

From Classroom Communication to Online Interaction: The Evolution of Pedagogical Modalities in the Digital Age

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Abstract

This article examines the evolution of pedagogical communication modalities, from face-to-face teaching to online interaction, in a context marked by the widespread use of digital technology. It highlights the transformations brought about by technological tools on teaching practices and the professional roles of teachers. Through a comparative analysis of classroom exchanges (both verbal and non-verbal) and mediated interactions (synchronous and asynchronous), the study demonstrates that technology does not replace educational communication, but rather redistributes its functions. The emergence of hybrid formats thus imposes a new conception of teaching, centered on pedagogical scripting, online social presence, and active learner engagement. The article concludes that the success of hybrid devices depends on thoughtful pedagogical design, ongoing teacher training, and equitable access to digital infrastructures.

KEYWORDS

Classroom communication, Online interaction, Hybrid learning, Synchronous /asynchronous modalities, Digital pedagogy, LMS

1 | INTRODUCTION

For more than a century, pedagogical communication has relied on the co-presence of teachers and learners, whose verbal and nonverbal cues, such as tone of voice, eye contact, and gestures, foster both cognitive and socioemotional growth (Hargie, 2011). In Vygotsky's sociocultural perspective, these cues provide the scaffolding that helps learners advance through their zone of proximal development (Vygotsky, 1978). However, the digital turn has multiplied the "channels" in the sender-receiver chain (Planer & Godfrey-Smith, 2020) and introduced new sources of "noise," ranging from bandwidth constraints to interface fatigue. Communication is a fundamental aspect of daily life, whether personal, professional, or social, and understanding its various forms, as well as the digital tools that enable them, can significantly enhance our capacity to share information clearly and effectively (Ouariach et al., 2023). The traditional classroom often fails to furnish students with practical knowledge relevant to their future careers and tends to prioritize rote memorization over genuine comprehension (Soufiane et al., 2024).

More than a mere shift in tools, the digitalization of

education has introduced a structural transformation in pedagogical modalities. In traditional classrooms, communication tends to follow a linear teacher-student pattern, where meaning is co-constructed in real time through bodily presence, spontaneous feedback, and shared temporal rhythms. In contrast, online learning environments, especially those built around Learning Management Systems (LMSs), videoconferencing tools, and collaborative platforms, fragment the spatio-temporal continuity of interaction. They introduce new forms of mediation that alter the nature of presence, attention, and engagement (Chen et al., 2022).

The COVID-19 pandemic accelerated this transformation, compelling higher-education institutions to adopt videoconferencing, discussion forums, and cloud-based collaboration on a large scale. Research on blended-synchronous classrooms shows that learning gains depend less on the mere presence of technology than on the quality of dialogic interaction it enables (Li et al., 2024; Mu et al., 2025). Consequently, teachers have had to adopt design-oriented roles curating resources, orchestrating multimodal exchanges, and cultivating an online social presence while students

assume greater responsibility for self-paced learning and peer support (Bayaga, 2024).

In this shift, communication is no longer restricted to oral speech or classroom-based writing, but extends to multimodal elements, including icons, animations, voice-over videos, chat discussions, emoji reactions, and hyperlinks. These features, while enriching expression, demand new digital literacies from both instructors and learners. As highlighted by Lameul and Loisy (2020), online interaction redefines didactic roles by transforming teachers into mediators, facilitators, and designers of learning environments, rather than mere transmitters of knowledge.

Furthermore, the synchronous/asynchronous dichotomy has profound implications for the construction of knowledge. While synchronous settings (e.g., Zoom sessions) replicate the immediacy of face-to-face conversation, they also generate fatigue and cognitive overload when not adequately designed. Conversely, asynchronous forums and wikis allow learners to reflect, research, and contribute at their own pace but at the risk of social disconnection and demotivation. This trade-off calls for an intentional orchestration of modalities based on pedagogical goals, learner profiles, and technological affordances. Communication plays a vital role in learning management systems (LMS), as it directly influences learner engagement, participant collaboration, and the overall effectiveness of the educational process (Ouariach et al., 2025). Information and communication technologies (ICT) have fundamentally transformed the e-learning landscape (Zahra et al., 2025). Communication tools facilitate real-time interaction between teachers and learners, offering quicker and more effective methods for teaching and learning (Zahra et al., 2023).

