	24.90
SB_4	I feel a sense of pride and institutional belonging as a student in this online university.	0.825	23.95
SB_5	I feel supported and cared for by my instructors and online learning community.	0.822	23.40
API_1	I am fully committed to completing my online degree program at this institution.	0.882	36.20
API_2	I rarely consider dropping out or withdrawing from my online university courses.	0.855	29.80
API_3	I am confident that I will re-enroll in online courses for the upcoming academic term.	0.861	31.10
API_4	Achieving my academic degree through this online program is a top personal priority.	0.822	23.50