Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute
InformingScience.org

JITEResearch.org

Volume 25, 2026

# STRATEGIES FOR ENHANCING SOCIAL PRESENCE AND WELL-BEING IN ONLINE LEARNING: A CONCEPTUALLY LED SYSTEMATIC LITERATURE REVIEW

| | | |
|---|---|---|
| Thilini Chathurabani Irugalbandara* | Queensland University of Technology, Brisbane, Australia | thilini.irugalbandara@hdr.qut.edu.au |
| Jason Watson | Queensland University of Technology, Brisbane, Australia | ja.watson@qut.edu.au |
| Freya Wright-Brough | Queensland University of Technology, Brisbane, Australia | f.wrightbrough@qut.edu.au |
| Shantha Fernando | University of Moratuwa, Moratuwa, Sri Lanka | shantha@cse.mrt.ac.lk |
| Trina Myers | Deakin University, Melbourne, Australia | trina.myers@deakin.edu.au |

* Corresponding author

## ABSTRACT

| | |
|---|---|
| Aim/Purpose | This study investigates the underexplored interdependence of social presence and well-being in online learning. It aims to clarify their reciprocal relationship and identify technology-enabled strategies that support both constructs, along with the associated challenges and support factors, to help educators design socially engaging and well-being supportive online environments. |
| Background | Despite the recognised importance of social presence and well-being for engagement and collaboration in online learning, existing research largely examines these constructs in isolation, resulting in fragmented understandings of how they jointly influence learning experiences. Moreover, there is a notable lack of systematic reviews that synthesise technology-enabled strategies designed to support both simultaneously. Together, these gaps leave e-learning designers without a unified, evidence-based framework, leading to design decisions guided more by intuition than by evidence. |

Accepting Editor Rangarajan (Ray) Parthasarathy | Received: October 25, 2025 | Revised: January 17, February 12, 2026 | Accepted: February 16, 2026.
Cite as: Irugalbandara, T. C., Watson, J., Wright-Brough, F., Fernando, S., & Myers, T. (2026). Strategies for enhancing social presence and well-being in online learning: A conceptually led systematic literature review. *Journal of Information Technology Education: Research, 25,* Article 9. https://doi.org/10.28945/5732

| | |
|---|---|
| Methodology | A two-phase design was employed: a narrative literature review to develop a preliminary conceptual framework linking social presence and well-being, followed by a systematic literature review (SLR) using hybrid inductive–deductive analysis to synthesise strategies, support factors, and challenges from empirical studies published between 2019 and 2025 across ACM Digital Library, IEEE Xplore, Web of Science, and Scopus. |
| Contribution | This study contributes by (1) proposing a preliminary conceptual framework that advances understanding of social presence, well-being, and their mutual reinforcement, and (2) offering practical insights into technology-enabled strategies and associated challenges for holistic online learning design. |
| Findings | Social presence and well-being are mutually reinforcing constructs underpinning engagement and collaboration in online learning. A key conceptual contribution of this study is the development of a unified framework that maps the reciprocal influence between these constructs, thereby addressing a gap in fragmented prior research. Phase 2 synthesized empirical evidence to identify six technology-enabled strategies, visualization, real-time interaction, social connectivity, personalization, proactive support, and interactive environments, that support both constructs. The study also highlights practical implementation challenges, including technical barriers, learner engagement, pedagogical alignment, ethical considerations, and staff training needs. |
| Recommendations for Practitioners | Practitioners should intentionally integrate strategies that support both social presence and well-being, while anticipating implementation challenges, to foster meaningful connection and engagement in online learning. |
| Recommendations for Researchers | Researchers should examine social presence and well-being as interdependent constructs to capture their dynamic interplay, providing richer insights into learners' experiences and guiding the development of more effective online learning communities. |
| Impact on Society | By highlighting the interdependence of social presence and well-being, this study informs the design of supportive online learning environments that foster inclusion, emotional stability, and meaningful engagement. |
| Future Research | Future research should empirically test the preliminary conceptual model, investigate cascading effects between social presence and well-being, and evaluate how new technologies can be ethically and effectively leveraged to enhance both constructs. |



| | |
|---|---|
| Keywords | social presence, well-being, technology-enabled strategies |


## INTRODUCTION

The online learning environment often lacks the level of social interaction and engagement found in physical classrooms, which may affect students' sense of connectedness and overall learning experience (Santini et al., 2020). According to social learning theory, students learn through observing others (Bandura, 1986). However, many learners struggle with meaningful communication and collaboration in online settings, particularly when learning environments are poorly designed. Such contexts can foster isolation and predominantly transactional forms of interaction, which may increase stress, anxiety, and disengagement among students. As a result, social presence and student well-being

emerge as critical and interrelated factors for supporting sustained engagement and effective learning in online environments.

Social presence is a multidimensional construct that enables learners to perceive others as "real" and engage meaningfully in online learning environments, fostering trust, belonging, and group cohesion (Garrison et al., 1999; Kreijns et al., 2022; Lowenthal & Dunlap, 2010; Wise, 2004). Drawing on the Social Information Processing (SIP) model, Social Presence Theory (Short et al., 1976), and the Community of Inquiry framework (Garrison et al., 1999), social presence emerges as learners gradually exchange social information, build relationships, and develop emotional and social bonds, even in the absence of physical cues. Within the COI framework, social presence is identified as one of three core components, alongside teaching and cognitive presence, highlighting its central role in fostering engagement and collaborative knowledge construction.

Alongside social presence, well-being is a critical construct that shapes learners' capacity to engage meaningfully in online environments. Unlike social presence, which emphasizes interpersonal connection, well-being focuses on individuals' emotional experiences and social functioning, influencing motivation, persistence, and overall engagement (Boulton et al., 2019; Michalos, 2017; Zhoc et al., 2022). Theoretical perspectives from emotional and social well-being highlight how learners' subjective perceptions of stability, belonging, and value within social contexts affect their capacity to participate effectively in collaborative learning (Courtwright et al., 2020; Keyes, 1998; Park et al., 2022). In this study, well-being is conceptualized as a dynamic resource that interacts with social presence, enabling learners to navigate the psychological and relational challenges of online learning, such as isolation and reduced peer support, thereby supporting sustained engagement and meaningful participation.

Taken together, social presence and well-being form the conceptual lens guiding this review. Social presence provides the structural foundation that facilitates communication and interaction, while well-being represents the emotional and social resources that support continued engagement. Analysing these constructs together allows for an understanding of both communicative behaviours and the underlying psychological processes that influence belonging, motivation, and achievement.

Building on this conceptual foundation, the empirical gap lies not in recognising the importance of social presence or well-being individually, but in understanding how both can be supported simultaneously. In technology-mediated environments, where embodied cues, informal interaction, and spontaneous peer support are reduced (Magni et al., 2025), the deliberate integration of strategies that enhance both constructs becomes essential. However, existing literature rarely examines how technology-enabled strategies address social presence and well-being in an integrated manner. Instead, implementations often focus on either communication tools or emotional support mechanisms, resulting in fragmented practice.

This paper addresses that gap by positioning social presence and well-being as interdependent constructs. Accordingly, it examines not only strategies that support each dimension independently but also how these strategies intersect and reinforce one another, offering a unified lens that can inform instructional and technological design. This conceptual stance guided the methodological structure of this study.

This gap underpins the guiding research question of this study:

> **RQ:** What technology-enabled strategies used in online learning environments support social presence and well-being, and what are the associated support factors and challenges?

Answering this question required a clear conceptual understanding of the two core constructs, social presence and well-being, and their interrelationship. This leads to the following sub-question:

> **Sub-RQ:** What role does the relationship between social presence and well-being play in an online learning environment?

Although many researchers are already intuitively employing initiatives that leverage this connection, it has not been explicitly theorized. The sub-research question, therefore, guided the effort to make this implicit relationship more visible and analytically grounded.

To explore these questions, a two-phase approach was adopted. In Phase 1, a narrative literature review was conducted to define the constructs and examine their connection. These insights informed Phase 2, during which a systematic literature review (SLR) was conducted to investigate technology-enabled strategies, the factors supporting their implementation, and the challenges they pose. The combined findings from both phases provide a foundation for developing a framework to guide the purposeful use of technology in enhancing social presence and well-being in online learning environments.

# METHODS

This paper addresses the gap in understanding how technology-enabled strategies can simultaneously support social presence and well-being by positioning these constructs as interdependent rather than separate dimensions. Accordingly, the study examines not only strategies that enhance each dimension independently but also how these strategies intersect and reinforce one another, offering a unified lens to inform instructional and technological design. This conceptual stance guided the methodological structure of the study.

Examining how technology-enabled strategies can simultaneously support social presence and well-being required a clear conceptual understanding of these constructs and their interrelationship. Therefore, in Phase 1 of this study, a preliminary conceptual model was developed using a narrative literature review to make implicit relationships between social presence and well-being visible and analytically grounded. Phase 2, a systematic literature review (SLR), then investigated technology-enabled strategies in online learning environments, ensuring that the exploration of strategies and support factors was conceptually anchored and methodologically rigorous. The methodologies adopted for Phase 1 (narrative literature review) and Phase 2 (systematic literature review) are presented in detail in the following two sections.

## *PHASE I: A NARRATIVE LITERATURE REVIEW TO EXPLORE THE RELATIONSHIP BETWEEN SOCIAL PRESENCE AND WELL-BEING IN AN ONLINE LEARNING ENVIRONMENT*

Phase 1 addresses the sub-research question: "What role does the relationship between social presence and well-being play in an online learning environment?" Understanding this relationship is essential for answering the main research question (RQ) concerning technology-enabled strategies that support these constructs, as Phase 2, the systematic literature review (SLR), relies on a clearly articulated conceptual framework to identify relevant strategies and associated support factors.

This phase aimed to establish a preliminary conceptual model of social presence and well-being within online learning environments through a narrative literature review. The review synthesized evidence from 72 scholarly sources, including peer-reviewed journal articles, foundational theoretical works, books, and conference publications spanning educational technology, online pedagogy, learning sciences, and psychology. A narrative review was selected for its capacity to synthesise diverse bodies of literature and critically evaluate theoretical and empirical knowledge across disciplines (Rother, 2007; Sukhera, 2022). Developing a clear conceptual understanding of social presence and well-being, and their interconnections, helped establish the theoretical boundaries and analytical focus for the subsequent SLR. The conceptual model was used as a guiding lens for interpreting the findings by identifying the support factors underpinning the strategies examined.

The construction of the conceptual model followed a structured and iterative process. First, the two domains, social presence and well-being, were conceptualised independently by synthesising their defining attributes as reported in the reviewed literature. Studies were analysed to identify recurring theoretical definitions, empirical indicators, and domain-specific attributes relevant to online and blended learning contexts. Through this process, social presence was conceptualised using three attributes, while well-being was conceptualised using seven attributes, resulting in a total of 10 attributes across both domains.

Second, relationships within and across these domains were examined by analysing how attributes were discussed, co-occurred, or were empirically linked within the literature. Particular attention was given to studies that addressed both constructs explicitly. Where direct evidence of intersection was limited, relationships were interpreted based on theoretically supported, mutually reinforcing mechanisms described across the two domains, such as the reciprocal relationship between emotional expression (social presence) and positive emotions (well-being) in online learning environments.

Finally, these within-domain and cross-domain relationships were systematically mapped to develop a preliminary conceptual model that makes explicit the interdependence between social presence and well-being. This model provides a coherent analytical lens for Phase 2 by guiding the identification and interpretation of technology-enabled strategies and their associated support factors.

To enhance the validity and transparency of this phase, the narrative literature review was conducted collaboratively by a four-member research team. Inclusion decisions were based on each study's relevance to the theoretical conceptualisation or empirical examination of social presence, well-being, or their relationship within online learning contexts. Regular team meetings were held to discuss inclusion and exclusion decisions and to reconcile differing interpretations, ensuring intersubjective agreement and strengthening the transparency, credibility, and conceptual coherence of the synthesis.

By explicitly addressing the sub-research question, Phase 1 establishes a theoretically grounded foundation for Phase 2 and ensures that the subsequent SLR focuses on technology-enabled strategies that support both social presence and well-being, as well as their intersection.

## *Phase II: SLR to Explore Technology-Enabled Strategies Used in Online Learning Environments to Support Social Presence and Well-Being*

To address the main research question, which asks *"what technology-enabled strategies used in online learning environments support social presence and well-being and what the associated support factors and challenges are"*, a systematic literature review (SLR) was conducted. This approach enabled a structured examination of empirical studies to identify concrete strategies, the aspects of social presence and well-being they support, and the practical challenges encountered in implementing them in online learning environments.

### Rationale for using SLR

SLRs provide a rigorous, structured approach to exploring research questions, enabling thorough literature coverage within defined parameters. This aligns with the study's goals of synthesizing evidence, examining technology-enabled strategies, and connecting them to social presence and well-being in online learning environments.

Existing SLRs have explored the use of technologies in education, emphasizing their diverse applications. Studies have investigated the roles of Artificial Intelligence in Education (AIED) in learning, teaching, assessment, and administration (Chiu et al., 2023), its use in K-12 education for tasks like performance prediction and curriculum design (Martin et al., 2023), and the evolution of AI and deep learning in instructional design and analytics (Guan et al., 2020). Reviews also highlight human-centred approaches in AIED, focusing on trust, safety, and stakeholder engagement (Alfredo et al., 2024). Affective computing studies have examined emotion recognition systems and their

impact on learning and motivation (Yadegaridehkordi et al., 2019), with further reviews emphasizing the emotional dimensions in educational interactions and identifying key emotional states that influence outcomes, such as anxiety, enjoyment, and frustration (Yadegaridehkordi et al., 2019).

