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Reflection article

Social Interaction in Blended Learning: A Reflection on Technology Integration*

Interacción social en el blended learning: una reflexión sobre la integración de la tecnología

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Abstract: This paper aims to foster discussion on the critical role of social interaction in blended learning, emphasizing its potential to guide technology integration in higher education as a means to overcome its instrumental bias. To achieve this, the study reviews the concepts of technology integration and social interaction and presents an analysis of ChatGPT's use in universities. Additionally, it examines three key results from a systematic literature review on interaction in blended learning. The findings highlight a predominant focus on implementing technologies and learning approaches; the interactions between students and their teachers and peers; and the growing interest in student-related factors such as motivation, attitudes, engagement, and collaboration. In short, the study underscores that human transactions—grounded in social interaction—enable the exchange of meanings, which furthers the transformation of learning environments. This transformation is essential for addressing the challenges faced by higher education, including ethical training, intellectual production, and the development of human skills.

Keywords: blended learning, higher education, technology integration, artificial intelligence, social interaction.

Resumen: el presente artículo tuvo como objetivo promover la discusión sobre la importancia de la interacción social en el *blended learning*, con el fin de integrar las tecnologías en la educación superior, considerándolo como una de las posibles alternativas para superar su sesgo instrumental. Para alcanzar este objetivo, se revisaron los conceptos de integración tecnológica e interacción social, para luego analizar el caso de ChatGPT en las universidades, así como tres de los resultados de una revisión sistemática de la literatura sobre el estudio de la interacción en el *blended learning*, la cual permitió visibilizar el interés predominante por la implementación de tecnologías y enfoques de aprendizaje, las interacciones de los estudiantes con sus docentes y pares, y facilitó reconocer que una de las tendencias investigativas en la interacción social está centrada en las características de los estudiantes, particularmente con su motivación, actitudes, compromiso y trabajo con otros. En definitiva, las transacciones humanas, desde la interacción social, permiten la transmisión de significados que potencializan la transformación de los entornos de aprendizaje, ayudando a afrontar los retos de la educación superior, como la formación ética, la producción intelectual y el desarrollo de las habilidades humanas.

Palabras clave: *blended learning*, educación superior, integración tecnológica, inteligencia artificial, interacción social.

INTRODUCTION

In recent years, education has transitioned from face-to-face to distance, online, and Blended Learning (BL) models, driven by technological advancements that facilitate teacher–student interaction in the learning process (Graham, 2006). Despite ongoing debates about its definition and nature (Castro-Rodríguez et al., 2021; Norberg et al., 2011; Oliver & Trigwell, 2005; Wu & Luo, 2022), BL has become widely adopted in higher education. It is generally understood as a learning system that combines face-to-face instruction with technology-mediated environments, distinguishing it from fully online learning. This model offers greater flexibility in terms of time and space, allowing students to engage with content according to their needs (Graham, 2006).

The transition toward technology-mediated models has increasingly emphasized social interactions, particularly as concerns grow over how human connections may be threatened or transformed in digital environments. Castells (2000) argues that technological revolutions are not external to human activity but are embedded within it, stating that new information technologies are not simply tools to be applied, but processes to be developed. This perspective highlights that users are not just passive consumers but active participants in creating and shaping technology. Consequently, the focus shifts from mere knowledge acquisition to the application of technology across various aspects of life.

Since technology is an extension of human capability rather than an external threat, it can be directed toward creative and constructive purposes. However, this requires an ethical approach and policies that ensure its responsible use and democratization (Chan, 2023; Rahman & Watanobe, 2023; van Dis et al., 2023). These regulations should not only govern the use of technology within educational institutions and research but also be integrated into training processes to protect human integrity in digital interactions.

Given that learning is deeply rooted in social interaction, it is crucial to examine how technology integration in BL impacts these dynamics. To contribute to this discussion, the following section reviews key concepts related to technology integration and social interaction. This is followed by an analysis of ChatGPT's role in BL, along with findings from a systematic review (Gómez Martínez & García Naranjo, 2024) that explores interactions in BL. The analysis focuses on three key aspects: the main topics investigated, the most studied types of interaction, and emerging research trends.

