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Editorial

In search of adequate models of pedagogy

1. Introduction

Composing this editorial presented a considerable challenge, undertaken with the hope that it will make even a modest contribution towards a transformation in how we conceptualize, discuss, and think about learning. One might wonder why we have not included "learning" in the title. Recognizing that, at this point, we cannot sufficiently advance our understanding of the complex topic of learning, we have opted to focus on terms that still capture the essence of human activity and interaction within the so-called learning process without centering solely on the internal states of those involved. The purpose of this editorial is to investigate how educational principles, pedagogy, and technology can help bridge gaps in learning while exploring various pedagogical theories and the corresponding technological frameworks that can enhance learning opportunities. We hope to encourage scholars to consider and more explicitly articulate their assumptions regarding the role of learning theory within their work.

Pedagogy (Hattie, 2008), refers to the methods and practices of teaching—the “how” of designing, implementing, and facilitating learning—while educational principles (Ornstein & Hunkins, 1993) are the underlying theories, values, and assumptions that guide these methods, providing the "why". In our quest for suitable pedagogical orientations given our current constraints, we acknowledge the limited scope of today’s understanding of ’learning’. Our ambition is modest: to enhance this understanding incrementally until broader change becomes feasible. This raises a critical question: Is it possible to achieve such transformation within the confines of the existing language that shapes learning?

The meaning of the word learning, as with all other words, is shaped by socio-historical influences (Vygotsky, 1978). The term ’learning’ has indeed moved from one neighborhood to another. The old neighborhood (until the invention of the school as we know it today) was big and extensive, covering all of life. However, the new definition is narrow and mostly represents the individual and level-specific conscious efforts gained and developed within institutionally dedicated frameworks, such as formal educational institutions. Notably, research evidence (e.g., Heish & Tsai, 2018; Tsai, 2009) has suggested that learners’ general conceptions of learning might be restricted or less sophisticated than what they perceive as possible in a different context, particularly due to the dominance of traditional schooling experiences. In other words, this new ’neighborhood’ of learning is narrowly focused on acquiring isolated cognitive skills and competing for achievements in an environment dominated by standardized measurements and competition (Nichols & Berliner, 2007). Such an approach has been criticized for undermining intrinsic motivation and holistic educational outcomes (Dweck, 2006; Ryan & Deci, 2000).

What is clear is that we need to begin to rethink our conceptualization of learning—perhaps because many of the challenges faced by educational institutions today stem from a limited understanding of how learning truly occurs. To do so, we offer a theoretical perspective which should help us take a few first steps.

In Section 2, we define the specific problem we address within the framework of the outlined theoretical perspectives. Section 3 delves into various pedagogical theories, while Section 4 examines the diverse technological frameworks provided by digital innovation, all viewed through the lens of the two theoretical orientations under analysis. In Section 5, we address the question posed in Section 2 by determining which theories and technologies most effectively bridge the identified learning gaps. Finally, in Section 6, the Conclusion, we offer a series of concluding remarks.

2. Learning gaps and theoretical perspectives

Learning gaps are defined as the differences between what students are expected to know at a particular stage of their educational

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journey and their actual knowledge and skills (Scherer et al., 2019; Vygotsky, 1978). Addressing learning gaps is essential to provide all students with equal opportunities to succeed academically. Various types of learning gaps can be identified:

- Foundational Skill Gaps: These occur when students lack essential skills in areas such as reading, writing, and arithmetic (Aesaert et al., 2015).
- Subject-Specific Gaps: These arise in specific academic subjects where students struggle with crucial concepts necessary for advancement (Tondeur et al., 2017).
- Skill Development Gaps: These refer to shortcomings in higher-order thinking and analytical skills (Scherer et al., 2019).
- Digital Literacy Gaps: These gaps highlight a student's inability to effectively use technology for learning (Siddiq et al., 2016).
- Language and Communication Gaps: These are difficulties related to language comprehension and effective communication (Livingstone, 2012).
- Socio-Emotional Learning Gaps: These encompass deficiencies in social skills, emotional regulation, and self-management abilities (Toh & Kirschner, 2023).
- Engagement and Motivation Gaps: These occur when students display a lack of interest or motivation, which can negatively impact their learning outcomes (Fredricks et al., 2004).