These SLRs exhibit the following focus areas:

1. *Pedagogical Focus:* Most reviews concentrate on pedagogical aspects, such as improving academic performance, instructional design, or creating adaptive learning environments (Chiu et al., 2023; Guan et al., 2020; Martin et al., 2023).
2. *Technology-Centric Analysis:* They analyse specific technologies, including AI, machine learning, and affective computing, categorizing their applications and methods (Alfredo et al., 2024; Martin et al., 2023; Yadegaridehkordi et al., 2019).
3. *Outcome-Oriented:* The reviews evaluate the impact of technologies on teaching efficacy, student engagement, learning outcomes, and emotion-based educational interactions (Chiu et al., 2023; Guan et al., 2020; Yadegaridehkordi et al., 2019).

Despite these contributions, none of the existing reviews specifically address technology-enabled strategies designed to enhance social presence and well-being in online learning environments. Although reviews emphasize emotion recognition and its relationship with learning motivation and cognition, their focus remains limited to affective computing rather than broader strategies to foster meaningful connections and emotional resilience in virtual settings (Yadegaridehkordi et al., 2019).

Existing SLRs emphasize technology's role in academic outcomes, often overlooking its potential to support social presence and well-being. This gap, partly due to challenges in identifying support mechanisms, justifies the inclusion of Phase 1 in this study. The current literature mostly emphasizes the pedagogical improvements associated with each strategy. Although many of these strategies also contribute to the enhancement of learners' social experiences, these aspects are not explicitly discussed. Instead, they are presented in a very general manner, making it necessary to apply a conceptual interpretation. This highlights the need for a conceptually led SLR that examines how technology can support these aspects of online learning.

## Methodological approach for conducting the SLR

In this study, a technology-enabled strategy is defined as an IT-based approach within an online learning environment aimed at strengthening social presence by promoting interactive communication, emotional expression, and a sense of belonging, as well as supporting attributes of social and emotional well-being, including positive emotions, self-esteem, resilience, social integration, and acceptance among learners.

The preliminary conceptual model, developed through the narrative literature review in Phase 1, played a central role in guiding the systematic literature review (SLR) by providing a structured understanding of the interrelationships among social presence, well-being, and related constructs.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method (Page et al., 2021) was followed to report this systematic review. PRISMA involves four phases: identification, screening, eligibility assessment, and inclusion of studies. Figure 1 illustrates how articles were identified, screened, and selected for analysis. The method emphasizes the importance of a comprehensive literature search, including the evaluation of existing systematic reviews and meta-analyses, ensuring that new research builds on established foundations (Page et al., 2021). This process also includes database searches, screening, forward and backward citation tracking, and final selection of studies for inclusion.

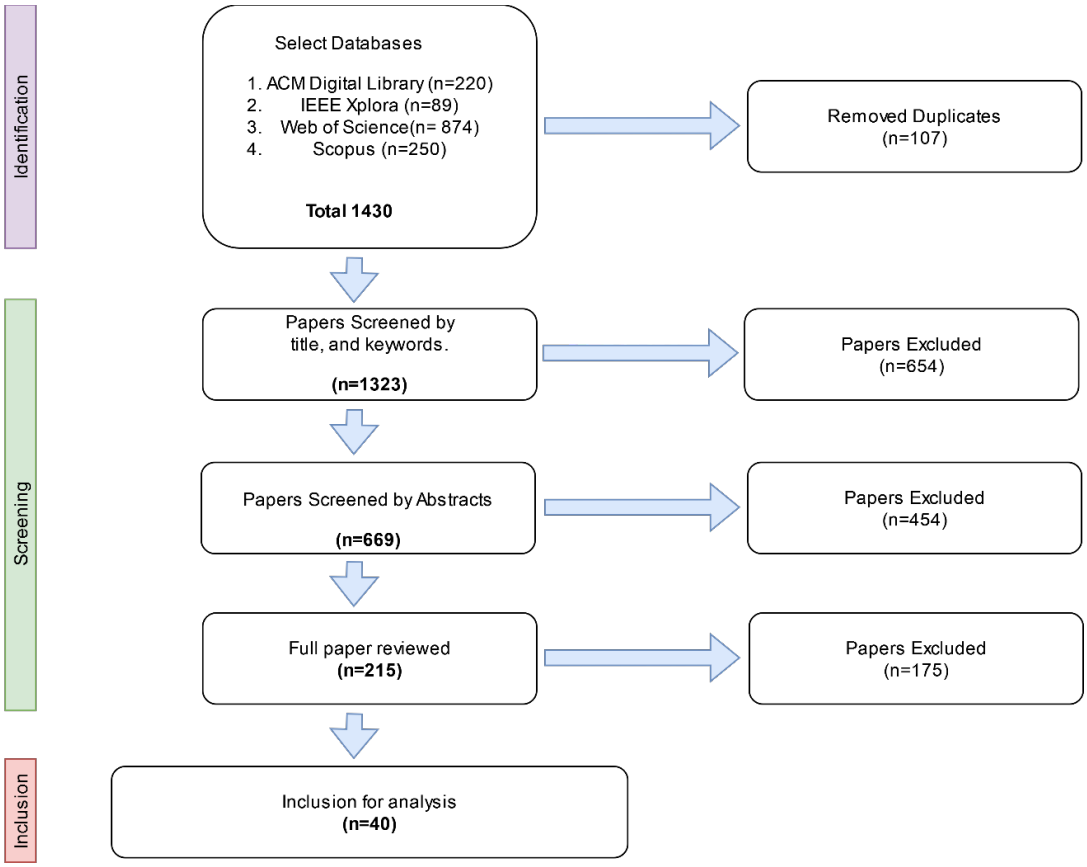



**Figure 1. Process flow using PRISMA**

**Search string.** The following search string was used across databases to identify relevant studies.

Initially, the following inclusion and exclusion criteria were applied in the initial search across the selected databases: ACM Digital Library, IEEE Xplore, Web of Science, and Scopus. The following search string was used to identify relevant studies:

> (technology* OR "Artificial Intelligence" OR AI OR "Social Media" OR "Virtual Reality" OR "Augmented Reality" OR "Mobile App*" OR "Machine Learning" OR Platform) OR (approach* OR strateg* OR enhance* OR improve*) AND ("Social Presence" OR "Sense of Community" OR interactivity OR connectivity) OR (wellness OR "Mental Health" OR Well-being OR Wellbeing OR mindfulness) AND ("E-learning" OR "Distance Learning" OR "Online Learning" OR "Virtual Learning" OR "Learning Community" OR "Digital Learning" OR "Web-based Learning" OR "Computer-based Learning") AND (student) AND (University OR "Higher Education" OR "Tertiary Education")

**Inclusion Criteria**

1. Studies must be published in peer-reviewed journals or conference proceedings.
2. Research must focus on learning technologies meant to support social presence or the well-being of students in higher education (as per the understanding of social presence and well-being adopted by this paper).
3. Publications must be empirical studies published between 2019 and 2025 to capture the post-COVID surge in online learning research and to ensure inclusion of recent, high-quality studies reflecting current practices and innovations.

**Exclusion Criteria**

1. Works in progress or non-empirical studies are to be excluded.
2. Studies that pertain to K-12 education will not be considered.
3. Review papers are also excluded from this search.

The initial search yielded 1,430 records. After removing duplicates, 1,323 papers remained. During title and keyword screening, 654 papers were excluded, and 669 were retained for abstract and full-text review. Full-text screening excluded studies that: (a) proposed conceptual models without empirical validation, (b) introduced tools without practical evaluation, or (c) focused solely on academic outcomes without addressing social presence or well-being. A conservative inclusion strategy was adopted during early screening to minimise premature exclusions, followed by stricter criteria at the full-text stage. Screening decisions were independently reviewed, and disagreements were resolved through discussion until consensus was reached. Ultimately, 40 studies were included in the final analysis.

Figure 2 presents the temporal distribution of the included studies, indicating a noticeable increase in publications from 2020 onwards, reflecting heightened scholarly interest in technology-supported social presence and well-being following the widespread shift to online learning.

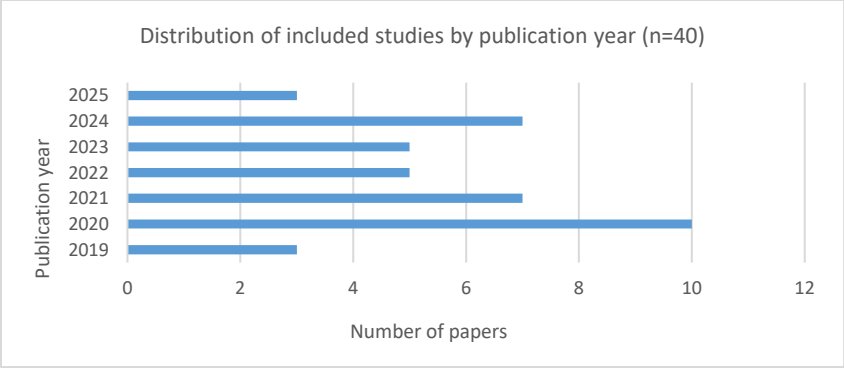



**Figure 2. Distribution of included studies by publication year**

Figure 3 summarises the research designs adopted across the 40 included studies. The majority of studies focused on technical or system evaluation, followed by mixed-methods approaches, as well as quantitative and qualitative methods. This distribution highlights the diversity of methodological approaches in the included studies.

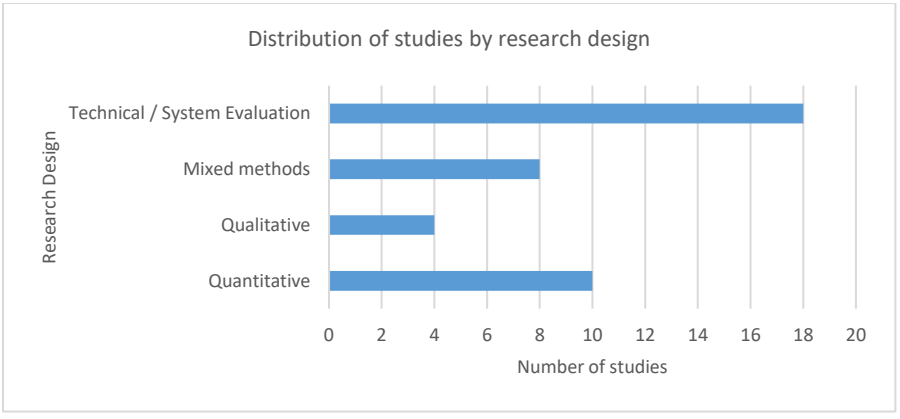



**Figure 3. Distribution of studies by research design**

The included studies either developed a technological tool and empirically evaluated its impact. directly or indirectly on social presence and well-being, or used existing tools to assess these effects empirically. Figure 4 provides an overview of the various technological tools used across the included studies.

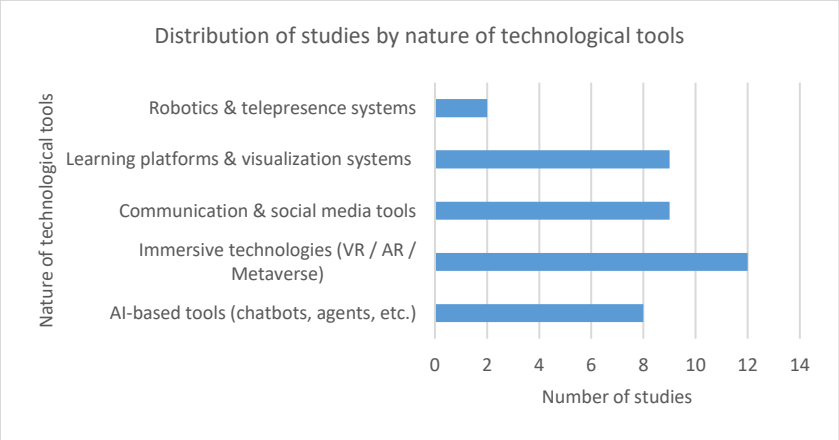



**Figure 4. Distribution of studies by nature of technological tools developed or employed**

This selection process ensures a robust foundation for understanding the interplay between technology, social presence, and student well-being in higher education.

**Steps Involved in Coding**

A hybrid coding approach was adopted, in which technology-enabled strategies and implementation challenges were identified inductively, while social presence and well-being support factors were identified deductively and further examined through a model-based analysis. This approach ensured that interpretations were grounded in empirical evidence while remaining theoretically coherent.

The coding process comprised three interconnected steps. First, technology-enabled strategies were identified inductively through close reading of the included studies to determine the approaches used to support learning, engagement, or interaction. Following Braun and Clarke's (2006) thematic analysis framework, similar codes were grouped into categories to generate coherent themes.

Second, the social presence and well-being attributes associated with each strategy were identified deductively, based on the attributes defined in earlier conceptualisation. Attributes explicitly reported in the studies were directly extracted, while implicit attributes were inferred using the preliminary conceptual model developed in Phase 1, which articulates the mutually reinforcing relationships between social presence and well-being. For example, descriptions such as *"active and sustained engagement through discussions, questioning, and referencing others' contributions to facilitate shared understanding"* were coded as interactive communication, a core social presence attribute. The model then guided the identification of related well-being attributes, such as resilience, social integration, and social acceptance, that the strategy implicitly supported.

Finally, implementation challenges associated with each strategy were identified inductively, drawing primarily from the discussion and conclusion sections of the studies. These challenges captured reported barriers influencing the effective deployment of the strategies.

An initial coding frame was developed after coding five studies and was refined iteratively as additional studies were analysed. Coding was conducted using NVivo to support systematic data management and analysis.

To enhance the transparency and credibility of the coding process, inter-coder reliability was assessed on a randomly selected subsample of 15% of the included studies, which were independently coded by two researchers. Coding consistency was first evaluated using average mutual agreement (K), calculated as the proportion of coding units on which both coders agreed (Holsti, 1969). The formula used was $K = M/N$, where *M* represents the number of agreements and *N* the total number of coding decisions. To account for the presence of two coders and provide a corrected reliability estimate, a reliability coefficient (R) was calculated using $R = \frac{n \cdot K}{1+(n-1) \cdot K}$ where *n* denotes the number of coders. This approach is consistent with established practices in qualitative content analysis and is considered appropriate when codes are inductively derived, and exact category matching is not predefined (Halpin, 2024; Neuendorf, 2017). Using this method, Technology-enabled strategies achieved K = 0.714 and R ≈ 0.833, Support factors yielded K = 0.706 and R ≈ 0.827, and challenges showed K = 0.75 and R = 0.86, indicating moderate to high coding consistency. Such levels of agreement are common in inductive thematic analysis within information systems research.