TECHNOLOGY INTEGRATION

The *Horizon Report* (Ebner, 2022), which brings together higher education experts from around the world to identify key trends, technologies, and practices shaping the future, emphasizes that the impact of the COVID-19 pandemic will continue to influence higher education. In particular, it highlights a growing shift toward hybrid and online learning, skills-based education, and remote work. The report underscores the need for institutions to develop hybrid and online pedagogies, improve instructional design, and invest in faculty

development. Additionally, enhancements in resources and infrastructure are essential to support new programs and courses aligned with these learning modalities. To meet the needs of non-traditional students, institutions must adopt the principle of *education for anyone, anywhere*, which requires providing adequate training and support to ensure effective learning in these evolving environments.

Although many institutions were forced to adopt hybrid and remote learning models during the pandemic, the *Horizon Report* (Ebner, 2022) highlights the broader impact of technology on learning outcomes, equity, and inclusion. It also identifies Artificial Intelligence (AI) as a valuable tool for automating feedback, allowing faculty to dedicate more time to students who require individualized support. Furthermore, AI-driven data analytics can assist educators in making informed decisions regarding course design and implementation. The report further notes that universities that strategically invested in faculty training and physical infrastructure developed cost-effective, low-risk practices that yielded significant benefits. As a result, external accreditation and funding agencies are expected to demand more rigorous evaluation and improvement efforts in distance learning standards, positioning online education as a key strategy for maintaining enrollment.

However, successful technology integration is not achieved merely through the use of digital tools. Instead, it depends on the adoption of BL models that facilitate meaningful interaction aligned with specific learning objectives. As Graham (2006) outlines, BL can be classified into three distinct categories based on their primary function: enabling, enhancing, or transforming blends. The first category seeks to replicate face-to-face learning experiences, while the second one introduces changes to both teaching methodologies and learning processes. The third category, for its part, fundamentally redefines the learning experience through technologies such as simulations and augmented reality. These categories also vary in the degree of student agency, which increases significantly in interactive formats that involve simulation, visualization, communication, and feedback. In the third category particularly, students actively construct knowledge through interactions that are deeply mediated by technology.

SOCIAL INTERACTION

The rise of new technologies has fostered hyperconnectivity, transforming individuals into informational beings with unprecedented ubiquity, connectivity, and accessibility. Nonetheless, in the field of education, there remains a gap between the rapid advancement of technology and the pace of pedagogical adaptation and reflection (García del Dujo & Martín-Lucas, 2020). This disconnect within existing theoretical and practical frameworks hinders the effective integration of technology into educational settings (Graham, 2006).

From the perspective of symbolic interactionism, interaction is understood as a process of meaning-making between individuals. This process not only enables people to anticipate responses and recognize social roles but also helps them understand their own behavioral patterns in specific contexts (Pons Díez, 2010). In educational settings, interactions based on shared cultural meanings facilitate the internalization of socially constructed norms and values.

Consequently, social reality becomes a collective mental construction that evolves over time (Gadea, 2018).

However, Moore and Anderson (2003) argue that interaction in education is far more complex than simple bidirectional exchanges between individuals. They propose a broader perspective, emphasizing that interaction occurs at multiple levels across the educational system—including instruction, teaching, learning, and administrative processes. These interconnected processes influence each component of the system and, consequently, all participants, forming mutually dependent relationships.

According to this view, limiting teacher–student interaction to synchronous or asynchronous exchanges overlooks other essential forms of interaction, such as those involving non-human agents. These differing perspectives highlight the importance of aligning interaction models with specific learning objectives. In turn, these interactions align with specific BL models, which are adapted to students' needs at varying levels of technology integration.

THE CASE OF CHATGPT

AI has been evolving for over fifty years. The ability of a machine to simulate conversation and adapt its responses to context is the result of deliberate efforts that have significantly impacted various human activities. ChatGPT, a generative pre-trained transformer, gained one million users within its first five days after launching in November 2022. Within two months, this number reached 100 million (Lim et al., 2023), sparking discussions in higher education about new forms of interaction and potential risks.