We focus our analysis on two theoretical perspectives: Constructivism and Maturana's learning theories. Constructivism centers on cognitive and individual knowledge construction, highlighting structured scaffolding and collaboration (Scherer et al., 2019; Tondeur et al., 2017). In contrast, Maturana's theories emphasize learning as a natural, emergent, and relational process influenced by emotional, ecological, and systemic interactions (Bekerman & Zembylas, 2018).

In educational technology, the dominant theoretical orientation has trended toward constructivism, a learning theory that explains how individuals build knowledge and meaning through experience and interaction. Constructivism promotes the idea that learners should actively build their own understanding and knowledge by interacting with the material and then reflecting on their experiences with the content. (Scherer et al., 2019; Tondeur et al., 2017).

Introducing new theoretical perspectives can enhance pedagogy by broadening how educators understand learning, and the learner's role. One such proposal is Maturana's theories, which highlight the biological foundations of human cognition and the relational and dynamic nature of learning (Bekerman & Zembylas, 2018; Maturana, 2002). These theories align with contemporary educational needs for holistic, interconnected, and adaptive learning environments (Nussbaum & Bekerman, 2025).

From Maturana's perspective, learning transcends mere information transfer; it involves creating environments where learners can engage in meaningful activities that encourage self-directed knowledge construction (Maturana & Varela, 1980, 1987). Education must adapt and respond to learners' needs, recognizing that learning emerges from the interaction between the learner and their environment (Souza et al., 2019). Consequently, effective teaching should account for the dynamic interplay between a student's internal states and external conditions (Scherer et al., 2019; Stolz, 2015). Maturana argues that cognitive processes are inherently biological, rooted in the organism's bodily structures. As such, education should not abstract these processes from the physical and emotional experiences of the learner. This understanding calls for holistic learning experiences that integrate intellectual, emotional, and physical development (Bunnell & Riegler, 2022). Highlighting the relational nature of learning, Maturana places emotions at the core of educational processes. Effective learning, therefore, entails fostering emotionally rich relational experiences among learners and between learners and teachers. In such an environment, creativity and learning outcomes naturally emerge, unbound by predetermined expectations, as students explore and create new pathways of understanding (Whitaker, 2022).

3. Pedagogical theories

Constructivism posits that learning is an active process wherein individuals build knowledge through experiences and interactions with the world (Tan & Ng, 2021). The following are theories that align with this perspective.

Social Constructivism underscores the importance of social interactions and cultural contexts in the construction of knowledge. Understanding and meaning are shaped not only by individual experiences but also through participation in cultural and social activities, in line with constructivist principles (Liangshi, 2025). Collaborative tools like co-authoring software (Frassl et al., 2018) and social learning platforms (Yilmaz & Yilmaz, 2019) are practical applications of this theory.

Problem-Based Learning (PBL) embraces an active, student-centric approach to education. Rather than absorbing knowledge passively, students tackle complex, real-world problems. This strategy fosters autonomy, as learners research, collaborate, and apply their understanding to solve open-ended challenges that mirror real-life situations (Hmelo-Silver, 2004). Simulations and virtual labs are often utilized to enrich scenario-based learning. Through PBL, students engage deeply with problems, devise solutions, and reflect on their experiences, aligning seamlessly with the constructivist emphasis on learning through experience and social interaction. An example is AI-driven problem-solving platforms like the ones used for creative problem-solving (Urban et al., 2024), or to predict protein structures solving complex problems in biology (Rives et al., 2021), among others.

Experiential Learning stresses that learning happens when students actively participate in experiences, reflect on them, and apply their newfound knowledge to new situations (Kolb, 2014). Immersive activities, such as virtual reality, exemplify this process. This approach aligns with Constructivism, as learners build understanding and skills through direct, hands-on experiences and subsequent reflection. Examples include immersive experiences with virtual and augmented reality (Liberatore & Wagner, 2021).