Strategy clusters were developed using Braun and Clarke's (2006) thematic analysis framework. This process involved systematic code grouping, iterative theme review, and theme definition. Candidate themes were discussed with the supervisory team to refine boundaries and ensure conceptual coherence and agreement.

## FINDINGS OF PHASE 1: WHAT ROLE DOES THE RELATIONSHIP BETWEEN SOCIAL PRESENCE AND WELL-BEING PLAY IN AN ONLINE LEARNING ENVIRONMENT?

The findings from Phase 1 address the theoretical component of the research objective by developing a unified understanding of the relationship between social presence and well-being in online learning. The analysis demonstrates that these constructs are mutually reinforcing, resulting in a conceptual framework that explicates their reciprocal interactions and provides a coherent theoretical foundation for examining them as interdependent rather than isolated dimensions.

The first phase of the narrative literature review focused on conceptualising social presence and well-being in online learning environments and examining the interrelationships between these constructs. Social presence, originally defined as the salience of another person in mediated interaction, has been extended in contemporary literature to encompass emotional connectedness, interpersonal relationships, and group dynamics (Short et al., 1976). Drawing on Social Presence Theory, the Community of Inquiry (CoI) framework (Garrison et al., 1999), and the Social Information Processing (SIP) model (Kreijns & Kirschner, 2018), social presence is positioned as encompassing both the perceptual experience of "being there" and the socio-emotional bonds formed through interaction. Together, these frameworks highlight how learners recognise others as "real," develop interpersonal trust, and engage collaboratively in online learning communities.

The online learning environment often lacks the level of social interaction and engagement found in physical classrooms, which may affect students' sense of connectedness and overall learning experience (Santini et al., 2020). According to social learning theory, learning occurs through observation, interaction, and social participation, underscoring the importance of interpersonal engagement in educational contexts (Bandura, 1986). However, when online learning environments are poorly designed, interaction may become predominantly transactional, fostering isolation and limiting opportunities for meaningful connection. Such conditions can increase stress, anxiety, and disengagement, thereby undermining students' social and emotional well-being. Consequently, intentionally building social presence and supporting student well-being are essential priorities in online learning environments.

Based on this conceptual foundation, social presence in this study is operationalised by synthesising foundational and contemporary perspectives. Early work within the Community of Inquiry framework emphasised emotional expression, open communication, and group cohesion as mechanisms through which learners project themselves as real people in online communities (Garrison et al., 1999; Lowenthal & Dunlap, 2010). More recent perspectives further highlight social presence as a psychological phenomenon centred on the perception of others as real and the projection of personal identity in mediated environments (Kreijns et al., 2022). Accordingly, social presence is operationalised through the following interrelated attributes:

1. *Interactive Communication* – reciprocal and open exchanges that support dialogue, mutual understanding, and collaborative meaning-making (Garrison et al., 1999; Lowenthal & Dunlap, 2010).
2. *Emotional Expression* – the ability to convey emotions, personal reactions, and aspects of identity that humanise interaction and foster trust (Garrison et al., 1999; Lowenthal & Dunlap, 2010; Short et al., 1976).
3. *Cohesiveness* – the sense of belonging and group identity developed through interpersonal connections, social bonding, and mutual support within an online learning community (Garrison et al., 1999; Kreijns et al., 2022).

Together, they capture the cognitive, affective, and relational dimensions of social presence relevant to this study's context. This operationalization explicitly links theoretical underpinnings to practical mechanisms, demonstrating how perception, emotion, and group cohesion collectively sustain engagement and enable collaborative knowledge construction.

In contrast, the literature did not reveal a single framework capable of fully representing social and emotional well-being in online learning contexts. Consequently, well-being was conceptualised through an integrated synthesis of Keyes' social well-being framework (Keyes, 1998) and contemporary models of emotional well-being (Courtwright et al., 2020; Park et al., 2022). This integrative approach enabled a holistic representation of well-being by combining socially embedded dimensions with individual emotional capacities. Analysis of the reviewed studies identified seven core attributes, which are considered fundamental for fostering positive, supportive, and engaging learning environments. Together, these attributes reflect a social–emotional perspective on well-being that aligns with the relational and interactive nature of collaborative online learning environments (Wilson-Nash et al., 2023). These attributes are defined as follows:

1. *Positive Emotions:* Refer to the expression of feelings of happiness, optimism, and general satisfaction with one's life (Courtwright et al., 2020; Park et al., 2022).
2. *Self-esteem:* Satisfaction with oneself (Courtwright et al., 2020; Park et al., 2022).
3. *Resilience:* The ability to meet challenges, recover, and exhibit positive emotions relatively quickly (Courtwright et al., 2020; Park et al., 2022).
4. *Social Integration:* The quality of one's relationship with others and society, including a feeling of belonging and the extent to which individuals are integrated into society (Keyes, 1998; Wilson-Nash et al., 2023).
5. *Social Contribution:* One's sense of social value. This includes the belief that one is a vital member of society with something of value to contribute. Social contribution is related to the concepts of efficacy and responsibility (Keyes, 1998; Wilson-Nash et al., 2023).
6. *Social Coherence:* Refers to the strength of bonds and relationships within society. Individual-level attitudes and behaviours contribute to social coherence (Keyes, 1998; Wilson-Nash et al., 2023).

7. *Social Acceptance:* The feeling of being accepted by others. With social acceptance, individuals believe that others are capable of kindness and develop trust in them (Keyes, 1998; Wilson-Nash et al., 2023).

Building on the conceptualisation of social presence and well-being, this study identifies a dynamic, reciprocal relationship between the two constructs. Rather than treating them as separate domains, the review acknowledges their conceptual and functional interdependence. Several attributes, such as cohesiveness and social coherence, appear across both constructs, revealing overlaps that highlight the conceptual ambiguity between them. These intersections suggest that social presence and well-being are not discrete categories but mutually reinforcing dimensions of the online learning experience.

Attributes commonly associated with well-being, such as positive emotions, self-esteem, and resilience, contribute significantly to the development of social presence. Conversely, key elements of social presence, such as cohesiveness and interactive communication, actively support and enhance learners' emotional and social well-being. Despite this interconnectedness, previous research has often approached these constructs in isolation, limiting understanding of their synergistic potential.

To address this gap, the review synthesized evidence that illustrates how specific attributes interact across the two domains. For instance, community cohesiveness may foster social integration and self-esteem, while positive emotions can support emotional expression and relational depth. These interrelationships informed the development of the preliminary conceptual model (Figure 5), which reflects the mutual reinforcement between social presence and well-being.

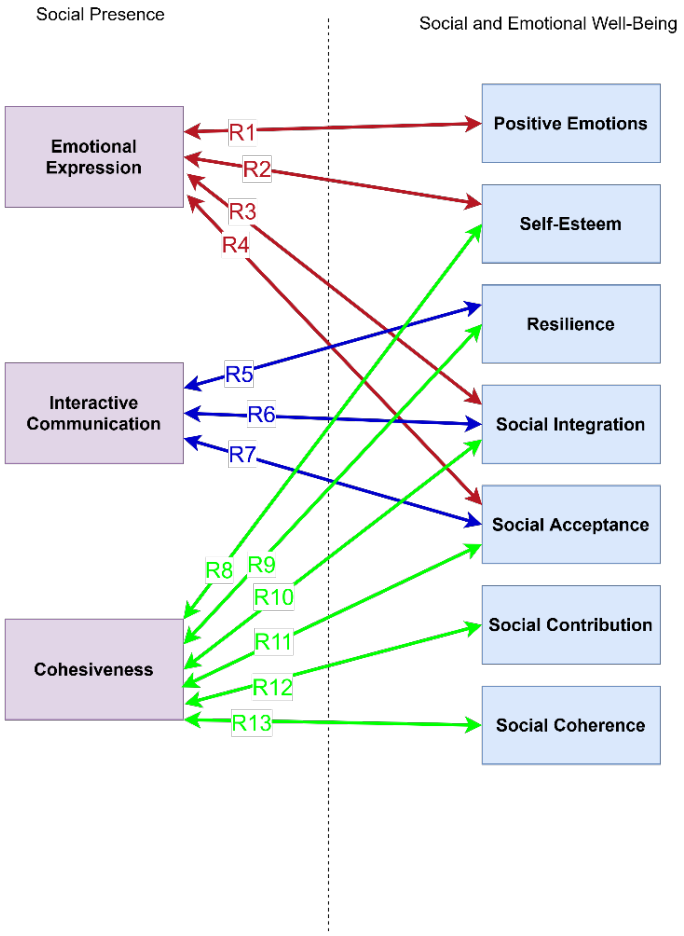



**Figure 5. Social presence and well-being (preliminary conceptual model)**

Importantly, this preliminary conceptual model directly guided the systematic review in phase II by functioning as an analytical lens for evaluating technology-enabled strategies. Instead of listing strategies broadly, the model enabled a structured mapping process in which each strategy was examined in relation to the specific attributes of social presence and well-being it influences. In doing so, the model guided the identification of strategies that contribute to both constructs simultaneously, clarified where contributions were implicit rather than stated, and anchored the interpretation of findings within a theoretically coherent framework. Thus, the conceptual model not only synthesised existing knowledge but also shaped the methodological approach and evaluative criteria used in the systematic review.

The preliminary conceptual model (Figure 5) was developed through a narrative synthesis of literature on social and emotional well-being in online learning contexts. It identifies three key interactional factors, emotional expression, interactive communication, and belongingness/cohesiveness as central influences on well-being. These factors were consistently linked across studies to multiple social-emotional attributes, highlighting reciprocal and reinforcing relationships. The model illustrates how each factor connects to relevant well-being dimensions.

## *The Effect of Emotional Expression on Social and Emotional Well-Being (R1-R4)*

Emotional expression, the verbal and non-verbal communication of feelings, is a fundamental human mechanism for social navigation and peer bonding (Kret et al., 2020). Evidence indicates that emotional expression supports positive emotions, self-esteem, social integration, and social acceptance (de la Barrera et al., 2019; H. Gao et al., 2022; Kemeny et al., 2004).

**Positive emotions (R1 in Figure 5)** refer to psychological and physiological states like happiness, optimism, and life satisfaction (N. Gao et al., 2020). In social settings, emotional expressions reflect and strengthen emotional bonds, aiding social navigation (Kret et al., 2020). As a key form of communication, emotional expression is tightly linked to positive emotions (Koelsch, 2020; Suvilehto et al., 2015). These emotions, such as happiness, foster more frequent and genuine expressions (e.g., the Duchenne smile) (Ekman et al., 1990), which in turn promote social engagement and deepen emotional connections.

**Self-esteem (R2 in Figure 5)** refers to individuals' satisfaction with themselves and their perceived self-worth. It is closely linked to emotional expression; those who express and manage emotions well tend to have higher self-esteem (de la Barrera et al., 2019). Low self-esteem, however, may lead to shame and hinder emotional expression, highlighting self-esteem's key role in promoting emotional expression (Kemeny et al., 2004).

**Social integration (R3 in Figure 5)** refers to fostering inclusion and a sense of belonging within society (Gidron & Hall, 2020). Affective emotions enhance social bonds and promote integration (Rimé et al., 2020). Emotional expression is shaped by social interactions, relationships, and cultural norms (Peluso & Freund, 2019), and individuals who feel included are more likely to express emotions openly. This underscores a mutually reinforcing link between social integration and emotional expression.

**Social acceptance (R4 in Figure 5)** is the feeling of acceptance by others (Wentzel et al., 2021). Communicating through affective emotions ensures the social acceptance of individuals. There is a positive correlation between social acceptance and emotional expression, and emotional expression has a major impact on social acceptance among men (Bartholomeu et al., 2021).

## *The Effect of Interactive Communication on Social and Emotional Well-Being (R5-R7)*

Interactive communication, involving active exchange of ideas among participants, is strongly associated with **resilience, social integration, and social acceptance** in online learning (Courtwright et al., 2020; Park et al., 2022; Wilson-Nash et al., 2023). Reciprocal relationships were evident, where higher levels of well-being further support engagement in communication.

**Resilience (R5 in Figure 5)** is the capacity to overcome challenges and regain emotional stability (Courtwright et al., 2020; Park et al., 2022). Interactive communication, especially in problem-based learning, supports resilience, grit, and a growth mindset (Courtwright et al., 2020; Park et al., 2022). Collaborative environments enhance social presence, which helps build these traits (Courtwright et al., 2020). Research also highlights how well-designed online spaces and shared experiences promote resilience through community support (Noorafshan et al., 2013; Park et al., 2022).

**Social integration (R6 in Figure 5)** refers to an individual's connection with others and their sense of belonging in society (Gidron & Hall, 2020). Sharing emotions drives social connection, and communication with close friends indicates strong integration (Appau et al., 2019). Interactive communication reinforces these bonds, as inclusion in social groups encourages further engagement (Karlsson, 2013). Literature underscores a reciprocal relationship between social integration and interactive communication.

**Social acceptance (R7 in Figure 5)** reflects the feeling of being accepted by others, grounded in trust within social circles. Interactive activities like forum discussions promote engagement and a sense of acceptance (Wilson-Nash et al., 2023). As indicated by R7 in Figure 2, interactive communication and social acceptance have a reciprocal relationship; feeling accepted encourages communication, and communication fosters acceptance (Karlsson, 2013).