Although technology, especially AI, is recognized for its benefits in education, academic discussions have focused on its impact on intellectual production. The debate is polarized between those who believe generative AI could replace human intellectual output (van Dis et al., 2023) and those who argue that it cannot (Giraldo Forero & Orozco Duque, 2023; Lim et al., 2023).

Some publishers have rejected AI-generated content as a form of authorship (Nature, 2023; Zeta de Pozo, 2023), asserting that ChatGPT cannot be considered a co-author since it is not accountable for its outputs. They emphasize that when used in research, its contributions should be properly cited. Currently, ChatGPT cannot replace expert authors. However, as it is exposed to more natural language, it will continue synthesizing and memorizing information by combining generative and conversational AI (Lim et al., 2023). While this allows it to recognize statistical patterns, it does not enable true understanding of meaning or the development of creative or conceptual thinking (van Dis et al., 2023).

In education, ChatGPT is used for generating research ideas, formulating search equations, summarizing content, translating texts, and even drafting articles. In applied fields, it assists with software debugging, clinical summaries, and radiological decision-making (Stojanov, 2023), performing these tasks with increasing efficiency. The ongoing debate revolves around

defining the skills and competencies that should remain exclusive to human researchers to preserve creativity, originality, and autonomy (van Dis et al., 2023).

The usefulness of ChatGPT in programming education has also been recognized (Rahman & Watanobe, 2023). Research has explored computational thinking, programming self-efficacy, and student motivation (Yilmaz & Karaoglan Yilmaz, 2023). University students generally perceive it positively, considering it a valuable tool for personalized learning, brainstorming, proofreading, and research support (Chan & Hu, 2023).

Even though ChatGPT facilitates personalized learning, some critics argue that it cannot replace a teacher. They highlight its biases, its inability to verify information, and its lack of awareness of its conversational partner. Because it generates responses instantaneously without deeper engagement, it cannot function as an expert guiding students within their zone of proximal development (Stojanov, 2023).

Ethical concerns have also been raised regarding its use in academia, particularly in relation to plagiarism and fraud in online assessments (Chan, 2023; Rahman & Watanobe, 2023). There are fears that reliance on AI may reduce conscientious academic preparation, hinder critical thinking, and weaken source verification skills (Rahman & Watanobe, 2023).

From a regulatory perspective, these concerns highlight the need for clear pedagogical policies, along with their governance and implementation (Chan, 2023). In the absence of external regulations governing technology-based interactions, educational institutions must establish internal guidelines to regulate their use in interactions with others. At the same time, efforts should be made to formalize international regulations through discussions with various societal stakeholders. This would help democratize access to generative AI tools and reduce research disparities (van Dis et al., 2023).

THE STUDY OF INTERACTION IN BL

The integration of technology into education has been expanding in Colombia, particularly in BL within higher education, with the number of programs holding official accreditation increasing from 33 in 2020 to 248 by 2024 (Sistema Nacional de Información de la Educación Superior [National Higher Education Information System], 2024). Given this rapid expansion, studying BL from multiple educational perspectives is essential. This paper draws upon three key findings from a systematic literature review on interaction in BL (Gómez Martínez & García Naranjo, 2024), which analyzed how interaction has been studied in higher education, given its central role in learning processes.

Such study followed three phases: planning, review, and reporting (Kitchenham, 2004). In the planning phase, efforts were made to minimize researcher bias by assessing the relevance of the review, developing a structured protocol (including steps, criteria, and procedures), and outlining the necessary time and resources. Additionally, a double-entry matrix was designed to systematically assess the criteria evaluated by the protocol.