Hybrid learning formats, where face-to-face teaching is combined with digital extensions, have emerged as a promising solution. These models leverage the immediacy of physical presence and the flexibility of online resources to foster learner autonomy, engagement, and collaboration. However, their effectiveness depends on a carefully structured “script” or scenario that aligns pedagogical objectives with interactional forms. This requires teachers to develop competencies in digital design, evaluation, and facilitation, as well as critical awareness of ethical, technical, and cognitive issues.

This article, therefore, asks: How have communicative modalities evolved from the physical classroom to the online environment, what hybrid configurations are emerging, and what competencies do educators now need to navigate this landscape? In answering, we map the continuum from fully face-to-face to fully online formats, examine synchronous–asynchronous trade-offs and propose design principles for inclusive, high-impact digital pedagogy.

2. Classroom Communication

2.1. The Foundations of Pedagogical Communication in Face-to-Face Teaching

Pedagogical communication in face-to-face contexts is a foundational element of effective teaching and learning. It encompasses both verbal and non-verbal dimensions, allowing teachers to transmit knowledge, manage the classroom, and establish relational bonds with students. According to Hargie (2011), communication in educational settings is not merely about delivering information; it is a complex, interactive process that shapes understanding and facilitates cognitive and socio-emotional development. In the classroom, teachers use voice tone, eye contact, facial expressions, gestures, and proxemics to support and enhance verbal discourse. These elements help clarify instructions, maintain students’ attention, and create a supportive learning climate.

Moreover, pedagogical communication involves feedback, questioning, reformulation, and scaffolding strategies that allow learners to actively engage with content and develop autonomy (Vygotsky, 1978; Mercer & Howe, 2012). The relational dimension is equally essential: building trust and a sense of belonging through empathetic and respectful interactions contributes to student motivation and participation. Effective teachers are those who not only master subject content but also know how to adapt their communication style to their learners’ needs, cultural backgrounds, and emotional states (Rogers & Freiberg, 1994). In this sense, pedagogical communication is both an instructional and a human process, essential for creating meaningful, inclusive, and transformative educational experiences.

2.2. Sender–Receiver Model of Communication

The Sender–Receiver model represents a foundational framework in communication theory, outlining how information is exchanged between two entities (Planer & Godfrey-Smith, 2020; Daylight, 2017). In this model, the sender encodes a message, transmits it through a communication channel, and the receiver decodes it (Grandgeorge, 2020). The presence of noise within the channel can disrupt or distort the intended message (Grandgeorge, 2020). This model has been widely applied and adapted in multiple fields, including business, biology, and engineering (Waller & Polonsky, 1998; Godfrey-Smith, 2014 ; Soyak & Ercetin, 2024).

Core Components and Processes

- **Sender:** The sender is the originator of the message (Grandgeorge, 2020). Their role involves determining what information to communicate and selecting how to encode it into a message (Grandgeorge, 2020).
- **Message:** This refers to the actual content that is being communicated.

- **Encoding:** Encoding is the process of transforming information into a form suitable for transmission (Grandgeorge, 2020). This could include converting ideas into spoken language, translating data into electrical signals, or encoding biological information into genetic material (Grandgeorge, 2020).
- **Channel:** The channel is the medium used to carry the message (Grandgeorge, 2020). It can be physical, such as air or cables, or virtual, such as radio frequencies or digital networks (Grandgeorge, 2020).
- **Noise:** Noise refers to any disturbance that disrupts or alters the transmission of the message (Grandgeorge, 2020). This interference can be physical, such as static noise, or semantic, including language misunderstandings (Grandgeorge, 2020).
- **Decoding:** Decoding is the act by which the receiver interprets the encoded message and transforms it into a meaningful form (Grandgeorge, 2020).
- **Receiver:** The receiver is the individual or system to whom the message is directed and who interprets the conveyed information (Grandgeorge, 2020).
- **Feedback:** While not always formally included in linear models, feedback plays a vital role by allowing the sender to assess whether the message was understood correctly.



Figure 1: Basic Comm Model

The image depicts a classic model of communication, illustrating the process by which information is transmitted from a source to a destination (Grandgeorge, 2020). This model is often referred to as the Shannon - Weaver model.

2.3. The role of verbal and non-verbal language

Verbal and non-verbal language are both essential aspects of human communication (Argyle, 1976). Verbal communication includes both spoken and written language, acting as a fundamental channel for expressing thoughts, needs, and emotions (Salim, 2023; Farid et al., 2023). In contrast, non-verbal communication conveys meaning through gestures, facial expressions, eye contact, and body movements (Farid et al., 2023).