## *The Effect of Belongingness/Cohesiveness on Social and Emotional Well-Being (R8-R13)*

Belongingness, or cohesiveness, reflects the bonds among group members and the willingness to support one another (Kreijns et al., 2003). Literature shows that cohesive communities foster multiple well-being attributes, including self-esteem, resilience, social integration, social acceptance, social contribution, and social coherence.

**Self-esteem (R8 in Figure 5)** represents individuals' satisfaction with themselves and is shaped by social connectedness and group unity. Cohesive communities provide acceptance and recognition, enhancing self-worth (Németh & Bernáth, 2022). Supportive family environments also play a crucial role in fostering healthy self-esteem (Németh & Bernáth, 2022).

**Resilience (R9 in Figure 5)**, within social networks, promotes cohesiveness by strengthening social ties, enabling knowledge sharing, and supporting adaptive risk governance. In turn, cohesive networks enhance resilience by offering a supportive environment. This reciprocal relationship extends to community-level social capital, where trust and collective action bolster resilience (Bouwer et al., 2021; Jacobs & Cramer, 2017).

**Social integration (R10 in Figure 5)** reflects individuals' inclusion in society, rooted in community bonds. Cohesiveness, defined by group belonging and mutual support, is a central component of social integration. This relationship, illustrated by R10, highlights how cohesiveness fosters stronger social integration (Richter et al., 2021).

**Social acceptance (R11 in Figure 5)** refers to the feeling individuals have when they belong to a particular community. Social cohesion encompasses a sense of belonging, trust, willingness to help one another, connectedness, and acceptance (Chan et al., 2006; Erdoğan, 2020; Healy, 2019). Additionally, social acceptance is considered a metric of social cohesion (Pepper et al., 2019).

**Social contribution (R12 in Figure 5)** reflects the feeling that individuals' actions are valued by society and contribute to it (Keyes, 1998). Social cohesion is defined as helping each other and the success of others (Richter et al., 2021). These definitions in the literature convey the reciprocal link between social contribution and social cohesion depicted in R12 in Figure 5.

**Social coherence (R13 in Figure 5)** refers to the strength of relationships and connectedness within a society (Keyes, 1998; Wilson-Nash et al., 2023). It reflects social cohesiveness formed through group interactions (Jennings & Bamkole, 2019; Norz et al., 2023). Strong social coherence fosters mutual 13 support, while cohesiveness, in turn, enhances coherence by promoting unity and connection among individuals (Otte, 2019). Social presence and social-emotional well-being are mutually reinforcing.

Across the three factors, emotional expression, interactive communication, and belongingness/cohesiveness, the literature shows reciprocal, mutually reinforcing relationships with social-emotional well-being. Improvements in these factors enhance well-being attributes such as positive emotions, resilience, and social integration, which in turn strengthen engagement, interaction, and connectedness. Social presence both supports and is reinforced by these attributes, highlighting the dynamic interplay that shapes holistic well-being in online learning environments.

The reciprocal relationships identified through the narrative literature review are theoretically supported by Social Exchange Theory, which conceptualises social interactions as dynamic exchanges of resources and rewards (Blau, 1964; Cropanzano & Mitchell, 2005). From this perspective, social presence-related behaviours such as emotional expression, interactive communication, and belongingness function both as inputs to and outcomes of social and emotional well-being. Engagement in these behaviours generates social rewards, including acceptance, trust, and emotional support, which enhance well-being and strengthen relational bonds (Eisenberger et al., 2020; Shore et al., 2004). In turn, higher levels of well-being reduce the perceived costs of participation and motivate continued engagement in communicative and relational exchanges, thereby reinforcing social presence.

# FINDINGS OF PHASE 2: WHAT TECHNOLOGY-ENABLED STRATEGIES USED IN ONLINE LEARNING ENVIRONMENTS SUPPORT SOCIAL PRESENCE AND WELL-BEING, AND WHAT ARE THE ASSOCIATED SUPPORT FACTORS AND CHALLENGES?

This section presents the findings of the systematic literature review. The first part examines technology-enabled strategies for online learning to enhance social presence and well-being, along with the associated support factors, while the second part addresses the challenges of implementing these strategies. Employing the conceptual framework developed in Phase 1, the findings from Phase 2 address the applied component of the research objective by identifying six strategy clusters that simultaneously support social presence and well-being. These clusters translate the integrated theoretical insights into practical, evidence-based guidance for the design of online learning environments that holistically foster both constructs.

## *TECHNOLOGY-ENABLED STRATEGIES AND SUPPORT FACTORS DETERMINED FROM THE SLR*

A review of previous studies focused on improving social presence and well-being identified six key strategies used to enhance these outcomes. Table 1 presents the associated themes and the corresponding supporting codes for each strategy. As most existing studies do not explicitly address all support factors, often mentioning them only in general terms, both inductive and deductive reasoning were applied during the identification process. In this section, support factors are first identified deductively. Attributes explicitly reported in the studies were directly extracted, and additional factors

were subsequently identified using the preliminary conceptual model guided approach, which is reported later in this section.

**Table 1. Technology-enabled strategies and supporting factors**

| Technology-enabled strategy | Supporting factors | References |
|---|---|---|
| **Visualization and Simulation:** Using visual tools to create immersive experiences. | Cohesiveness | (Capello et al., 2024; Chessa & Solari, 2021; Ghanbarzadeh & Ghapanchi, 2020; Li et al., 2025) |
| | Emotional expression | (Kim et al., 2025; Wong et al., 2021) |
| | Interactive communication | (Ghanbarzadeh & Ghapanchi, 2020; Y. Lin & Yu, 2025) |
| | Positive emotions | (Kim et al., 2025; Melgar et al., 2021) |
| | Social integration | (Li et al., 2025; Melgar et al., 2021) |
| **Real-Time Interaction and Engagement:** Facilitating immediate communication among participants. | Interactive communication | (Ginige & Vanderwall, 2022; H. Liu et al., 2024; J. Liu et al., 2019; Thalheimer et al., 2020; Vázquez-Cano et al., 2021; Weidlich & Bastiaens, 2019) |
| | Positive emotions | (Ahmad, 2020; Thalheimer et al., 2020) |
| | Social contribution | (Rabotapi & Matope, 2024) |
| | Social integration | (Ahmad, 2020; Cui & Wang, 2024; Li et al., 2025; Rabotapi & Matope, 2024) |
| **Enhancing Social Connectivity and Community Building:** Promoting teamwork and social connections among learners. | Cohesiveness | (Duque et al., 2021) |
| | Emotional expression | (Johnson et al., 2024) |
| | Interactive communication | (Aouidi et al., 2019; Johnson et al., 2024; H. Lin & Pryor, 2020; Weidlich & Bastiaens, 2019) |
| | Positive emotions | (H. Lin & Pryor, 2020; Weidlich & Bastiaens, 2019) |
| | Social acceptance | (Huang et al., 2024; Johnson et al., 2024) |
| | Social contribution | (Aouidi et al., 2019; Huang et al., 2024; Johnson et al., 2024) |
| | Social integration | (Chen & DiFranzo, 2025; Mdaghri-Alaoui et al., 2023) |
| | Social coherence | (Huang et al., 2024) |
| **Personalization and Adaptive Learning:** Tailoring experiences to meet individual needs. | Cohesiveness | (Chen & DiFranzo, 2025; Chowdhury & Siddique, 2024; Huang et al., 2024; Johnson et al., 2024) |
| | Emotional expression | (Gruber et al., 2023; Hopman et al., 2023; M. Wang et al., 2022) |
| | Interactive communication | (Ghanbarzadeh & Ghapanchi, 2020) |
| **Proactive Support and Feedback Mechanisms:** Offering timely assistance and constructive feedback. | Cohesiveness | (Hopman et al., 2023; Motlhaka, 2020; Sprowls, 2020) |
| | Emotional expression | (Hopman et al., 2023) |
| | Interactive communication | (Q. Wang et al., 2022) |
| | Positive emotions | (Q. Wang et al., 2022) |
| | Self-esteem | (Aouidi et al., 2019) |

| Technology-enabled strategy | Supporting factors | References |
|---|---|---|
| **Building interactive learning environments:** Creating dynamic spaces that encourage active participation. | Cohesiveness | (Mardi, 2022; Rojas et al., 2023; Thalheimer et al., 2020) |
| | Interactive communication | (Mardi, 2022; Rojas et al., 2023; Thalheimer et al., 2020) |
| | Positive emotions | (Thalheimer et al., 2020; Zhou & Tao, 2020) |
| | Social contribution | (Mardi, 2022) |
| | Social integration | (Adil et al., 2023; Mardi, 2022) |

### Visualization and simulation

Visualization relies on models to represent information in graphical forms such as charts and graphs, while simulation creates dynamic models that replicate real-world processes. These techniques are primarily employed to achieve pedagogical objectives by providing a clear understanding of complex concepts. The literature revealed various approaches that integrated visualization and simulation in educational settings, primarily to enhance the overall learning experience and pedagogical practices. However, it was evident that visualization and simulation also improved social presence and well-being in online learning environments, contributing to a more engaging and supportive educational experience.

The visualization of learning behaviours, using tools such as heatmaps and hierarchical pie charts, encouraged students to reflect on their engagement, promoting active participation, social presence, and collaborative learning (Xu et al., 2021). Simulated learning environments enhanced cohesiveness and social integration in online education through interactive virtual platforms (Chessa & Solari, 2021; Ghanbarzadeh & Ghapanchi, 2020; Mdaghri-Alaoui et al., 2023; Wong et al., 2021). Mozilla Hubs, for instance, enabled users to create and join virtual spaces via browsers, using personalized avatars and classroom-like features to build community (Chessa & Solari, 2021). Similarly, Three-Dimensional Virtual Worlds (3DVWs) fostered experiential learning through realistic scenarios and game-like interactions (Kim et al., 2025). The Virtual Patient Immersive Communication Training (VPICT) system enhances students' social presence and well-being by immersing them in realistic nurse–patient simulations, enabling safe practice of communication skills, reducing anxiety, and fostering confidence through reflection and self-awareness (Kim et al., 2025). Sandbox games like InteractDiff provided students with freedom to explore virtual campuses, engage in collaborative activities, and express themselves through avatars, enriching online teaching and campus life (Wong et al., 2021).

The integration of multi-agent systems into learning platforms created dynamic, immersive scenarios in which intelligent agents collaborated with learners to provide personalized feedback and promote teamwork (Mdaghri-Alaoui et al., 2023). The human likeness strategy in online learning stimulated community cohesion through simulation techniques (Capello et al., 2024; Y. Lin & Yu, 2025). Pedagogical agents were specifically designed to simulate human instructors, leveraging human-likeness to enhance engagement, foster relatable learning environments, and improve acceptance of AI tools. These strategies significantly improved student interaction and immersion (Ahmad, 2020; Capello et al., 2024; Kim et al., 2025; Y. Lin & Yu, 2025; J. Liu et al., 2019). Telepresence robots also supported remote learning by enabling real-time interactions, reducing isolation, and allowing students to project their identities, simulating physical presence in classrooms to foster community building and engagement (Capello et al., 2024).

The literature indicates that visualization and simulation have been used in various ways to enhance social presence and well-being in online learning. Key strategies included visualizing learning environments, simulating educational experiences, developing virtual communities, and implementing human likeness. Collectively, these approaches contributed to increased social interaction, cohesiveness, positive emotions, and social integration, all of which are vital to fostering social presence and well-being. This body of research supports the notion that visualization and simulation are not only effective

pedagogical strategies but also important for enhancing the social dynamics of online learning environments.

### Real-time interaction and engagement

Real-time interaction and engagement emphasise the immediacy of communication, reducing psychological distance and supporting timely assistance, shared participation, and emotional connection, thereby strengthening social presence and well-being. This can take several forms, such as real-time student event tracking, identifying real-time student emotions, and real-time content analysis and replacement. Real-time synchronous interactions lead to greater engagement and a stronger sense of connection among participants, which are key components of social presence (Dahlstrom-Hakki et al., 2020). This section describes how real-time interaction and engagement have been used.

Collectively, these studies underscored the effectiveness of real-time engagement strategies in creating interactive, supportive, and inclusive educational settings. Real-time interaction and engagement in these environments were driven by several key factors: social integration, positive emotions, and interactive communication (Ginige & Vanderwall, 2022; H. Liu et al., 2024; J. Liu et al., 2019; Thalheimer et al., 2020; Vázquez-Cano et al., 2021; Weidlich & Bastiaens, 2019). The concept of "real" in real-time engagement reflects the essence of cohesiveness. Through real-time interactions, students receive the support and assistance they need whenever and wherever it is required, fostering a sense of connection and cohesiveness. By facilitating connections among students, real-time interactions encourage them to engage with each other, share experiences, and collaborate on tasks, fostering a sense of community and belonging (J. Liu et al., 2019). These interactions enhance emotional well-being, satisfaction, and happiness, fostering positive emotions (Ahmad, 2020; Capello et al., 2024; J. Liu et al., 2019). Furthermore, real-time communication allows for immediate feedback and dialogue between students and instructors, promoting active participation and nurturing a dynamic classroom atmosphere where students feel empowered to express themselves. These interconnected factors contribute to a holistic environment that enhances both social presence and well-being, enriching the overall educational experience. Social integration and positive emotions are vital aspects of well-being, while interactive communication and cohesiveness are key to social presence. These elements are closely linked. Social integration promotes positive emotions by fostering a sense of connection, and interactive communication supports cohesiveness through meaningful exchanges. Together, they create a supportive and engaging learning environment.

Real-time interaction and engagement in educational environments have been explored in many studies to enhance student learning and foster a sense of community. In the Moodle learning environment, three specific plugins were introduced to improve sociability (Weidlich & Bastiaens, 2019). One such plugin, the course contact plugin, displays students who are currently online, facilitating natural conversations and immediate engagement, thereby strengthening interactive communication within the learning environment. Moreover, the effectiveness of real-time student event tracking was demonstrated through a browser extension that monitored engagement via behavioural data, enabling educators to provide immediate feedback and support (Ginige & Vanderwall, 2022). This enhanced interactive communication by providing immediate feedback, encouraging participation, facilitating peer interactions, and promoting a sense of belonging and collaboration among students (Ginige & Vanderwall, 2022).