The review phase involved a rigorous assessment of original studies using a predefined structure that facilitated information synthesis and ensured the reliability and applicability of findings. This phase consisted of five stages: identification, selection, evaluation, extraction, and synthesis. A search strategy (see Table 1) was developed using the descriptors *blended learning*, *interaction*, and *higher education* in English across two major academic databases: Web of Science (WoS) and Scopus. Inclusion criteria required that documents be classified as "articles" and contain the selected descriptors in their titles, abstracts, or keywords. In WoS, the *enriched article* option was excluded, as these publications include additional resources that were not analyzed in the review (Gómez Martínez & García Naranjo, 2024). The Tree of Science (ToS) software (Valencia-Hernández et al., 2020) was employed to extract data through an R package, an open-source programming language that integrates datasets from WoS and Scopus. A total of 1,167 documents were initially retrieved. After applying inclusion criteria (selecting only articles and excluding other types of publications), the dataset was reduced to 780 articles. Using ToS, 122 duplicates were removed, leaving 658 articles. From this set, the tree of science was constructed with 98 documents. Finally, the 44 articles with the highest PageRank[1] (Page et al., 1999) were selected, comprising 37 research articles and 7 review articles.

Table 1. Article selection

Databases	Web of Science	Scopus
Time span	All years	
Consultation date	April 10, 2023	
Document type	Any type	
Journal type	Any type	
Search field	Title, abstract, keywords	
Search strings	B-learning (All Fields) OR Blended AND Learning (All Fields) AND interaction AND (All Fields) higher AND educa-tion (All Fields) (Not Enriched Cited References)	(TITLE-ABS-KEY (B-learning) OR TITLE-ABS-KEY (Blended AND Learning) AND TITLE-ABS-KEY (interaction) AND TITLE-ABS-KEY (higher AND education))
Search results	652	515
Total articles retrieved	1167	
Articles excluded	387	
Articles meeting inclusion criteria	780	
Duplicates removed using ToS	122	
Articles without duplicates	658	
Articles pre-selected by ToS	98	
Final selection using PageRank	44	
Research articles analyzed	37	
Review articles analyzed	7	

Source: Own work based on the study by Gómez Martínez and García Naranjo (2024).

[1] Algorithm that ranks web pages based on their quality rather than merely on the number of incoming links.

Then, the selected articles underwent a deductive content analysis (Finfgeld-Connett, 2014). This analysis was guided by an analytical summary matrix, which structured the category of interaction in BL around four key aspects: the research approaches used, the participants and contexts studied, the types of interaction analyzed, and the suggested research directions in the field. Each aspect helped define a thematic axis, facilitating the classification of analytical units (paragraphs) into subcategories, enabling data reduction, comparison, and correlation. This process was further complemented by a graph analysis using ToS, which included citation networks, annual scientific production, leading countries in publications, keyword co-citation networks, and major thematic clusters.

Regarding the keyword analysis in the 44 selected articles, ToS was used to identify clusters of research topics. The software structured a network of nodes using the Blondel et al. (2008) algorithm, which grouped nodes based on their strongest interconnections. The three largest clusters were identified, but only the most frequently cited authors within the 44 selected articles were analyzed.

Finally, in the third phase proposed by Kitchenham (2004)—the reporting phase—the authors chose to present their findings in a book chapter. The review revealed a growing trend in research on interactions in BL, as reflected in the annual increase in academic publications over time. In Scopus, the number of articles on this topic grew from one in 2005 to 50 in 2022. Similarly, in WoS, publications increased from 19 in 2010 to 55 in 2022.

The systematic review yielded three key findings. The first finding pertains to the main topics of research, which can be classified into three overarching themes. Although these themes may initially appear similar, a closer examination of the most frequently cited authors revealed nuanced distinctions between them. These themes encompass (i) implementation, (ii) teaching, and (iii) psychological characteristics.

The first theme (see Table 2), which exhibits the highest level of development, focuses on the implementation of BL. Research in this area primarily addresses technology integration, perceptions, and the outcomes associated with specific learning approaches following its adoption.