- **Importance of Verbal Communication**

Verbal communication is the natural means by which individuals express their thoughts and intentions. It encompasses both spoken and written language used to convey messages (Farid et al., 2023). The effectiveness of verbal communication depends on

several factors, including word choice, sentence structure, tone of voice, vocabulary, and grammatical accuracy (Anwar et al., 2020).

- **Significance of Non-Verbal Communication**

Non-verbal communication functions as a silent language that complements and reinforces verbal expression (Farid et al., 2023; Argyle, 1976). It encompasses a wide range of signals, including facial expressions, gestures, posture, eye movements, and vocal tone (Rashed et al., 2024; Farid et al., 2023). These cues play a crucial role in conveying emotions, emphasizing key points, and managing the flow of interactions (Han et al., 2023). Research has shown that non-verbal elements make up a substantial part of communication, with some studies estimating that they account for up to 93% of the information transmitted in interpersonal exchanges.

- **Integration of Verbal and Non-Verbal Communication**

Effective communication requires the integration of both verbal and non-verbal elements to promote clarity and mutual understanding (Argyle, 1976). Non-verbal cues can either reinforce or contradict spoken messages, significantly shaping how those messages are interpreted (Farid et al., 2023). For example, maintaining eye contact and using appropriate body language can strengthen the impact and credibility of verbal expression (Farid et al., 2023).

- **Non-Verbal Communication in Specific Contexts**

Education: Teachers can enhance students' understanding by utilizing body language, maintaining eye contact, and employing facial expressions (Farid et al., 2023). Non-verbal cues also contribute to fostering an inclusive and supportive classroom environment (Nguyen & Huynh, 2024).

Virtual Environments: In collaborative virtual environments (CVEs), non-verbal communication remains vital. Avatars often represent users, and analyzing their gestures and movements can provide valuable insights into the dynamics of collaborative interactions.

Robotics: Advances in social robotics have led to the development of robots capable of interacting with humans using both verbal and non-verbal communication. These robots are equipped with speech, gaze, and gesture detectors, enabling them to perceive and respond to human communicative behaviors.

Cross-Cultural Communication: Nonverbal cues differ significantly across cultures, and understanding these variations is crucial for effective intercultural communication (Salmanova, 2024; Purnell, 2018).

Healthcare: In medical settings, the interpretation of

non-verbal signals can enhance patient care by helping healthcare providers establish trust and deliver culturally appropriate services (Purnell, 2018). Additionally, spiritual caregivers use visual gestures and cues to communicate with patients affected by aphasia.

• The Four Key Dimensions Shaping Human Communication

The figure illustrates the four major dimensions that influence human communication: verbal, non-verbal, environmental, and personality-related factors. Each dimension contributes uniquely to the transmission and interpretation of messages in interpersonal interactions. Verbal communication encompasses the structure and content of spoken or written language, including tone, vocabulary, and phrasing. Non-verbal communication conveys emotions and intentions through body language, facial expressions, and eye contact. Environmental influences such as cultural context, physical surroundings, and social settings shape how messages are perceived and expressed. Ultimately, personality traits such as introversion, self-esteem, and social intelligence influence how individuals communicate and interact with others. Understanding the interplay between these elements is essential for effective communication in both personal and professional contexts.

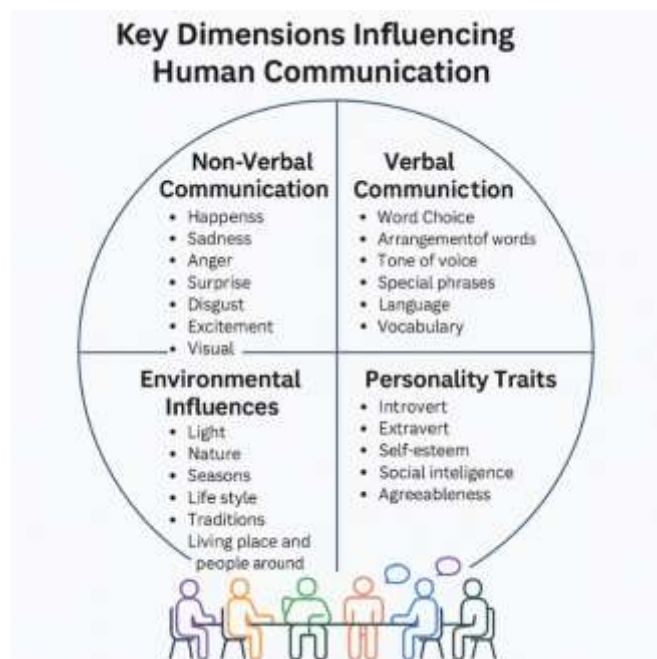


Figure 2: The Four Key Dimensions Shaping Human Communication

2.4. Synchronous teacher-learner interactions

Synchronous teacher-learner interactions are essential for effective learning, particularly in both traditional and blended classroom settings (Mu et al.,