Moreover, the Meezaj system, which employed real-time emotion detection to gauge student well-being and promoted empathy and stronger social bonds through the visualization of collective moods (Ahmad, 2020), was presented. The importance of real-time content analysis in Virtual Learning Environments (VLEs), which enabled the dynamic adaptation of learning materials based on engagement metrics to personalize the educational experience, was further emphasized (Thalheimer et al., 2020). GestureTeach was a pedagogical approach that enhanced online teaching by utilizing gesture recognition technology for real-time interactive engagement, allowing for immediate feedback and dynamic content generation, which facilitated a more engaging learning experience (H. Liu et al., 2024). Similarly, Telepresence robots enabled remote users to participate in real-time interactions as

if they were physically present, enhancing communication and collaboration through audiovisual capabilities and interactive features (Capello et al., 2024). Real-time eye tracking captures learners' visual attention and behavioural patterns during interactions with pedagogical agents, providing measurable insights into social presence and engagement. It reveals how gaze frequency, fixations, and transitions toward agents indicate stronger motivation, involvement, and perceived social connection (Li et al., 2025). Likewise, augmented Interactive Video (AIV) based on a script engine fosters interactive communication through real-time engagement, thereby enhancing social presence (J. Liu et al., 2019).

### Enhancing social connectivity and community building in learning environments

In educational settings, strategies that promote social connectivity and community building are essential for student success and well-being. This category demonstrates that intentional design for peer connection and group formation is critical for sustaining belonging, social integration, and emotional support in online learning environments. By adopting diverse technological and social strategies, educators can enhance students' social engagement and create an inclusive learning community that encourages active participation and mutual support. These methods are beneficial for developing students' social skills, confidence, and emotional well-being, ultimately creating a more cohesive and supportive educational experience.

Various methods have been used to enhance social connectivity and build community in learning environments. Audio-visual technologies supported group collaboration on projects such as multimedia presentations, fostering interpersonal relationships and open dialogue. Social matching tools, like those in Netlearn and SAMI, applied social network analysis to group students with similar interests, creating personalized and engaging experiences (Aouidi et al., 2019; Q. Wang et al., 2022). Virtual reality platforms such as CollabVR offered immersive environments for real-time social interaction (Johnson et al., 2024). While telepresence robots enabled two-way video and audio communication to help reduce feelings of isolation (Capello et al., 2024). AI-driven approaches also contributed, with self-disclosure management allowing AI instructors to share personal information or feelings to build trust and social connection with learners (Chen & DiFranzo, 2025).

By making interactions feel more humanlike, this strategy increased learners' engagement, perceived support, and satisfaction, complementing the role of pedagogical agents, which further promoted social learning by encouraging group activities and peer communication (Y. Lin & Yu, 2025). Heterogeneous profiles in e-focus groups allowed for diverse, dynamic discussions (Duque et al., 2021). In the Moodle environment, three plug-ins were developed to enhance social interaction through social affordances (Weidlich & Bastiaens, 2019). The Dialogue plug-in enabled private conversations and document sharing to strengthen collaboration, while the Meet the Students plug-in increased identity visibility, fostering emotional expression and peer connection. Similarly, the use of TikTok in education has shown potential to strengthen social connectivity. Through short-form videos, challenges, and collaborative features like duets, TikTok encourages participation, peer recognition, and shared content creation. In learning environments, these practices support social acceptance, contribution, and coherence by fostering engagement, mutual understanding, and a sense of community (Huang et al., 2024).

Implementing these diverse strategies for enhancing social connectivity and community building was essential for the success of modern educational environments. These methods encouraged collaboration, supported social integration, and fostered a sense of community (Aouidi et al., 2019; Capello et al., 2024; Duque et al., 2021; Huang et al., 2024; Johnson et al., 2024; Y. Lin & Yu, 2025; Y. Wang et al., 2021). As learning environments continue to evolve, prioritizing these social and collaborative strategies will be key to creating supportive, interactive spaces where students can succeed. There was an interesting finding in this strategy. Enhancing social connectivity and community building leverages two complementary methods: social matching (Aouidi et al., 2019; Q. Wang et al., 2022) and defining heterogeneous profiles (Duque et al., 2021). Social matching, as seen in platforms like Netlearn and the SAMI AI agent, connects learners with similar interests and emotional states. This fosters

collaboration and a sense of belonging through personalized groupings. In contrast, defining heterogeneous profiles brings together individuals with diverse skills and backgrounds, promoting rich discussions and innovative problem-solving within e-focus groups. While social matching builds connections based on shared interests, heterogeneous profiles encourage learning across different perspectives, with both approaches creating an inclusive and supportive learning environment.

## Personalization and adaptive learning

Personalization and adaptive learning strategies have become central to enhancing the learning experience in online education. This shows that adapting learning experiences to individual needs enhances engagement, emotional comfort, and social presence in online learning. By tailoring educational tools to meet the unique needs of individual learners, these strategies ensure that students receive targeted support that promotes engagement, well-being, and academic success. From emotional detection systems to empathetic dialogue and immersive virtual environments, technologies were being harnessed to create a responsive, personalized educational experience. These adaptive tools went beyond traditional teaching methods by focusing not only on academic outcomes but also on fostering emotional connections, enhancing social presence, and encouraging collaborative learning in virtual spaces. This review explores the various personalization and adaptive learning strategies that aim to support students emotionally and academically in online education (Chowdhury & Siddique, 2024; Ghanbarzadeh & Ghapanchi, 2020; Hopman et al., 2023; Johnson et al., 2024; Q. Wang et al., 2022).

Personalization and adaptive learning strategies played a crucial role in addressing both the academic and emotional needs of students in online education. Emotional detection tools and empathy-driven dialogues created supportive environments that foster trust, emotional expression, and engagement (Hopman et al., 2023; Q. Wang et al., 2022). Group discussions and immersive virtual platforms, such as CollabVR, helped build social connections and a sense of belonging, enhancing engagement and community (Ghanbarzadeh & Ghapanchi, 2020; Johnson et al., 2024). Personalized digital representations, such as avatars, enhance communication and emotional expression, particularly in sensitive conversations, making students feel more comfortable and supported (Gruber et al., 2023). Personalization in education can also be enhanced through AI instructors, which provide adaptive, just-in-time guidance tailored to individual learners, increasing engagement and perceived learning outcomes (Chen & DiFranzo, 2025). Similarly, TikTok's content recommendation system personalizes educational content to students' preferences, fostering relevance, social integration, and active participation in learning activities (Huang et al., 2024). Additionally, proximity-based communication and presence amplification strategies in virtual spaces strengthened social interaction and community building, fostering a sense of "being there" (Johnson et al., 2024). Together, these strategies promoted cohesiveness, emotional well-being, and engagement, offering a comprehensive approach to online learning that prioritizes student well-being (Ghanbarzadeh & Ghapanchi, 2020; Hopman et al., 2023).

## Proactive support and feedback mechanism

Proactive support and feedback strategies in online learning use AI and digital tools to deliver timely, caring, and personalized assistance that supports students' academic and emotional development. By monitoring learning patterns, engagement, and emotional states, these strategies provide tailored feedback that boosts motivation, reduces stress, and promotes both academic progress and well-being. Tools such as personalized recommendations, real-time feedback, and collaborative communication enhance student engagement and support (Motlhaka, 2020; Q. Wang et al., 2022). Furthermore, caring communication and community-focused feedback activities strengthen social connections and self-esteem, promoting overall well-being in online settings (Aouidi et al., 2019).

AI agents in music education fostered a personalized and supportive learning environment by offering proactive support, real-time feedback, and continuous monitoring of students' learning patterns, emotions, and engagement to tailor activities and boost motivation (Q. Wang et al., 2022). Conversational agents like ERICA promoted emotional support through caring communication (Hopman et

al., 2023), while systems like Netlearn aligned content with student interests to enhance engagement and self-esteem (Aouidi et al., 2019). Tools such as WhatsApp enabled collaborative feedback, and structured activities like the Feedback Carousel encouraged thoughtful, community-oriented growth (Motlhaka, 2020). Collectively, these technologies supported both academic progress and emotional well-being. Incorporating these proactive support and feedback strategies across AI platforms fostered a responsive and inclusive learning environment. By promoting positive emotions, enhancing cohesiveness, and facilitating interactive communication, these tools addressed students' academic and emotional needs (Hopman et al., 2023; Motlhaka, 2020; Q. Wang et al., 2022). The caring communication style used in platforms like ERICA created a supportive atmosphere, while continuous monitoring and feedback tailored to students' interests, as seen in Netlearn, boosts self-esteem and engagement. Together, these mechanisms contributed to a personalized, collaborative learning experience that values student well-being and encourages a holistic approach to education.

### Building interactive learning environments

Building interactive learning environments has become a cornerstone in modern education, with advancements in technology enabling immersive, collaborative, and adaptive learning experiences (Chowdhury & Siddique, 2024; Rojas et al., 2023). This strategy demonstrates that interactive and immersive learning environments reduce isolation and strengthen social presence, engagement, and learner belonging. These environments go beyond traditional passive learning by actively engaging students through real-time feedback, virtual simulations, gamified learning, and intelligent tutoring systems (Y. Lin & Yu, 2025). The focus on creating cohesive and socially integrated spaces in these environments has been shown to reduce isolation and increase students' motivation and engagement, ultimately enhancing learning outcomes (Mdaghri-Alaoui et al., 2023). Emerging technologies such as the educational metaverse, social annotation tools, multi-agent systems, and emotion-monitoring frameworks were particularly effective in fostering a sense of presence and interactivity, thereby enabling deeper learning experiences (Cui & Wang, 2024; Zhou & Tao, 2020).

Immersive virtual reality (VR) in educational metaverse platforms enables students to engage with complex content in realistic settings through features such as 3D modelling, gamification, and social interaction, thereby enhancing engagement and retention (Rojas et al., 2023). Educational blogs and social annotation tools foster critical thinking and collaborative learning by facilitating diverse perspectives, real-time feedback, and community-based discussions (Chowdhury & Siddique, 2024; Cui & Wang, 2024). AI-driven multi-agent systems (MAS) provide personalized feedback, simulate human-like interactions, and promote group activities. When integrated with VR, MAS enhances hands-on practice by enabling the application of theoretical knowledge in simulated environments, thereby improving engagement and comprehension (Mdaghri-Alaoui et al., 2023). Gamified elements, such as points, badges, and leaderboards, motivate students by rewarding achievements and fostering competition, thereby improving participation and performance (Pane et al., 2020). Additionally, real-time communication via IPTV systems and telepresence robots supports collaboration and accessibility by replicating in-person experiences with high-quality audio and video, ensuring inclusivity in remote learning (Adil et al., 2023; Seck et al., 2020).

## *Model-Guided Identification of Support Factors*

Figure 5 focuses on how strategies enhance social presence through direct and well-being mediated pathways. It illustrates how each strategy is linked to specific aspects of social presence and well-being, and it visualizes the interrelationships between the two constructs. Social presence is conceptualized through three core attributes: emotional expression, interactive communication, and cohesiveness, while well-being is represented by seven attributes, resulting in a total of ten. From these, thirteen bidirectional relationships can be identified (phase 1 preliminary conceptual model). To enhance clarity, the overall depiction has been divided into three subfigures:

a) *Figure 6a.* Emotional expression perspective: Online learning community strategies enhancing social presence through direct and well-being mediated pathways.

b) *Figure 6b.* Interactive communication perspective: Online learning community strategies enhancing social presence through direct and well-being mediated pathways.
c) *Figure 6c.* Cohesiveness perspective: Online learning community strategies enhancing social presence through direct and well-being mediated pathways.

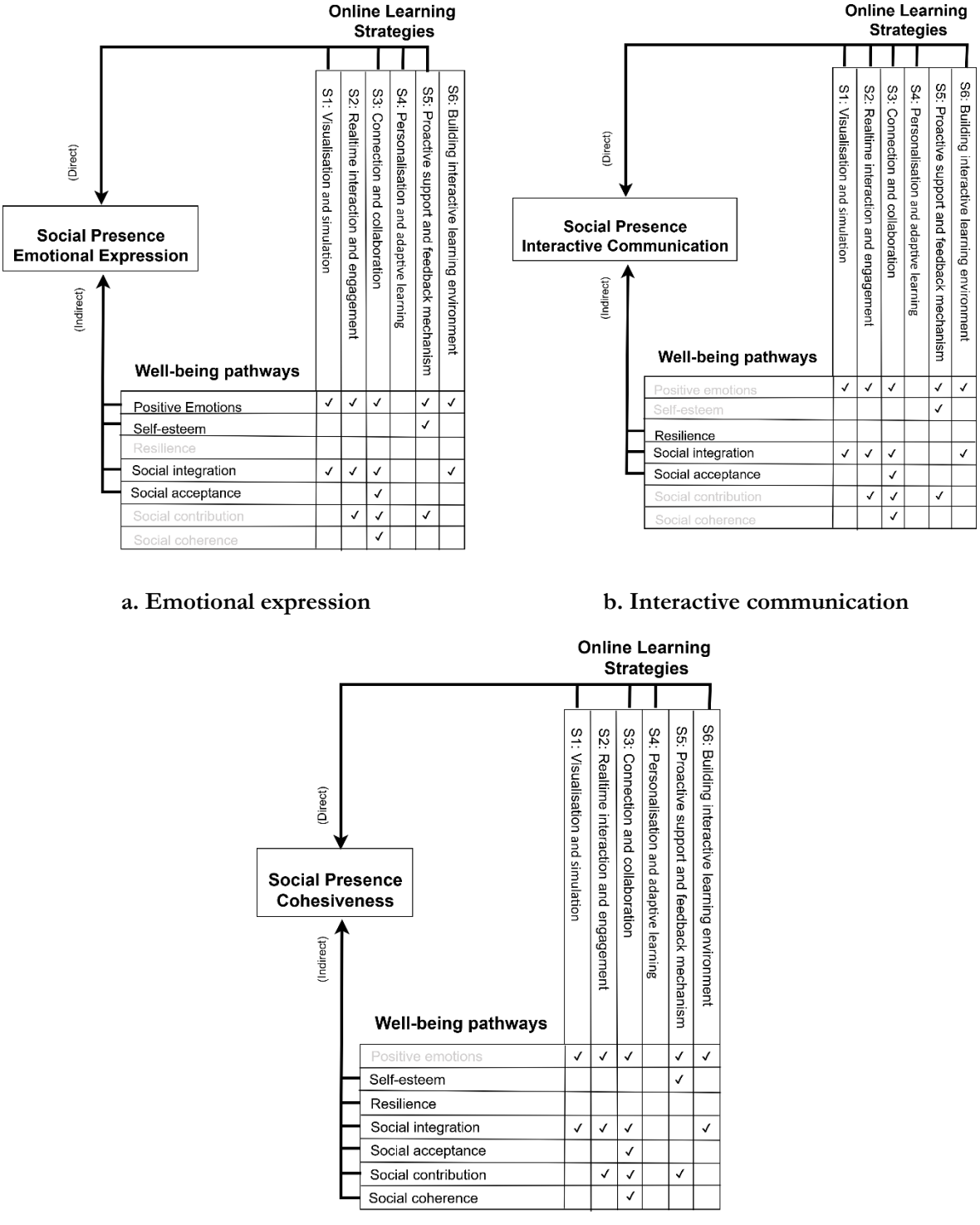



**Figure 6. Pathways to enhancing social presence: direct and well-being mediated effects**

Together, these sub-figures provide a more detailed and structured understanding of how technology-enabled strategies reinforce the intertwined nature of social presence and well-being in online learning environments.