Table 2. Theme 1: Implementation of BL

Description	Most cited articles
Blended learning mediated by technology, focusing on students' and teachers' perceptions, course implementation in terms of time and physical and online spaces, and student performance	Moore (1989); Owston & York (2018); Owston et al. (2019); Drysdale et al. (2013); Kuo et al. (2014); Bernard et al. (2014); Donnelly (2010); Çardak & Selvi (2016); Means et al. (2013); Chen (2016); Ateş Çobanoğlu (2018); Lai et al. (2016); Castro (2019); Yang et al. (2013); Papanikolaou et al. (2017); Ciudad Gómez & Valverde Berrocoso (2021); Thurber & Trautvetter (2020); Meulenbroeks (2020); Olt (2018); Gómez et al. (2022); Hewett et al. (2018); Hilliard & Stewart (2019); Çetin & Özdemir (2018); Engelbertink et al. (2022); Balladares-Burgos (2018); Zhao y Song (2020); Pollock et al. (2019); Raturi (2021); Heilporn & Lakhal (2021); Calderon & Sood (2018); Dahlstrom-Hakki et al. (2020); Roza et al. (2019); Chan (2019); Roberts (2019)

Source: Own work based on the study by Gómez Martínez and García Naranjo (2024).

The second theme (see Table 3) centers on teaching and encompasses both individual and collaborative learning activities. In contrast to the first theme, this category includes a smaller number of highly cited authors.

Table 3. Theme 2: Teaching in BL

Description	Most cited articles
Interaction in blended learning that supports teaching through both individual and collaborative activities mediated by technology	Shu & Gu (2018); Van Leeuwen (2018); Yang et al. (2017)

Source: Own work based on the study by Gómez Martínez and García Naranjo (2024).

Lastly, the third theme (see Table 4) explores the psychological dimensions of student interaction, particularly in terms of attitudes, motivation, and engagement. These aspects are closely linked to teacher feedback, as recognizing students' psychological states allows educators to tailor their responses accordingly. For instance, if a teacher detects a lack of motivation among students, feedback may extend beyond task-related activities to include strategies aimed at enhancing motivation. Although this theme is associated with a smaller cluster of research compared to the previous one, it includes a higher number of cited authors.

Table 4. Theme 3: Psychological characteristics in interaction in BL

Description	Most cited articles
Blended learning from a psychological perspective, identifying key social interaction components (attitudes, motivation, engagement, and collaboration), as well as strategies employed by teachers to support students	Westerlaken et al. (2019); Røe et al. (2019); Rowe et al. (2012); Islam et al. (2021); Hyll et al. (2019); Zhao & Li (2021); Ullah et al. (2021); Sorokova (2020)

Source: Own work based on the study by Gómez Martínez and García Naranjo (2024).

The second key finding of the review pertains to the types of interaction examined in the 44 analyzed articles. Among the 37 research articles (see Table 5), the most frequently studied interactions were those between teachers and students (Çardak & Selvi, 2016; Islam et al., 2021; Owston & York, 2018; Røe et al., 2019; van Leeuwen, 2018). This was followed by studies exploring student–teacher–peer interactions (Ciudad Gómez & Valverde Berrocoso, 2021; Hewett et al., 2018; Meulenbroeks, 2020; Owston et al., 2019; Pollock et al., 2019; Sorokova, 2020). Several authors have also examined interaction in relation to engagement, reinforcement of interaction, effective learning, and self-efficacy (Heilporn & Lakhal, 2021; Thurber & Trautvetter, 2020; Westerlaken et al., 2019; Zhao & Li, 2021). Others have adopted a constructivist perspective, analyzing interactions between students and instructors, students and peers, and students and content (Chan, 2019; Donnelly, 2010; Kuo et al., 2014; Ullah et al., 2021).

Table 5. Types of interaction in BL identified in the examined articles

Type of interaction	# of articles
Teacher–student interaction	6
Student–teacher–peer interaction	6
Social interaction	4
Constructivist interaction	4
Online interaction	2
Interaction with technology	2
Interaction with activities	2
Online–face-to-face interaction	1
Effective interaction	1
Interaction by educational level	1
Not mentioned directly	8

Source: Own work based on the study by Gómez Martínez and García Naranjo (2024).