2025) (Li et al., 2024). These interactions involve communication strategies, classroom discourse, and various pedagogical approaches. Understanding the dynamics of these interactions helps identify ways to enhance teaching effectiveness and student engagement (Mu et al., 2025) (Li et al., 2024).

• Communication Strategies in Synchronous Environments

Effective communication strategies are essential for fostering a positive and productive learning environment. In synchronous settings, teachers employ various techniques to engage students and facilitate meaningful discussions. These strategies include:

- ✓ **Questioning Techniques:** Teachers employ various types of questions to stimulate critical thinking and assess students' understanding (Ng et al., 2020).
- ✓ **Feedback Mechanisms:** Providing timely and constructive feedback helps students to improve their learning outcomes (Tong et al., 2025).
- ✓ **Active Listening:** Paying attention to student responses and adapting instruction accordingly (Li et al., 2023).

• Interaction Patterns and Classroom Discourse

The patterns of interaction between teachers and students significantly influence the success of the learning process (Riyadini & Basikin, 2024). Analyzing classroom discourse can reveal dominant patterns and areas for improvement. Some key aspects include:

- ✓ **IRF (Initiation-Response-Feedback) Patterns:** Understanding how these patterns shape classroom dialogue.
- ✓ **Turn-Taking:** Analyzing how teachers and students take turns in speaking.
- ✓ **Multimodal Discourse Analysis:** Examining verbal and non-verbal behaviors to understand interaction dynamics (Li et al., 2023).

• Traditional vs. Learner-Centered Approaches

Traditional teacher-centered approaches differ significantly from constructivist, learner-centered methods (Kaymakamoglu, 2017). The choice of approach impacts student engagement and learning outcomes:

- ✓ **Teacher-Centered:** In traditional settings, teachers often control the flow of information and provide direct instruction (Kaymakamoglu, 2017).
- ✓ **Learner-Centered:** Constructivist approaches emphasize student autonomy and collaborative learning (Antón, 1999). Studies show that student-centered pedagogies can enhance self-directed learning.

• Blended Synchronous Classrooms (BSCs)

Blended Synchronous Classrooms (BSCs) combine face-to-face instruction with online learning, offering access to high-quality digital resources (Mu et al., 2025). Effective teacher-student interactions are crucial in

these environments (Mu et al., 2025) (Li et al., 2024). Key considerations include:

- ✓ **Distribution of Interactions:** Understanding how interactions are distributed between teachers and students (Mu et al., 2025).
- ✓ **Quality of Dialogue:** Focusing on the depth and quality of teacher-student dialogue to improve teaching effectiveness (Li et al., 2024).
- ✓ **Multimodal Analysis:** Using multimodal discourse analysis to understand dynamic coordination in BSC interactions (Li et al., 2023).

• Impact of Technology on Teacher-Student Interactions

Technology plays a significant role in modern classrooms, influencing how teachers and students interact. Smart classrooms leverage technology to enhance teaching and learning. Aspects to consider include:

- ✓ **Interactive Media:** Utilizing language, resources, and tool media to facilitate interaction.
- ✓ **Intelligent Tutors:** Incorporating AI-based systems to provide instructional guidance.
- ✓ **TPACK (Technological Pedagogical Content Knowledge):** Integrating technology, pedagogy, and content knowledge to improve teaching (Abouelenein & Selim, 2024).

2.5. Limits and constraints of the face-to-face model

The face-to-face learning model has faced numerous limitations in the wake of the recent pandemic, necessitating careful consideration for effective educational delivery. These constraints arise from a combination of health regulations, pedagogical challenges, and logistical issues, all of which influence the overall efficacy of this instructional approach.

Health-related protocols, in particular, have significantly impacted traditional classroom settings. Educational institutions are required to enforce strict sanitary measures, including mandatory vaccination for teaching staff and reduced classroom capacities to ensure social distancing. For example, guidelines often limit class occupancy to 50% and cap the duration of learning sessions at three hours to comply with safety requirements (Nofiana et al., 2022). Moreover, the requirement for all participants to be vaccinated presents logistical difficulties, especially in areas where access to vaccines remains inconsistent (Oktarina et al., 2022). Although face-to-face instruction is intended to compensate for the shortcomings of remote learning, these health-related adaptations inevitably limit the frequency and quality of in-person interactions.