If a particular strategy enhances emotional expression, it simultaneously contributes to multiple aspects of well-being, such as positive emotions, self-esteem, social integration, and social acceptance. This cascading effect highlights that when a strategy supports certain aspects of social presence or well-being, it inherently contributes to the overall enhancement of both within the online learning environment. As an example, visualization and simulation strategies encourage positive emotions and all three aspects of social presence: interactive communication, emotional expression, and cohesiveness. While this strategy explicitly addresses four aspects, it implicitly contributes to all attributes of social presence and well-being due to the interconnected nature of these attributes.

- *Emotional Expression:* Relates to positive emotions, self-esteem, social integration, and social acceptance.
- *Interactive Communication:* Relates to resilience, social integration, and social acceptance.
- *Cohesiveness:* Relates to self-esteem, resilience, social integration, social acceptance, social contribution, and social coherence.

These connections collectively encompass all well-being attributes through the R1–R13 relationships. The initial preliminary conceptual model thus provides a framework for understanding these relationships, demonstrating how specific strategies contribute to the overall social presence and well-being within online learning environments.

This understanding emphasizes the role of implemented strategies in fostering social presence and well-being. It highlights the multifaceted impacts of these strategies and provides a foundation for developing tools specifically designed to enhance both constructs.

## *Challenges Implementing Technology-Enabled Strategies Determined From the SLR*

Six technology-enabled strategies, along with their supporting factors, have been discussed. The next part of the question focuses on the associated challenges. When examining these challenges, six primary issues emerge. Given the focus on technology-enabled strategies, the discussion addresses the challenges specific to these tools.

### Technical barriers

Technical barriers were among the most reported challenges in implementing advanced online learning technologies. These included limited access to high-speed internet, capable devices, and other essential resources, particularly impacting students from disadvantaged backgrounds (Rojas et al., 2023). Connectivity issues, hardware malfunctions, and the need for high-performance equipment hindered technologies like metaverse platforms, telepresence robots, and 3D virtual worlds (Capello et al., 2024; Ghanbarzadeh & Ghapanchi, 2020). Even tools with educational benefits, such as blogs and VoiceThread, faced obstacles related to internet reliability and system usability, with design flaws and glitches disrupting learning (Chowdhury & Siddique, 2024; Mardi, 2022).

### Issues in participation and engagement

Participation and engagement were important aspects of online learning, but several challenges hindered their effectiveness. For example, the implementation of human-like strategies in AI agents, designed to mimic real instructors, could unintentionally promote negative behaviours among learners. These included reduced emotional responsiveness, perceived lower accountability, and impersonal interactions, which might lead to frustration, disengagement, or procrastination (H. Lin & Pryor, 2020; Y. Lin & Yu, 2025; J. Liu et al., 2019). Similarly, limited participation in educational blogs often

arose from students' unfamiliarity with blogging as a learning tool. A lack of experience or confidence in using the platform could result in a reluctance to engage actively, reducing the potential benefits of this resource (Chowdhury & Siddique, 2024). Another concern was the negative relationship between humanness and eeriness in AI instructors. While moderate levels of humanness can enhance comfort and trust, highly realistic features may trigger feelings of eeriness, consistent with the "uncanny valley" effect. This discomfort can undermine the perceived learning and satisfaction of learners, reducing their willingness to engage with AI-based instruction (Chen & DiFranzo, 2025).

### Alignment with pedagogy

When these strategies were implemented, aligning them with pedagogy was crucial to their success. Pedagogical alignment and design in online learning environments posed significant challenges, particularly with immersive technologies like metaverse platforms (Rojas et al., 2023). A related challenge was balancing social presence and cognitive load when designing pedagogical agents in a virtual learning environment. While enhancing social presence through social cues can strengthen connection and motivation, it may also increase cognitive demands on learners, reducing the overall effectiveness of the learning process if not carefully managed (Li et al., 2025). These environments demanded a rethinking of traditional teaching methods to ensure they complemented the virtual context. Educators needed to design curricula that seamlessly integrated virtual elements, develop effective interaction models tailored to these settings, and ensure that the intended learning outcomes were achieved.

### Social and ethical concerns

The integration of AI agents in education brings social and ethical concerns. Privacy remains a significant issue, with extensive data collection and ambiguous consent processes raising ethical challenges. Students may also experience emotional strain from intrusive interactions, mistrust stemming from perceived privacy violations, and the potential for data misinterpretation, which can lead to inappropriate or unhelpful responses (Q. Wang et al., 2022).

### Emotional and psychological challenges

The emotional and psychological dimensions of AI-based educational tools introduced another layer of complexity. AI systems often struggle to interpret students' emotions accurately, particularly when relying on limited data. This misalignment resulted in responses that failed to meet students' needs, potentially causing feelings of alienation or frustration. Additionally, the use of emotionally charged language by AI exacerbated vulnerability or discomfort, especially among already-isolated students (Q. Wang et al., 2022).

### Staff training

Preparing staff and faculty to adopt new technologies was another critical hurdle. For instance, leveraging the metaverse for education requires educators not only to adapt to novel pedagogical approaches but also to design engaging learning experiences that fully utilize its immersive features. This necessitated significant investment in professional development to equip educators with the skills needed to communicate effectively and foster meaningful interactions in these innovative environments (Rojas et al., 2023).

## DISCUSSION

This study examined how social presence and well-being interact within online learning environments and identified technology-enabled strategies that support both constructs. The research contributes a novel understanding by integrating two previously fragmented domains and offering a unified framework to inform online learning design. Social presence and well-being have complementary roles in supporting students' engagement, motivation, and emotional resilience in online learning environments. Phase 1 revealed that these constructs are mutually reinforcing, while Phase 2 identified six strategies to promote them, although their effectiveness varies.

By integrating social presence and well-being into a single explanatory framework, this study addresses a gap in the literature where these constructs are typically examined in isolation, highlighting their synergistic potential for enhancing online learning outcomes. The preliminary conceptual model (R1–R13) maps reciprocal relationships between three social presence attributes, emotional expression, interactive communication, and cohesiveness, and seven well-being attributes. It demonstrates how technology-enabled strategies can simultaneously enhance multiple dimensions, providing a conceptual and practical lens for understanding the multifaceted impact of online learning tools. This relational mapping is original and advances theory by showing how specific attributes co-activate each other, extending prior research that often focuses on single constructs or outcomes.

The SLR revealed how different strategies activate parts of the conceptual model. Among the strategies identified, a substantial number of studies emphasized Real-Time Interaction and Engagement, which facilitated immediate communication among participants, with ten studies employing this approach. This strategy directly enhanced social presence by fostering interactive communication, while simultaneously supporting well-being attributes such as positive emotions, social integration, and social contribution. Notably, resilience, a well-being construct, was not addressed in any of the reviewed studies. Furthermore, personalization and adaptive learning approaches did not report any contributions to the well-being constructs. Except for the strategies of real-time interaction and engagement, and building interactive learning environments, all other strategies contributed to all three constructs of social presence.

However, these two strategies do not contribute to emotional expression. Among the strategies, enhancing social connectivity and community building demonstrates the most extensive contributions, supporting a greater number of attributes of both social presence and well-being. In contrast, personalization and adaptive learning contribute only to the attributes of social presence. This indicates that the reviewed studies did not adequately consider well-being as a part of learning environments. Although the direct findings highlight specific effects, a model-guided analysis shows that strategies like Real-Time Interaction and Engagement and Building Interactive Learning Environments can indirectly support additional social presence and well-being attributes, such as emotional expression, through cascading effects on positive emotions, social integration, and social contribution. This underscores the value of a conceptual framework in revealing latent benefits beyond what is explicitly reported.

These findings generate important implications for practice. For educators and instructional designers, the results emphasise the need to prioritise tools and strategies that create shared social spaces and opportunities for authentic connection. Course design should intentionally include moments of synchronous interaction, community-building tasks, and structured peer collaboration. Moreover, the study highlights the importance of staff readiness and training, as digital confidence and pedagogical adaptability critically shape whether strategies translate into meaningful social and emotional benefits for learners.

From a theoretical perspective, the study contributes to literature by offering a conceptual bridge between social presence and well-being two areas that, despite their relevance, have evolved along separate academic trajectories. By integrating these domains, the study provides a holistic view of the learner experience and a mechanism for interpreting why certain digital strategies succeed or fail.

This integration opens avenues for future research to empirically validate the relational pathways proposed in the model, examine cultural differences in the expression of social presence and well-being, and explore how AI-mediated environments may reshape the relational dynamics at the core of online learning. While this study provides a conceptual foundation, the model remains theoretical and requires empirical validation. The SLR focused on published studies, potentially overlooking emerging or unpublished interventions. Future research should empirically test the proposed relationships, expand to diverse learning contexts, and explore strategies specifically targeting underrepresented well-being attributes such as resilience.

# CONCLUSION

This study advances understanding of how technology-enabled strategies support social presence and well-being in online learning environments. By developing the preliminary conceptual model that synthesises relational pathways between these constructs and applying it to a systematic review of existing technologies, the research provides both theoretical and practical contributions.

The novelty of the work lies in its integrated conceptualisation of social presence and well-being domains that have traditionally been examined separately. The study demonstrates that these constructs are interdependent and that strategies affecting one inevitably influence the other through multiple relational pathways. This insight strengthens current theoretical discourse by offering a unified lens through which online learner experience can be understood and designed.

## *STRATEGY IMPLEMENTATION RECOMMENDATIONS*

The SLR identifies six key technology-enabled strategies that enhance social presence and learner well-being in online learning environments. These strategies are discussed in detail in the Findings section and are briefly restated here to support the practical recommendations that follow:

- *Real-time interaction and engagement,* enabling synchronous communication that strengthens feedback, connection, and collaborative engagement.
- *Community-building tasks*, promoting teamwork, peer interaction, and group problem-solving to foster belongingness and social integration.
- *Building interactive learning environments*, creating participatory spaces that support interaction, emotional expression, and group cohesiveness.
- *Visualization and simulation*, using immersive and representational tools to encourage emotional expression, identity projection, and self-esteem.
- *Personalization and adaptive learning*, tailoring learning experiences to enhance social presence, with well-being benefits when combined with interactive and community-oriented approaches.
- *Proactive support and feedback mechanisms*, providing timely guidance, structured feedback, and reflective prompts to respond to learners' social and emotional needs.

Implementing these strategies effectively requires addressing challenges identified in the SLR, including technical barriers, learner engagement issues, pedagogical alignment, ethical considerations, and staff readiness. While the recommendations identify strategies supported by the review, their effectiveness depends on how they are implemented within specific educational contexts. The following strategy implementation recommendations align strategy use with these identified challenges.

- **Prioritize strategies with broad impact:** Emphasize strategies such as building interactive learning environments, real-time interaction, and community-building tasks, as these simultaneously enhance multiple attributes of social presence and learner well-being.
- **Leverage the interconnectedness of attributes:** Improvements in one attribute (e.g., emotional expression through visualization or simulation) can positively influence related well-being aspects such as self-esteem, social integration, and social acceptance. Course design should intentionally harness these interdependencies.
- **Address technical and engagement barriers:** Ensure tools are user-friendly, accessible across devices, and supported by scalable infrastructure. Orientation sessions and clear guidance can reduce learner hesitance, particularly in contexts with limited technical resources.
- **Align pedagogy with technology:** Integrate technology-enabled strategies into curricula in pedagogically meaningful ways, supporting synchronous interaction, collaborative tasks, and

proactive feedback. Professional development is essential to equip educators to facilitate social connection and emotional well-being online.

- **Incorporate ethical and social considerations:** Strategy implementation should respect privacy, maintain emotional accuracy, and foster trust, particularly when introducing AI agents, immersive environments, or telepresence technologies.
- **Empower educators and learners:** Ongoing training and orientation programs can build digital confidence, enabling both educators and learners to engage effectively with technology-enabled strategies.