Constructionism posits that people learn most effectively when they actively engage in creating tangible objects in the real world. This approach extends beyond simply absorbing taught content to include crafting and interacting with what is learned in a tangible

manner (Kafai & Resnick, 2012; Papert, 1980). Examples include using platforms like Scratch, utilizing 3D printing, and working with robotics kits. As a natural progression of constructivism, constructionism also emphasizes that learners construct their own knowledge and understanding through experiences, rather than merely receiving information passively (Kafai & Resnick, 2012).

Transformative Learning emphasizes significant shifts in the fundamental aspects of thinking, feeling, and behaving. It entails profound perspective changes that occur through critical reflection and interaction (Mezirow, 2018). At the heart of transformative learning is critical reflection, where learners rigorously evaluate their own assumptions and beliefs. This approach is in line with Constructivist principles, which highlight that learners actively construct knowledge by engaging with and reflecting on their experiences within their environment. In transformative learning, this construction and reconstruction of knowledge and beliefs through critical reflection mirror the constructivist focus on developing and modifying mental models through interactive experiences. Tools such as e-portfolios (Chang et al., 2013) and AI-driven systems that facilitate reflective and adaptive feedback (Garcia-Varela et al., 2025) exemplify practical applications of these concepts.

Cultural-Historical Activity Theory aims to understand human consciousness and behavior by examining social interactions and cultural contexts. It posits that learning arises from interactions within these cultural and historical settings, facilitated by various tools and activities (Foot, 2014). Cultural-historical activity theory aligns closely with constructivism, sharing a focus on the pivotal roles of social interaction, cultural context, and mediation in shaping cognitive development.

Connectivism represents an evolution of constructivist theories into the digital age. It asserts that learning occurs through the formation and nurturing of connections among individuals and information, a concept that aligns with constructivism's emphasis on learners actively building knowledge from experience (Siemens, 2005). A prime example of connectivism in practice is the creation of online learning communities, where users share resources, exchange ideas, and ask questions using a common hashtag. Through these interactions, participants collaboratively construct and continuously refine knowledge, highlighting the networked and social character of connectivist learning.

On the other side, Maturana's Theories emphasize learning as a natural, emergent, and relational process shaped by emotional, ecological, and systemic interactions (Böhme et al., 2022). The following are theories that align closely with this perspective.

Emergent Learning presents a framework that views education as a dynamic, interactive, and ever-evolving process. In this framework, learning outcomes are collaboratively shaped by learners through their interactions within the educational environment. These outcomes are often unpredictable, emerging spontaneously from engaging with complex, adaptive systems. This approach highlights the non-linear and unpredictable nature of learning that results from system interactions, rather than from a top-down or rigidly structured approach (Yeoman & Wilson, 2019). Emergent learning aligns closely with Maturana's learning theories, which emphasize systemic, biological, and relational dynamics. Maturana's view of learning as a holistic, self-organizing process within adaptive systems offers a solid theoretical foundation for understanding the emergent and dynamic nature of learning in complex environments. An illustrative example of this is open-ended simulations, such as those experienced in Minecraft, where students are free to explore and interact with the environment in creative ways (Gui et al., 2025).

Relational Pedagogy is founded on the idea that meaningful educational experiences stem from the dynamic relationships among students, teachers, and the wider educational community. It acknowledges that learning transcends cognitive processes, incorporating emotional and social dimensions as well (Hinsdale & Ljungblad, 2016). Thus, learning unfolds through relationships and emotional connections. This approach aligns closely with Maturana's learning theories, which emphasize the integration of emotional and relational dynamics into educational practices. Maturana's theories, which emphasize systemic and biological interactions within learning environments, provide a profound theoretical foundation for highlighting the relational and emotional aspects of relational pedagogy.