Synthesis

In traditional classroom settings, communication plays a central role in the learning process. It is rooted in direct, real-time interactions between teachers and students, enriched by verbal and non-verbal cues such

as tone of voice, facial expressions, gestures, and eye contact. These dynamics foster immediate feedback, enable teachers to adapt their instruction on the spot, and encourage spontaneous dialogue. Structured interaction patterns, such as the IRF model (Initiation–Response–Feedback), are often used to guide classroom exchanges, supporting both cognitive development and socio-emotional engagement.

However, with the rapid integration of digital technologies and the global shift toward online and hybrid education accelerated notably by the COVID-19 pandemic this traditional communicative model has undergone a profound transformation. New modalities of interaction have emerged, redefining how educators and learners connect, exchange, and construct knowledge in virtual environments.

3. The Advent of Digital Mediation

3.1. Evolution of Media and Communication Channels

The transformation of media and communication channels has been profound, especially with the rise of digital technologies. While traditional media such as print and broadcast once dominated, the current landscape is defined by swift interactions enabled by the Internet, mobile technologies, and social networks.

A central aspect of this transformation lies in the shift from mass communication to more individualized marketing approaches via digital platforms. Zhukovskiy notes that the evolution of digital communication channels reflects broader trends in internet marketing, moving from generalized media tools toward highly customized interactions. These personalized channels include components like email marketing, retargeting mechanisms, and social media engagement, all of which leverage user data to adapt messages to individual preferences (Zhukovskiy, 2024). This development represents a significant shift in business-consumer interactions, with a focus on fostering relationships rather than merely broadcasting messages.

3.2. Digital tools

Digital skills refer to the set of abilities required to use information and communication technologies effectively in a professional, educational or personal context. They encompass technical skills (navigation, word processing, file management), informational skills (research and critical evaluation of information), communicational skills (interaction via digital tools), as well as skills linked to digital security and ethics. In the field of education, these skills have become essential, both for learners and teachers, in order to take full advantage of the digital tools made available to them. Indeed, the implementation of techno-pedagogical devices such as Learning Management Systems (LMS), synchronous and asynchronous tools, or even MOOCs

(Massive Open Online Courses) and SPOCs, relies on the ability of users to master these digital skills to teach, learn and collaborate effectively in virtual environments.

In this section, we have specified learning devices such as LMSs, MOOCs and SPOCs, as well as the communication tools used, whether synchronous or asynchronous:

- **LMS (learning management system)**

A Learning Management System (LMS) is a digital platform designed to create, deliver, and manage courses, educational resources, activities, and assessments (Dahal & Manandhar, 2024). It is a web-based application used by organizations and educational institutions to organize and offer online courses and programs. LMSs support learning and training processes by providing various tools such as video conferencing, assignments, quizzes, and progress tracking.

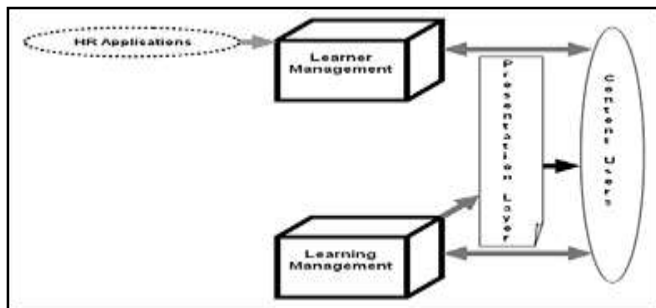


Figure 3 The components comprising an LMS (Zahra et al., 2024)

- **MOOC**

A Massive Open Online Course (MOOC) is an online course intended for distance learners, providing open access and unlimited participation through the internet (Haron et al., 2019; Chunwijitra., 2020). MOOCs create learning opportunities, especially in higher education, by leveraging information technologies (You, 2019). They represent a new and innovative approach to disseminating knowledge to millions of people around the world.

- **SPOC**

(Small Private Online Course) It is a hybrid teaching model that combines online learning with face-to-face interactions. This type of course is typically small-scale and has restricted access, designed for a specific group of learners (Du, 2021). SPOCs emerged in response to the challenges faced by MOOCs (Massive Open Online Courses), particularly the high dropout rates associated with them.