Strategic implementation of these SLR-informed strategies, while addressing associated challenges, supports the development of inclusive, engaging, and emotionally supportive online learning environments. Overall, these recommendations translate the study's findings into concrete design principles by prioritizing strategies with broad, interconnected impact and embedding ethical, pedagogical, and contextual considerations. In doing so, online learning communities can be intentionally designed to foster sustained social presence and learner well-being.

## FUTURE WORKS

This study proposed a preliminary conceptual model, based on a narrative literature review, to examine the relationship between social presence and well-being in online learning. While useful for guiding the SLR, the model requires empirical validation, a key focus of future research. Upcoming work will explore how technology-enabled strategies interconnect to support inclusive and effective online learning. The role of emerging technologies such as augmented reality (AR) and artificial intelligence (AI) in fostering social presence and enhancing student well-being will also be explored. Ultimately, the research aims to develop empirically validated design guidelines to assist learning designers in creating online environments that promote both social presence and well-being. The limited coverage of cross-cultural studies and discipline-specific applications in the current paper is acknowledged, with plans to address these aspects in a separate study, as they present interesting avenues for further research. This paper focused specifically on social presence and well-being in the context of collaborative online learning.

## REFERENCES

Adil, A., Noaman, N. M., Ismail, Z., & Palaniappan, R. (2023). Design and implementation of telepresence robot. *Proceedings of the IEEE 8th International Conference on Engineering Technologies and Applied Sciences, Bahrain*. https://doi.org/10.1109/ICETAS59148.2023.10346592

Ahmad, E. (2020). Meezaj: An interactive system for real-time mood measurement and reflection based on Internet of Things. *International Journal of Advanced Computer Science and Applications*, *11*(11), 629-636. https://doi.org/10.14569/IJACSA.2020.0111177

Alfredo, R., Echeverria, V., Jin, Y., Yan, L., Swiecki, Z., Gašević, D., & Martinez-Maldonado, R. (2024). Human-centred learning analytics and AI in education: A systematic literature review. *Computers and Education: Artificial Intelligence*, *6*, 100215. https://doi.org/10.1016/j.caeai.2024.100215

Aouidi, S., Lamia, M., & Hafidi, M. (2019). Analysis of learners' interests in a social learning environment. *Proceedings of the 4th International Conference on Smart City Applications* (Article 76). Association for Computing Machinery. https://doi.org/10.1145/3368756.3369060

Appau, S., Churchill, S. A., & Farrell, L. (2019). Social integration and subjective wellbeing. *Applied Economics*, *51*(16), 1748-1761. https://doi.org/10.1080/00036846.2018.1528340

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

Bartholomeu, D., Montiel, J. M., Couto, G., Bueno, C. H., Garcia, F. H. S., & Pessotto, F. (2021). Social skills and social acceptance in different educational levels: A cross-sectional study. *Psychology*, *12*(11), 1886-1899. https://doi.org/10.4236/psych.2021.1211114

Blau, P. M. (1964). Justice in social exchange. *Sociological Inquiry*, *34*(2), 193-206. https://doi.org/10.1111/j.1475-682X.1964.tb00583.x

Boulton, C. A., Hughes, E., Kent, C., Smith, J. R., & Williams, H. T. P. (2019). Student engagement and wellbeing over time at a higher education institution. *PLoS ONE*, *14*(11), e0225770. https://doi.org/10.1371/journal.pone.0225770

Bouwer, R., Pasquini, L., & Baudoin, M.-A. (2021). Breaking down the silos: Building resilience through cohesive and collaborative social networks. *Environmental Development*, *39*, 100646. https://doi.org/10.1016/j.envdev.2021.100646

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Capello, S. A., Gyimah-Concepcion, M., & Buckley-Hughes, B. (2024). Using telepresence robots for doctoral education: Student and faculty experiences. *American Journal of Distance Education*, *38*(4), 374-388. https://doi.org/10.1080/08923647.2022.2125252

Chan, J., To, H.-P., & Chan, E. (2006). Reconsidering social cohesion: Developing a definition and analytical framework for empirical research. *Social Indicators research*, *75*, 273-302. https://doi.org/10.1007/s11205-005-2118-1

Chen, X., & DiFranzo, D. (2025). Unpacking the dilemma: The dual impact of AI instructors' social presence on learners' perceived learning and satisfaction, mediated by the uncanny valley. *Proceedings of the 17th ACM Web Science Conference* (pp. 22–31). Association for Computing Machinery. https://doi.org/10.1145/3717867.3717870

Chessa, M., & Solari, F. (2021). The sense of being there during online classes: Analysis of usability and presence in web-conferencing systems and virtual reality social platforms. *Behaviour & Information Technology*, *40*(12), 1237-1249. https://doi.org/10.1080/0144929X.2021.1957017

Chiu, T. K., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, *4*, 100118. https://doi.org/10.1016/j.caeai.2022.100118

Chowdhury, S. A., & Siddique, M. N. A. (2024). Developing a Community of Inquiry using an educational blog in higher education from the perspective of Bangladesh. *Frontiers in Education*, *9*, 1302434 https://doi.org/10.3389/feduc.2024.1302434

Courtwright, S. E., Flynn Makic, M. B., & Jones, J. (2020). Emotional wellbeing in youth: A concept analysis. *Nursing Forum*, *55*, 106–117. https://doi.org/10.1111/nuf.12404

Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *Journal of Management*, *31*(6), 874-900. https://doi.org/10.1177/0149206305279602

Cui, T., & Wang, J. (2024). Empowering active learning: A social annotation tool for improving student engagement. *British Journal of Educational Technology*, *55*(2), 712-730. https://doi.org/10.1111/bjet.13403

Dahlstrom-Hakki, I., Alstad, Z., & Banerjee, M. (2020). Comparing synchronous and asynchronous online discussions for students with disabilities: The impact of social presence. *Computers & Education*, *150*, 103842. https://doi.org/10.1016/j.compedu.2020.103842

de la Barrera, U., Schoeps, K., Gil-Gómez, J.-A., & Montoya-Castilla, I. (2019). Predicting adolescent adjustment and well-being: The interplay between socio-emotional and personal factors. *International Journal of Environmental Research and Public Health*, *16*(23), 4650. https://doi.org/10.3390/ijerph16234650

Duque, R., Bringas, S., & Montaña, J. L. (2021). Active learning based on electronic focus groups and participatory design during the COVID-19 period. *Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality* (pp. 67-71). Association for Computing Machinery. https://doi.org/10.1145/3486011.3486421

Eisenberger, R., Rhoades Shanock, L., & Wen, X. (2020). Perceived organizational support: Why caring about employees counts. *Annual Review of Organizational Psychology and Organizational Behavior*, *7*, 101-124. https://doi.org/10.1146/annurev-orgpsych-012119-044917

Ekman, P., Davidson, R. J., & Friesen, W. V. (1990). The Duchenne smile: Emotional expression and brain physiology: II. *Journal of Personality and Social Psychology*, *58*(2), 342-353. https://doi.org/10.1037/0022-3514.58.2.342

Erdoğan, M. M. (2020). "Securitization from society" and "social acceptance": Political party-based approaches in Turkey to Syrian refugees. *Uluslararası İlişkiler Dergisi*, *17*(68), 73-92. https://doi.org/10.33458/uidergisi.883022

Gao, H., Qin, X., Barroso, R. J. D., Hussain, W., Xu, Y., & Yin, Y. (2022). Collaborative learning-based industrial IoT API recommendation for software-defined devices: The implicit knowledge discovery perspective. *IEEE Transactions on Emerging Topics in Computational Intelligence*, *6*(1), 66-76.

Gao, N., Shao, W., Rahaman, M. S., & Salim, F. D. (2020). n-gage: Predicting in-class emotional, behavioural and cognitive engagement in the wild. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, *4*(3), Article 79. https://doi.org/10.1145/3411813

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2-3), 87-105. https://doi.org/10.1016/S1096-7516(00)00016-6

Ghanbarzadeh, R., & Ghapanchi, A. H. (2020). Antecedents and consequences of user acceptance of three-dimensional virtual worlds in higher education. *Journal of Information Technology Education: Research*, *19*, 855-859. https://doi.org/10.28945/4660

Gidron, N., & Hall, P. A. (2020). Populism as a problem of social integration. *Comparative Political Studies*, *53*(7), 1027-1059. https://doi.org/10.1177/0010414019879947

Ginige, T., & Vanderwall, S. T. (2022). Effective online learning management system to improve and enhance the online learning and student engagement experience. *Proceedings of the 6th International Conference on Information System and Data Mining* (pp. 95-100). Association for Computing Machinery. https://doi.org/10.1145/3546157.3546172

Gruber, A., Canto, S., & Jauregi-Ondarra, K. (2023). Exploring the use of social virtual reality for virtual exchange. *ReCALL*, *35*(3), 258-273. https://doi.org/10.1017/S0958344023000125

Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, *4*(4), 134-147. https://doi.org/10.1016/j.ijis.2020.09.001

Halpin, S. N. (2024). Inter-coder agreement in qualitative coding: Considerations for its use. *American Journal of Qualitative Research*, *8*(3), 23-43. https://doi.org/10.29333/ajqr/14887

Healy, M. (2019). Belonging, social cohesion and fundamental British values. *British Journal of Educational Studies*, *67*(4), 423-438. https://doi.org/10.1080/00071005.2018.1506091

Holsti, O. R. (1969). *Content analysis for the social sciences and humanities.* Addison-Wesley.

Hopman, K., Richards, D., & Norberg, M. M. (2023). A digital coach to promote emotion regulation skills. *Multimodal Technologies and Interaction*, *7*(6), 57. https://doi.org/10.3390/mti7060057

Huang, G., Linmin, Z., & Sun, L. (2024). The role of TikTok in user well-being and education: A study on psychological effects on learning during COVID-19. *Education and Information Technologies*, *30*, 10911–10942. https://doi.org/10.1007/s10639-024-13211-y

Jacobs, D. B., & Cramer, L. A. (2017). Applying information network analysis to fire-prone landscapes: Implications for community resilience. *Ecology and Society*, *22*(1), 52. https://doi.org/10.5751/ES-09119-220152

Jennings, V., & Bamkole, O. (2019). The relationship between social cohesion and urban green space: An avenue for health promotion. *International Journal of Environmental Research and Public Health*, *16*(3), 452. https://doi.org/10.3390/ijerph16030452

Johnson, D., Mamani, B., & Salas, C. (2024). CollabVR: VR testing for increasing social interaction between college students. *Computers*, *13*(2), 40. https://doi.org/10.3390/computers13020040

Karlsson, M. (2013). Representation as interactive communication: Theoretical considerations and empirical findings. *Information, Communication & Society*, *16*(8), 1201-1222. https://doi.org/10.1080/1369118X.2012.757633

Kemeny, M. E., Gruenewald, T. L., & Dickerson, S. S. (2004). Shame as the emotional response to threat to the social self: Implications for behavior, physiology, and health. *Psychological Inquiry*, *15*(2), 153-160.

Keyes, C. L. M. (1998). Social well-being. *Social Psychology Quarterly*, *61*(2), 121-140. https://doi.org/10.2307/2787065

Kim, S. K., Lee, M., Lee, Y., Go, Y., & Park, M. H. (2025). Expanding virtual reality simulation with reflective learning to improve mental health nursing skills of undergraduate nursing students. *Education and Information Technologies*, *30*(7), 8541-8565. https://doi.org/10.1007/s10639-024-13102-2

Koelsch, S. (2020). A coordinate-based meta-analysis of music-evoked emotions. *NeuroImage*, *223*, 117350. https://doi.org/10.1016/j.neuroimage.2020.117350

Kreijns, K., & Kirschner, P. A. (2018). Extending the SIPS-model: A research framework for online collaborative learning. In V. Pammer-Schindler, M. Pérez-Sanagustín, H. Drachsler, R. Elferink & M. Scheffel (Eds.), *Lifelong technology-enhanced learning* (pp. 277-290). Springer. https://doi.org/10.1007/978-3-319-98572-5_21

Kreijns, K., Kirschner, P. A., & Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: A review of the research. *Computers in Human Behavior*, *19*(3), 335-353.