Ecological Systems Theory suggests that human development is influenced by interactions within a variety of environmental systems, such as family, community, and broader societal contexts. Consequently, effective teaching should look beyond the confines of the classroom to encompass the dynamics of the home, community, and wider cultural settings (Bronfenbrenner, 1979; Burns et al., 2015). Similarly, Maturana's theories describe how organisms evolve through continuous interactions with their environments. Maturana's idea of structural coupling highlights the relational dynamics within learning systems, paralleling the way Ecological Systems Theory views individual development through the lens of complex, interconnected systems. Both theories emphasize the adaptive responses of organisms or individuals to their environmental contexts, underscoring the importance of adaptability in developmental processes.

Post-humanist Pedagogy draws on posthumanism, a philosophical perspective that moves beyond the classical humanist notions of the human being as distinct from and superior to the natural world and other forms of life. This pedagogical approach fundamentally reevaluates the role and purpose of education in a world where the boundaries between human, technological, and ecological realms are increasingly blurred. It questions the anthropocentric perspective that traditionally places humans at the center of educational endeavors (Snaza & Weaver, 2015; Taylor & Bayley, 2019). In this model, knowledge and agency are recognized as distributed across a spectrum of actors including humans, non-humans (such as animals and plants), and inanimate entities (like technology and data). Post-humanist Pedagogy aligns more closely with Maturana's theories, sharing a broad, ecological, and systemic view of learning interactions that encompass diverse agents—biological, ecological, and technological. Maturana's focus on the interconnectedness and mutual evolution of living systems within their environments underpins the philosophical basis of Post-humanist Pedagogy. An illustrative example of this approach is platforms like NASA's Climate Kids, which integrate environmental and ethical awareness into climate education (https://climatekids.nasa.gov/).

We can distinguish a third group of theories where both theoretical orientations, supported by Constructivism and Maturana's theories, are not present.

Cognitivism is a distinct learning theory, separate from both constructivism and Maturana's theories. In cognitivism, learning is

primarily understood as a result of internal mental processes. The mind is likened to a computer that processes, stores, and retrieves information, emphasizing how people perceive, think, understand, and remember (Sweller et al., 2019). Learning Management Systems (LMS) exemplify this approach, as they provide structured content that scaffolds knowledge. While Cognitivism shares some similarities with Constructivism—such as acknowledging that learners actively process and organize information—it does not align specifically with the social and experiential focus of Constructivism or Maturana's theories on autopoiesis and self-organization An example of this is the use of spaced repetition systems for enhancing learning and memory. This method involves gradually increasing the intervals of time between subsequent reviews of previously learned material (Zhang et al., 2021). Commonly implemented using flashcards (Halamish & Elias, 2022), this technique can also be facilitated by digital platforms such as Anki or Quizlet (Gilbert et al., 2023).

Self-Determination Theory (SDT) (Deci & Ryan, 1980) is a psychological theory of motivation, distinct from both constructivism and Maturana's theories. SDT, describes human behavior as self-motivated and self-determined, emphasizing autonomy, competence, and relatedness (Deci & Ryan, 2012). Systems based on SDT empower individuals to take control of their behaviors and goals, interact effectively with their environment, and build connections with others. While SDT shares some similarities with constructivism—such as acknowledging that learners actively process and organize information—it does not align specifically with the social and experiential dimensions of constructivism. Maturana, on the other hand, views pedagogy as a natural, self-organizing process where learning emerges unpredictably through interactions within a system. While SDT focuses on motivation and fulfilling psychological needs within predefined goals, Maturana emphasizes emergent learning without predetermined outcomes. Despite these differences, the three theories agree that learning is most effective when self-motivated and shaped by meaningful interactions with the environment. Examples of SDT in action include digital systems addressing student motivation in motor skill practice and school digital learning activities shaped by institutional policy and culture (Chiang, 2024). Although SDT shares the idea that learners are active agents in their own learning, it does not specifically align with constructivist principles or Maturana's theories. Instead, SDT offers a unique perspective on the motivational aspects of learning and human behavior (Chiu et al., 2024).