- **Synchronous Communication Tools**

are technologies that support real-time interaction

between participants. Widely used in online learning environments, they allow learners and instructors to communicate, collaborate, and engage simultaneously. These tools are used in various contexts, including virtual classrooms, live discussions, online tutoring sessions, webinars, and virtual meetings. They include functionalities such as live chat, video conferencing, audio calls, and interactive whiteboards. Common examples are Zoom, Microsoft Teams, Google Meet, Skype, or built-in tools like BigBlueButton and Moodle's live chat module.

- **Asynchronous Communication Tools**

Are applications or platforms that enable users to exchange information without needing to be online at the same time. They allow individuals to post messages, respond to previous communications, and share content at their own pace, making them ideal for flexible learning and collaboration (Zahra et al., 2023). These tools include features such as discussion forums, email, messaging systems, wikis, blogs, and learning management system (LMS) message boards, allowing for thoughtful, time-independent interaction. These are communication tools that enable users to exchange information at different times, without requiring simultaneous interaction (Zahra et al., 2025).

3.3. Synchronous and Asynchronous Modes

Synchronous and asynchronous modalities represent two distinct approaches to online learning and e-learning. Understanding their strategies, methods, and objectives is essential for designing effective learning environments (Berestok, 2021).

3.3.1. Synchronous Learning

Synchronous learning is defined by real-time interaction between participants (Culbreth & Martin, 2025). This includes formats such as webinars, video conferences, and live discussions (Ebner & Gegenfurtner, 2019). In this mode, learners and instructors are present simultaneously, enabling immediate feedback, dynamic exchanges, and collaborative activities. It closely resembles traditional face-to-face teaching, fostering a sense of community and engagement through direct communication.

3.3.2. Asynchronous Learning

Asynchronous communication functions without a global clock, allowing unbounded message delays while nodes work independently (Chaurasia et al., 2024). This approach offers greater flexibility and can deliver higher performance in heterogeneous systems where processes operate at different speeds. By overlapping communication latency with the execution of memory-bound code, asynchronous execution can further boost overall performance (Afzal et al., 2023). Illustrative cases include AsyncFolding in federated

learning and asynchronous current-mode serial links for on-chip data exchange (Dobkin et al., 2010) (Stripelis et al., 2022).

3.4. Hybridization of Formats (face-to-face/off-site)

Hybrid learning integrates face-to-face and online learning approaches to address diverse learning preferences and scheduling needs (Almusaed et al., 2023). This model seeks to harness the benefits of technology to improve student engagement and learning outcomes. Its significance lies in combining the flexibility of digital education with the interpersonal connection offered by in-person instruction.

3.4.1. Benefits of Hybrid Learning

- **Improved Learning Outcomes**

Hybrid learning has demonstrated effectiveness in addressing misconceptions, often surpassing the results of traditional face-to-face or fully online learning. One study reported a 90.32% success rate in correcting misconceptions among students in a primary school teacher education program.

- **Increased Flexibility and Accessibility**

By removing constraints related to time and location, hybrid learning enhances access to education (Cui et al., 2023). It enables students to adjust their learning pace to their individual needs (Cui et al., 2023).

- **Enhanced Engagement**

Combining multimedia resources with in-person classroom activities can boost student engagement in hybrid settings (Almusaed et al., 2023). The use of interactive technologies also enriches the learning experience by stimulating student interest and participation.

- **Development of 21st-Century Skills**

Hybrid learning environments support the development of essential competencies, such as decision-making. For example, game-based collaborative decision-making can be successfully delivered in remote synchronous settings through the use of multidimensional scaffolding.

- **Personalized Learning Experience**

Hybrid learning enables a more personalized educational path by accommodating diverse learning styles and schedules. It offers students the flexibility to combine online and in-person formats, tailoring their experience to their specific needs (Çemçem et al., 2024).

3.4.2. Models of Hybrid Learning

Several models of hybrid learning exist, each offering a distinct combination of face-to-face and online

components (Çemçem et al., 2024):

- **The Rotation Model** involves students moving through various learning stations, such as teacher-led sessions, computer-based activities, and collaborative group work. Sub-models include station rotation, lab rotation, flipped classroom, and individual rotation (Çemçem et al., 2024).
- **The Flex Model** primarily delivers instruction online, while in-person support is provided as needed (Çemçem et al., 2024).
- **The A La Carte Model** allows students to select from a variety of online and in-person learning options according to their preferences (Çemçem et al., 2024).
- Lastly, the Enriched **Virtual Model** consists mostly of online learning, complemented by occasional in-person sessions or events (Çemçem et al., 2024).