Kreijns, K., Xu, K., & Weidlich, J. (2022). Social presence: Conceptualization and measurement. *Educational Psychology Review*, *34*, 139-170. https://doi.org/10.1007/s10648-021-09623-8

Kret, M. E., Prochazkova, E., Sterck, E. H., & Clay, Z. (2020). Emotional expressions in human and non-human great apes. *Neuroscience & Biobehavioral Reviews*, *115*, 378-395. https://doi.org/10.1016/j.neubiorev.2020.01.027

Li, X., Lan, Y. J., Pi, Z., Qi, G. Y., Grant, S., & Sun, J. (2025). Pedagogical agent positioning in external videos improves English academic presentation proficiency in desktop virtual reality settings. *British Journal of Educational Technology*, *56*(4), 1507-1529. https://doi.org/10.1111/bjet.13531

Lin, H., & Pryor, M. (2020). A motivational 3D edtech in online education: Digital exhibition space. In C. Cheung, R. Li, K. Phusavat, N. Paoprasert & L. Kwok (Eds.), *Blended learning: Education in a smart learning environment* (pp. 175-186). Springer. https://doi.org/10.1007/978-3-030-51968-1_15

Lin, Y., & Yu, Z. (2025). Learner perceptions of artificial intelligence-generated pedagogical agents in language learning videos: Embodiment effects on technology acceptance. *International Journal of Human-Computer Interaction*, *41*(2), 1606-1627. https://doi.org/10.1080/10447318.2024.2359222

Liu, H., Yao, C., Zhang, Y., & Ban, X. (2024). GestureTeach: A gesture guided online teaching interactive model. *Computer Animation and Virtual Worlds*, *35*(1), e2218. https://doi.org/10.1002/cav.2218

Liu, J., Zheng, Y., & Jiang, X. (2019). Design of augmented interactive video based on script engine. *Proceedings of the International Workshop on Artificial Intelligence and Education* (pp. 1-5). Association for Computing Machinery. https://doi.org/10.1145/3397453.3397455

Lowenthal, P. R., & Dunlap, J. C. (2010). From pixel on a screen to real person in your students' lives: Establishing social presence using digital storytelling. *The Internet and Higher Education*, *13*(1-2), 70-72. https://doi.org/10.1016/j.iheduc.2009.10.004

Magni, G., Amadini Genovese, L., Riva, G., & Repetto, C. (2025). Embodied metaphors and interpersonal synchrony in the digital age: The case of remote working. *Frontiers in Psychology*, *16*, 1648733. https://doi.org/10.3389/fpsyg.2025.1648733

Mardi, F. (2022). Providing rigour, differentiation, and sense of community using a three-pronged VoiceThread discussion strategy during the pandemic. *Technology, Pedagogy and Education*, *31*(5), 637-654. https://doi.org/10.1080/1475939X.2022.2138959

Martin, F., Zhuang, M., & Schaefer, D. (2023). Systematic review of research on artificial intelligence in K-12 education (2017-2022). *Computers and Education: Artificial Intelligence*, *6*, 100195. https://doi.org/10.1016/j.caeai.2023.100195

Mdaghri-Alaoui, G., Zouhair, A., & Elghouch, N. (2023). Employing multi-agent systems to enhance virtual reality platforms. *Proceedings of the 6th International Conference on Networking, Intelligent Systems & Security (*Article 39). Association for Computing Machinery. https://doi.org/10.1145/3607720.3607762

Melgar, A. S., Gamboa, J. N., Mesías, C. D. E., Orozco-Vargas, P. G., & Shardin-Flores, L. (2021). Micro mundos: probabilidades de aprendizagem em contextos simulados [Micro worlds: learning about probabilities in simulated contexts]. *Revista Tempos e Espaços em Educação*, *14*(33), e15122. https://doi.org/10.20952/revtee.v14i33.15122

Michalos, A. C. (2017). *Connecting the quality of life theory to health, well-being and education: The selected works of Alex C. Michalos*. Springer. https://doi.org/10.1007/978-3-319-51161-0

Motlhaka, H. (2020). Blackboard collaborated-based instruction in an academic writing class: Sociocultural perspectives of learning. *Electronic Journal of e-Learning*, *18*(4), 336-345. https://doi.org/10.34190/EJEL.20.18.4.006

Németh, L., & Bernáth, L. (2022). The mediating role of global and contingent self-esteem in the association between emerging adults' perceptions of family cohesion and test anxiety. *Journal of Adult Development*, *29*(3), 192-204. https://doi.org/10.1007/s10804-022-09396-6

Neuendorf, K. A. (2017). *The content analysis guidebook*. Sage. https://doi.org/10.4135/9781071873045

Noorafshan, L., Jowkar, B., & Hosseini, F. S. (2013). Effect of family communication patterns of resilience among Iranian adolescents. *Procedia – Social and Behavioral Sciences*, *84*, 900-904. https://doi.org/10.1016/j.sbspro.2013.06.670

Norz, L.-M., Dornauer, V., Hackl, W. O., & Ammenwerth, E. (2023). Measuring social presence in online-based learning: An exploratory path analysis using log data and social network analysis. *The Internet and Higher Education*, *56*, 100894. https://doi.org/10.1016/j.iheduc.2022.100894

Otte, H. (2019). Bonding or bridging? On art participation and social cohesion in a rural region of the Netherlands. *Poetics*, *76*, 101355. https://doi.org/10.1016/j.poetic.2019.02.006

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., & Brennan, S. E. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*(71). https://doi.org/10.1136/bmj.n71

Pane, M. M., Siregar, C., & Rumeser, J. A. (2020). The role of big data for interactive online learning: A case study in students' participations and perceptions. *Proceedings of the 2020 2nd International Conference on Big Data Engineering and Technology* (pp. 30-34). Association for Computing Machinery. https://doi.org/10.1145/3378904.3378923

Park, C. L., Kubzansky, L. D., Chafouleas, S. M., Davidson, R. J., Keltner, D., Parsafar, P., Conwell, Y., Martin, M. Y., Hanmer, J., & Wang, K. H. (2022). Emotional well-being: What it is and why it matters. *Affective Science*, *4*, 10-20. https://doi.org/10.1007/s42761-022-00163-0

Peluso, P. R., & Freund, R. R. (2019). Emotional expression. In J. C. Norcross & M. J. Lambert (Eds.), *Psychotherapy relationships that work* (pp. 421-460). Oxford Academic. https://doi.org/10.1093/medpsych/9780190843953.003.0012

Pepper, M., Powell, R., & Bouma, G. D. (2019). Social cohesion in Australia: Comparing church and community. *Religions*, *10*(11), 605. https://doi.org/10.3390/rel10110605

Rabotapi, T., & Matope, S. (2024). WhatsApp as a tool to facilitate continued adjustment of first time entering students into university during COVID-19 lockdown restrictions. *Electronic Journal of e-Learning*, *22*(8), 1-11. https://doi.org/10.34190/ejel.22.8.3405

Richter, N. F., Martin, J., Hansen, S. V., Taras, V., & Alon, I. (2021). Motivational configurations of cultural intelligence, social integration, and performance in global virtual teams. *Journal of Business Research*, *129*, 351-367. https://doi.org/10.1016/j.jbusres.2021.03.012

Rimé, B., Bouchat, P., Paquot, L., & Giglio, L. (2020). Intrapersonal, interpersonal, and social outcomes of the social sharing of emotion. *Current Opinion in Psychology*, *31*, 127-134. https://doi.org/10.1016/j.copsyc.2019.08.024

Rojas, E., Hülsmann, X., Estriegana, R., Rückert, F., & Garcia-Esteban, S. (2023). Students' perception of metaverses for online learning in higher education: Hype or hope? *Electronics*, *12*(8), 1867. https://doi.org/10.3390/electronics12081867

Rother, E. T. (2007). Systematic literature review X narrative review. *Acta Paulista de Enfermagem*, *20*(2), vii-viii. https://doi.org/10.1590/S0103-21002007000200001

Santini, Z. I., Jose, P. E., Cornwell, E. Y., Koyanagi, A., Nielsen, L., Hinrichsen, C., Meilstrup, C., Madsen, K. R., & Koushede, V. (2020). Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): A longitudinal mediation analysis. *The Lancet Public Health*, *5*(1), e62-e70. https://doi.org/10.1016/S2468-2667(19)30230-0

Seck, M., Diatta, B., Ouya, S., Mendy, G., & Gaglou, K. (2020). Contribution to improvement of distance learning based on Zeroconf protocol and an interactive IPTV. In M. Auer, H. Hortsch, H. & P. Sethakul (Eds.), *The impact of the 4th industrial revolution on engineering educatio*n (pp. 182-192). Springer. https://doi.org/10.1007/978-3-030-40274-7_19

Shore, L. M., Tetrick, L. E., Taylor, M. S., Coyle Shapiro, J. A.-M., Liden, R. C., McLean Parks, J., Wolfe Morrison, E., Porter, L. W., Robinson, S. L., & Roehling, M. V. (2004). The employee-organization relationship: A timely concept in a period of transition. In M. Buckley, J. Halbesleben & A. R. Wheeler (Eds), *Research in personnel and human resources management* (pp. 291-370). Emerald Group Publishing Limited. https://doi.org/10.1016/S0742-7301(04)23007-9

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. Wiley.

Sprowls, E. D. (2020). Collaborative learning tools to foster inclusive participation and sense of belonging in a microbiology outreach partnership. *Journal of Microbiology & Biology Education*, *21*(1). https://doi.org/10.1128/jmbe.v21i1.2079

Sukhera, J. (2022). Narrative reviews: Flexible, rigorous, and practical. *Journal of Graduate Medical Education*, *14*(4), 414-417. https://doi.org/10.4300/JGME-D-22-00480.1

Suvilehto, J. T., Glerean, E., Dunbar, R. I., Hari, R., & Nummenmaa, L. (2015). Topography of social touching depends on emotional bonds between humans. *Proceedings of the National Academy of Sciences*, *112*(45), 13811-13816. https://doi.org/10.1073/pnas.1519231112

Thalheimer, J. M., Filho, A. H., Briks, F. J. P., Ribeiro, R. C., Concatto, F., & Viecelli, A. K. (2020). A Micro-service-driven Collaborative Agent in Virtual Learning Environments: A Role Model for a Tracing Agent. Proceedings of the XVI Brazilian Symposium on Information Systems. https://doi.org/10.1145/3411564.3411630

Vázquez-Cano, E., Mengual-Andrés, S., & López-Meneses, E. (2021). Chatbot to improve learning punctuation in Spanish and to enhance open and flexible learning environments. *International Journal of Educational Technology in Higher Education*, *18*(1), 33. https://doi.org/10.1186/s41239-021-00269-8

Wang, M., Devitt, A., Gao, J., & Baurer, C. (2022). Computer mediated communication and task-based learning for adolescent learners of Chinese as a foreign language in Ireland: An eBook task design under the adaption of Bridge 21 technology-mediated learning model. In J. Colpaert, Y. Wang, & G. Stockwell (Eds.), *Proceedings of the 1st International CALL Research Conference* (pp. 117-125). Castledown. https://doi.org/10.29140/9781914291050-16

Wang, Q., Jing, S., & Goel, A. K. (2022). Co-designing AI agents to support social connectedness among online learners: functionalities, social characteristics, and ethical challenges. *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (pp. 541-556). Association for Computing Machinery. https://doi.org/10.1145/3532106.3533534

Wang, Y., Derakhshan, A., & Zhang, L. J. (2021). Researching and practicing positive psychology in second/foreign language learning and teaching: the past, current status and future directions. *Frontiers in psychology*, *12*, 731721. https://doi.org/10.3389/fpsyg.2021.731721

Weidlich, J., & Bastiaens, T. J. (2019). Designing sociable online learning environments and enhancing social presence: An affordance enrichment approach. *Computers & Education*, *142*, 103622. https://doi.org/10.1016/j.compedu.2019.103622

Wentzel, K. R., Jablansky, S., & Scalise, N. R. (2021). Peer social acceptance and academic achievement: A meta-analytic study. *Journal of Educational Psychology*, *113*(1), 157-180. https://doi.org/10.1037/edu0000468

Wilson-Nash, C., Pavlopoulou, I., & Wang, Z. (2023). Selecting, optimizing, and compensating during lock-down: How older consumers use social networking services to improve social well-being. *Journal of Interactive Marketing*, *58*(2-3), 301-320. https://doi.org/10.1177/10949968231155156

Wise, R. A. (2004). Dopamine, learning and motivation. *Nature Reviews Neuroscience*, *5*, 483-494. https://doi.org/10.1038/nrn1406

Wong, D. P. Y., Hsu, C.-M., Pan, J.-K., Huang, M.-L., Chew, Y. N., & Chang, J.-T. (2021). InteractDiff: A 3D sandbox game for online teaching and campus life experience. In C. Ardito, R. Lanzilotti, A. Malizia, H. Petrie, A. Piccinno, G. Desolda & K. Inkpen (Eds.), *Human-computer interaction - INTERACT 2021* (pp. 442-446). Springer. https://doi.org/10.1007/978-3-030-85607-6_54

Xu, Y., Chen, L., Geng, X., Taniguchi, Y., Goda, Y., Shimada, A., & Yamada, M. (2021). Using a visualization system to enhance students' online learning participation based on learning behaviors and social presence. *Proceedings of the IEEE International Conference on Engineering, Technology & Education, Wuhan, Hubei Province, China*, 399-404. https://doi.org/10.1109/TALE52509.2021.9678817

Yadegaridehkordi, E., Noor, N. F. B. M., Ayub, M. N. B., Affal, H. B., & Hussin, N. B. (2019). Affective computing in education: A systematic review and future research. *Computers & Education*, *142*, 103649. https://doi.org/10.1016/j.compedu.2019.103649

Zhoc, K. C., Cai, Y., Yeung, S. S., & Shan, J. (2022). Subjective wellbeing and emotion regulation strategies: How are they associated with student engagement in online learning during Covid-19? *British Journal of Educational Psychology*, *92*, 1537-1549. https://doi.org/10.1111/bjep.12513

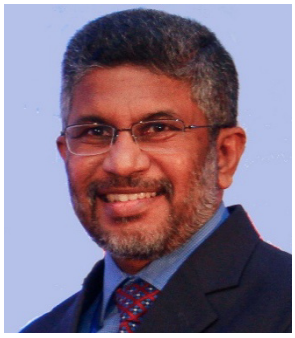
Zhou, Y., & Tao, X. (2020). A framework of online learning and experiment system based on affective computing. *Proceedings of the 3rd International Conference on E-Business, Information Management and Computer Science* (pp. 619-624). Association for Computing Machinery. https://doi.org/10.1145/3453187.3453405

## AUTHORS

**Thilini Irugalbandara** is a PhD researcher in the School of Information Systems, at Queensland University of Technology, focusing on enhancing student experiences in collaborative online learning by integrating social presence and well-being elements.

**Jason Watson** is a Senior Lecturer in the School of Information Systems at QUT. His research focuses on social technologies and online communities, examining their design, adoption, and impact. His work contributes to advancing the understanding of how these technologies influence individuals, businesses, and society.

**Freya Wright-Brough** is a Senior Lecturer, Educator Development and Recognition at QUT in Meanjin (Brisbane). Her research interests include belonging and social justice in higher education as well as student evaluations of teaching.



**Shantha Fernando** is a Professor in the Department of Computer Science and Engineering at the University of Moratuwa, Sri Lanka. His research interests include computer and information security, information systems, and e-learning, with contributions to IT security policy development and computer emergency readiness initiatives in Sri Lanka.

**Trina Myers** is a Professor and Head of the School of Information Technology at Deakin University. Her research focuses on natural language processing, semantic technologies, data and knowledge management, collective intelligence, and the Internet of Things (IoT). Her work in semantic technologies and artificial intelligence advances the integration of knowledge, information, and diverse data.