4. Technological frames

The following section discusses the diverse technological frameworks provided by digital innovation.

Blended learning (De Bruijn-Smolders & Prinsen, 2024), which merges online digital media with traditional classroom methods, effectively emphasizes the relational, embodied, and emergent aspects of education. It supports a relational learning process through both face-to-face and online interactions, enhancing relationships among students and between students and teachers, while extending these connections beyond the classroom for continuous community building (Graham, 2006). Blended settings reintroduce the physical and sensory dimensions often missing in purely online learning through in-class activities like hands-on experiments and demonstrations. This approach allows for emergent learning, where outcomes are not strictly predefined, enabling learners to delve deeply into subjects that interest them via project-based or inquiry-based tasks initiated in the classroom and extended online. Reflecting Maturana's theory of structural coupling, blended learning adapts and evolves with the interactions between the learner and their environment, with real-time customization of content based on feedback. In this model, technology is more than just a content delivery tool; it facilitates meaningful interactions through online discussions, collaborative digital projects, and virtual simulations that are integrated into classroom dialogues (Garrison & Vaughan, 2008).

Active methodologies leverage technology to create dynamic and interactive learning experiences that are student-centered. Within these we find different approaches; however, most focus on the technological-operational approach and not on the underlying pedagogical approach. For instance, interactive simulations and virtual labs, where virtual reality has taken control with situated learning where active simulation-based learning allows direct interactions and experiential learning (Santilli et al., 2024). When active methodologies overly emphasize technology, there's a risk that they may overshadow or underutilize human relationships. This can diminish the depth and richness of the learning experience, which should ideally nurture personal relationships and mutual emotional connections as foundational elements of learning. One way to counteract this is by integrating virtual reality with collaborative learning to foster community formation, support remote collaboration, and enhance the socialization skills of learners. However, as Jong (2023) points out, for Virtual Reality to become more widely adopted as an educational tool for formal education, the underlying pedagogies must be clearly structured and implemented. Learning scenarios should encourage reflection, questioning, and critical analysis of students' own learning processes. Technologies like virtual labs and simulations are highly effective for providing experiential learning opportunities but may not inherently promote reflective thinking unless specifically designed to do so. If these technologies are used mainly for operational tasks, students might miss deeper opportunities for critical engagement with the material or the implications of their actions within a broader societal and ecological context.

Among the various categories previously discussed, learning games are featured prominently (Hussein et al., 2025; Li & Tsai, 2013). These, along with edutainment, serious games, and gamification of learning, predominantly align with constructivist theories, emphasizing knowledge construction through active, interactive, and experiential learning processes. Certain aspects of these games also resonate with Maturana's theories, particularly when learning involves relational dynamics within the game environment or adaptations based on player interactions. Many studies show the educational benefits of using interactive devices for educational purposes (Hsia et al., 2025). However, it is crucial to acknowledge that the integration of games in educational settings can impact not only cognitive development but also physical, emotional, and social well-being (Melo et al., 2020).

Learning Management Systems (LMS) (Dias et al., 2017) such as Moodle, Blackboard, and Canvas are prevalent in educational institutions and align well with constructivist theories. These platforms support active learning by offering interactive content, quizzes, and assessments that engage students directly with the material. They also promote contextual learning through the use of case studies

and problem-based learning modules. Additionally, features like forums, wikis, and group project functionalities foster collaborative learning experiences, which are central to constructivist teaching. While primarily aligned with constructivist approaches, certain elements of Maturana's theories can also be integrated into these systems. For example, LMSs support relational learning by using discussion boards and group work tools that facilitate interactions among students and between students and instructors. Moreover, the incorporation of discussions, reflections, and project-based learning within these platforms can create opportunities for emergent learning, reflecting some aspects of Maturana's educational philosophy.