3.4.3. The Role of Technology

Technology plays a central role in hybrid learning, supporting a wide range of functions that enhance the overall educational experience (Anthony et al., 2020):

- **Learning Management Systems (LMS)** such as Moodle are commonly used for organizing courses, distributing learning materials, and facilitating communication between instructors and learners.
- **Synchronous and asynchronous resources** both contribute to the flexibility of hybrid learning environments. While synchronous tools like webinars and video conferencing allow for real-time interaction, asynchronous tools such as discussion boards and digital textbooks support self-paced learning (Anthony et al., 2020).
- **Collaborative tools** like Google Docs and Google Meet enable students to engage in live co-creation of documents and collaborative problem-solving, fostering both teamwork and communication skills.
- **Interactive technologies** further enrich the learning process by stimulating cognitive and emotional engagement, which positively affects students' learning outcomes.
- In sum, hybrid learning offers a flexible and powerful educational model that combines the advantages of in-person and online instruction. By strategically selecting appropriate models and leveraging technological tools, educators can design inclusive, interactive, and effective learning environments that respond to the diverse needs of students.

4. New Pedagogical Roles and Postures

The evolution of pedagogy reflects a transition from traditional, teacher-centered models focused on knowledge transmission to more facilitative and collaborative approaches. Educators are increasingly embracing learner-centered strategies by personalizing instruction, integrating digital technologies, and cultivating learning communities. These pedagogical

shifts align with the demands of a globalized and digitally driven educational environment, where transversal skills—such as critical thinking, communication, and problem-solving are becoming central to effective teaching and learning (Bayaga, 2024).

4.1. Adapting to New Roles

Teachers are increasingly adapting their roles to align with the evolving needs of students and educational contexts. This transformation involves embracing technology, recognizing and responding to diverse student profiles, and empowering students through active participation in their own learning process (Conner et al., 2024).

- **Integrating Technology**

Contemporary educators are expected to effectively integrate technology into their teaching practices to enrich the learning experience (Bayaga, 2024). This may include the use of learning management systems, educational applications, or social media tools to facilitate communication and engagement (Bayaga, 2024).

- **Understanding Diverse Needs**

Adaptive teaching involves tailoring instruction to accommodate students' social, linguistic, and cultural differences. This requires a deep awareness of learners' backgrounds and a flexible approach to pedagogy.

- **Promoting Student Voice**

Fostering a student-centered environment means acknowledging and incorporating student input into instructional decisions (Conner et al., 2024). Encouraging student voice enhances engagement, autonomy, and a sense of ownership over the learning process (Conner et al., 2024).

4.2. Innovative Pedagogical Practices

Several innovative pedagogical approaches are emerging to meet the evolving challenges and opportunities of contemporary education.

- **Immersive Blended Learning** is one such approach, combining multiple learning environments and methodologies. Rooted in principles drawn from social learning theory, humanistic education, and collaborative learning, this framework seeks to create meaningful and engaging learning experiences by integrating face-to-face and digital modalities (Bayaga, 2024).

- **Co-design Pedagogy** engages students directly in the instructional design process, fostering collaborative knowledge construction and the development of problem-solving skills (Sunday et al., 2024). This participatory approach strengthens student engagement and encourages shared responsibility in learning.

- **Learner-Centered Interactive Pedagogy (LCIP)** emphasizes the development of critical competencies such as inquiry, analytical thinking, and reflection. It requires learners to actively engage in classroom discourse, making the learning process more interactive and participatory (Tadesse et al., 2023).

- **Fishbone-Based Advanced Computational Thinking (FACT) Pedagogy** merges the use of fishbone diagrams with computational thinking strategies to enrich the teaching and learning of scientific and engineering subjects. This approach helps students visualize complex problems and develop structured, logical solutions (Gopinath & Santhi, 2020).

- **Post-method Pedagogy** represents a shift away from rigid, one-size-fits-all teaching models. Instead, it supports the use of flexible, context-sensitive strategies that empower educators to adapt their methods according to specific learning situations and student needs (Nepal, 2023).