Other studies have focused on different aspects of interaction, such as online and/or face-to-face interaction (Yang et al., 2013; Zhao & Song, 2020), technologically mediated interaction (Hyll et al., 2019; Papanikolaou et al., 2017), and interaction derived from various types of learning activities (Hilliard & Stewart, 2019; Yang et al., 2017). Additionally, some research has explored constructivist interaction and learner autonomy (Lai et al., 2016), learner characteristics (Cheng & Chau, 2015), distinctions between online and face-to-face interactions

(Shu & Gu, 2018), effective interaction (Ateş Çobanoğlu, 2018), and variations in interaction based on educational level (Raturi, 2021).

In the seven review articles analyzed, interaction was examined from broader perspectives. Some studies compared interaction in blended and face-to-face learning environments (Means et al., 2013), while others explored interaction through different theories of online learning and distance education (Roberts, 2019). Further research addressed the effectiveness of interaction (Rowe et al., 2012), its role in instructional and learning outcomes (Bernard et al., 2014), its integration with technology (Roza et al., 2019), emerging research trends (Drysdale et al., 2013), and its application in teaching with technology (Castro, 2019).

Finally, the third key finding of the review highlights emerging research trends, which emphasize expanding the perspective on BL implementation by considering students' learning processes and individual characteristics. These trends focus on several key areas such as design in BL (Ciudad Gómez, A., & Valverde Berrocoso, 2021; Calderon & Sood, 2018; Çardak & Selvi, 2016; Chan, 2019; Donnelly, 2010; Hewett et al., 2018; Islam et al., 2021; Meulenbroeks, 2020; Owston et al., 2019; Thurber & Trautvetter, 2020; Yang et al., 2013; Yang et al., 2017), student characteristics (Cheng & Chau, 2015; Dahlstrom-Hakki et al., 2020; Engelbertink et al., 2022; Kuo et al., 2014; Owston & York, 2018; Pollock et al., 2019; Røe et al., 2019; Ullah et al., 2021; Zhao & Li, 2021), adaptation of teaching styles in BL (Balladares-Burgos, 2018; Çetin & Özdemir, 2018; Papanikolaou et al., 2017; Westerlaken et al., 2019), effects of BL (Olt, 2018; Raturi, 2021; Shu & Gu, 2018), and empirical and experimental approaches in BL (Ateş Çobanoğlu, 2018; Lai et al., 2016; van Leeuwen, 2018).

DISCUSSION

Technology integration in BL in higher education often reflects an instrumental bias, focusing mainly on technology implementation (Gómez Martínez & García Naranjo, 2024). This approach tends to overlook other crucial pedagogical challenges inherent in student-centered models, such as ethical training, intellectual production, and the development of human skills, including creativity, originality, and autonomy. Although the shift toward hybrid education represents a growing trend with the potential to enhance higher education (Ebner, 2022), a key challenge lies in ensuring that this transition effectively supports social interactions in learning environments that integrate the strengths of both face-to-face and digital models.

A relevant example of this integration is the use of AI, particularly ChatGPT, as a tool for personalized learning. While AI can enhance the instrumental aspects of teaching, it does not replace the construction of shared meanings, which is a fundamental aspect of human interaction (Chan, 2023). Thus, the incorporation of AI, being intentional, must consider not only the level at which it is introduced but also its intended purpose within the learning experience. This aims to prevent the assumption that technology integration automatically enhances learning outcomes.

The way in which technology is integrated plays a central role in shaping teacher–student and peer interactions, which, in turn, fosters learner autonomy (Lai et al., 2016) and significantly enhances social engagement (Zhao & Li, 2021). Even though AI-driven tools such as video tutorials and short educational videos can facilitate self-paced learning and improve out-of-class feedback (Castro, 2019), they do not fully replace the benefits of face-to-face interaction, particularly in complex learning processes. Effective integration must therefore align with learning objectives and requires increased guidance from educators (Hyll et al., 2019). Maintaining a balance between technological mediation and in-person engagement is essential (Hewett et al., 2018), as research suggests that technology-enhanced learning environments can improve learning outcomes when they complement face-to-face instruction (Sorokova, 2020; Westerlaken et al., 2019; Yang et al., 2017).