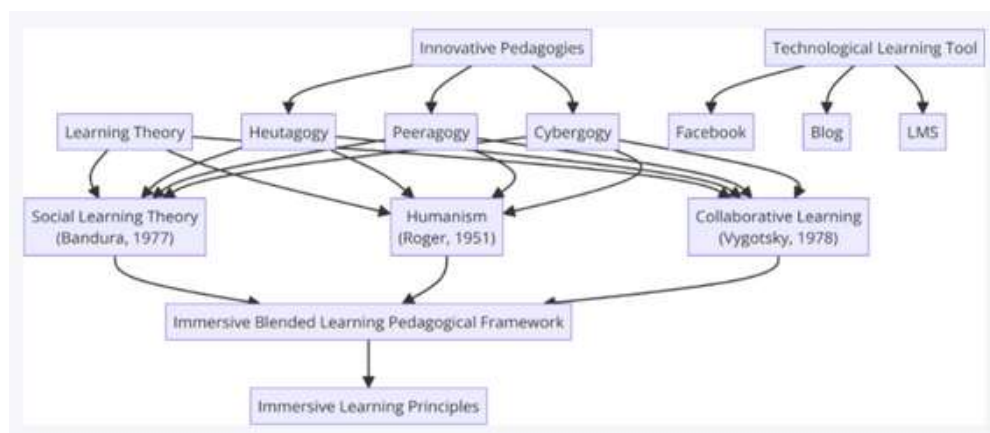


Figure 4: Immersive Blended learning pedagogical framework

Visual Synthesis

Figure 5 summarizes the main changes that have marked the transition, accelerated by the COVID-19 pandemic, between traditional face-to-face teaching

interactions and online learning environments. It highlights changes in interaction modes, communication channels, the role of the teacher, feedback and the tools used. This visual overview reminds us that the health

emergency has acted as a catalyst for rapid digitization, leading to a profound redefinition of pedagogical relationships and paving the way for new hybrid practices. This summary prepares the way for the conclusion by highlighting the structuring nature of this transformation for higher education.

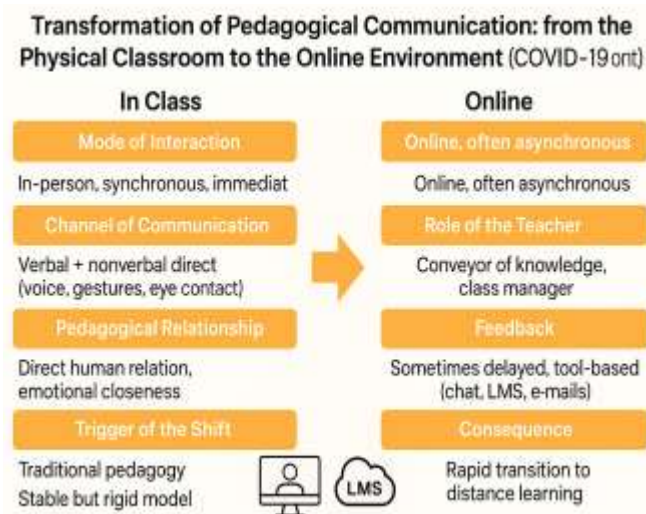


Figure 5: Transformation of Pedagogical communication: from face-to-face to online teaching under the impetus of the health crisis (COVID-19)

Conclusion

In sum, the evolution from face-to-face classroom communication to digitally mediated interaction has transformed teaching from a largely space-bound, teacher-centred act into a distributed, multimodal process that merges physical and virtual spaces. Rather than choosing between on-site or online instruction, educators must orchestrate the synergy of both: reserving synchronous meetings for activities that thrive on immediacy, dialogue, feedback, and community-building, while using asynchronous spaces for reflection, deep work, and equitable access to materials. Effective design now hinges on cultivating social presence through intentional cues that substitute for the paralinguistic signals lost online, from emoji reactions to carefully structured breakout-room protocols. To make this shift sustainable, institutions must invest in professional development that recasts teachers as learning-experience designers fluent in data-informed facilitation and the ethical integration of AI, and they must address persistent digital divides by expanding infrastructure and digital-skills training. When these conditions align, hybrid pedagogy can leverage the immediacy and relational richness of in-person communication alongside the scalability, flexibility, and personalization afforded by digital environments, producing resilient, learner-centred systems fit for the demands of the digital age.

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Author's Contributions

Ms, Ouariach Fatima Zahra drafted the original manuscript. Professor Nejari Amel and Professor Khaldi Mohamed provided academic guidance, validated the findings, and participated in the final review and approval of the manuscript.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Data Availability Statement

Data sharing does not apply to this article, as no datasets were generated or analyzed during the current study.

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