Although learning can occur in environments that involve non-human interactions (Moore & Anderson, 2003), pedagogical reflection should be understood as an evolving process rather than a set of fixed tools that dictate institutional decisions (Castells, 2000). Institutions must take an active leadership role in this transformation, ensuring the democratization of education while simultaneously addressing research gaps (van Dis et al., 2023).

If integrated thoughtfully, the potential negative effects of technology can be mitigated through clear regulatory frameworks that establish ethical guidelines and policies to govern its use. Such measures are necessary to safeguard intellectual production while also fostering the development of human skills, guaranteeing that technology implementation aligns with the educational objectives of each BL model (Graham, 2006).

Ethical considerations, therefore, must extend beyond implementation to include critical discussions on technology's role in societal transformation and its impact on individuals' quality of life. Rather than perceiving technological advancement as an unstoppable force, it is essential to define minimum ethical standards that protect both intellectual production and human integrity (Chan & Hu, 2023; van Dis et al., 2023).

The systematic review revealed that research on interactions in BL has predominantly focused on technology implementation, emphasizing the importance of understanding participants' perceptions, the differences between online and face-to-face interactions, and student performance, with many studies highlighting improved learning outcomes. Nevertheless, other key areas of interest have also emerged, particularly concerning teaching processes that prioritize the study of both individual and collective learning activities. Additionally, there is a growing focus on the psychological dimensions of interaction—such as motivation, attitudes, engagement, and collaboration—which underscores the role of social dynamics in shaping individual learning experiences. Interactions with teachers, tutors, and peers not only provide timely feedback but also foster learning and critical thinking.

Symbolic interactionism views, these approaches facilitate collective mental constructions (Gadea, 2018) in which meanings are shared among individuals. In this framework, students not only acknowledge the teacher's role within the educational environment but also develop an awareness of their own agency. In each BL model, the degree of student autonomy varies depending on the teacher's role. However, interaction in these contexts is not always inherently

social, as it relies on an exchange of meanings in which communication must align with students' needs and contribute to the transformation of the educational experience (Pons Díez, 2010).

In this regard, social interaction plays a crucial role in mitigating the instrumental bias associated with technology in education. While technology integration is essential, it is not sufficient on its own to foster meaningful learning experiences. From the perspectives of symbolic interactionism (Gadea, 2018) and constructivism (Lai et al., 2016), learning is understood as a social process of internalization that extends beyond the mere acquisition of knowledge or information. Rather, it enables individuals to recognize their active role in interpersonal relationships, thereby promoting the development of essential social skills.

CONCLUSIONS

This discussion on social interaction in BL addresses the instrumental bias that emerges when technologies are assumed to replace teachers. This bias is particularly evident in studies that focus primarily on the adoption of technological tools while neglecting the broader formative challenges associated with ethical training, conscientious preparation, and critical thinking in the use of technology.

In BL, effective social interaction must take into account the specific characteristics of each educational context, which determine the type of blend—whether enabling, enhancing, or transforming. Relying solely on market factors, trends, or fleeting opportunities to justify the adoption of technology in higher education risks overlooking other dimensions of learning. From the perspective of symbolic interactionism, human interaction is fundamentally social, involving the exchange of meanings shaped by cultural contexts. In this sense, meaningful communication has the potential to transform learning environments by facilitating the exchange of ideas and allowing the development of essential human skills.

The evolution of BL is becoming increasingly evident, shifting the focus from mere technology implementation to the psychosocial processes underlying student interactions. This evolving perspective reflects an emerging research trend in BL, which seeks to address students' broader educational needs beyond academic performance alone.

Despite the undeniable impact of technology, including AI, on teaching and learning support, these tools cannot replace the processes of shared meaning-making and collaborative knowledge construction among learners. Therefore, it is essential for universities to reinforce these aspects by approaching technology integration as a structured process guided by ethical considerations, which requires the establishment of clear policies that regulate its use and define its scope.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHORS' CONTRIBUTIONS

Vittoria Angélica Gómez Martínez led the conception and design of the study, data collection, theoretical framework, data analysis and interpretation, methodology, and manuscript writing. Martha Lucía García Naranjo contributed as a co-researcher, participating in the discussion, development of the theoretical and methodological framework, and manuscript writing.

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