Adaptive Learning Technologies (ALTs) (Ganesh et al., 2025) tailor learning content and paths to each learner's performance and needs. They support constructivist principles by dynamically adjusting content difficulty and type according to student interactions, promoting active learning. Similarly, these technologies reflect Maturana's focus on adaptive systems, as they modify content and challenges in response to a learner's performance and feedback, creating a responsive learning environment. While Maturana highlights the significance of emotional and relational dynamics in learning, ALTs primarily concentrate on cognitive elements, potentially overlooking some relational aspects emphasized by Maturana.

5. Solving the learning gap

Effectively addressing the learning gap depends significantly on the educational context and the specific skills to be developed. Cognitivism and Learning Management Systems (LMS) are particularly well-suited for this purpose, as cognitivism's focus on mental processes facilitates targeted strategies to enhance core competencies, while LMSs provide the necessary structure and resources for effective delivery of these strategies.

When tackling subject-specific learning gaps, which often require deep understanding and mastery of specific academic disciplines, educational theories and technologies that promote detailed exploration, practical application, and contextual learning are vital. Problem-based learning and experiential learning are particularly effective, thanks to their emphasis on real-world application. This approach is complemented by blended learning, which allows for a mix of teaching methods and technologies, providing a comprehensive learning experience that deeply addresses specific subject matter. Adaptive learning technologies also stand out for their ability to tailor learning to the specific needs and progress of the learner.

Addressing the skill development learning gap, which focuses on enhancing skills such as critical thinking, communication, collaboration, and technical abilities, requires educational approaches that promote active engagement, practical application, and reflective thinking. Experiential learning and Problem-based learning are ideal for their emphasis on practical application and real-world problem-solving. Blended learning and active methodologies are the most suitable technologies, facilitating the practical application of skills in diverse contexts, essential for meaningful skill development.

To bridge the digital literacy learning gap, which includes the skills and knowledge necessary to effectively use digital technologies, connectivism is highly aligned due to its focus on learning through digital networks. Blended learning is the most comprehensive platform for integrating digital skills training effectively, combining traditional and digital pedagogies to ensure learners not only use but also understand and critically engage with digital tools.

For the language and communication learning gap, which involves developing language comprehension, expression, and effective interpersonal communication skills, social constructivism and cultural-historical activity theory are particularly effective. They emphasize social interaction and contextual learning, which are crucial for language development. Blended learning and active methodologies are the best technologies, allowing for both technological engagement and real-time communication practice, providing diverse and enriching language learning environments.

Addressing the socio-emotional learning gap, which focuses on skills such as empathy, self-regulation, and emotional intelligence, requires approaches that promote interpersonal connections and reflection. Relational pedagogy and social constructivism are highly effective, addressing the relational and emotional dimensions of learning. Blended learning and active methodologies, by integrating a variety of socio-emotional activities into both digital and face-to-face environments, ensure that learners engage in meaningful social interactions and reflective practices crucial for socio-emotional development.

Finally, to address the engagement and motivation learning gap, which involves maintaining interest and motivation in learning activities, experiential learning and problem-based learning are effective due to their focus on engaging real-world applications and problem-solving. Blended learning and active methodologies, which allow for a variety of interactive and engaging learning activities, ensure that learning is not only relevant and interesting but also varied and adaptable to individual learner needs. These aspects are key for sustaining motivation and engagement.

6. Conclusion

Both constructivism and Maturana's learning theories provide strong frameworks for understanding the efficacy of the discussed educational approaches and technologies in addressing specific learning gaps. Constructivism highlights the importance of active, social, and contextual learning, while Maturana's theories underscore the relational, adaptive, and systemic aspects of learning. Together, they suggest that learning environments that are interactive, adaptable, and contextually rich are most effective in promoting deep and meaningful learning.

It is crucial to recognize that while technology can enhance learning by creating interactive and immersive environments, genuine learning arises from lived experiences and interactions, not merely from using digital tools. If technology becomes the primary focus, learning might be reduced to a sequence of operational tasks within a digital setting, rather than emerging as a dynamic phenomenon (Higgins et al., 2012). Thus, viewing learning holistically and ecologically essential, where digital tools are just one element of a

broader educational landscape.

While constructivism seeks to engage learners on a deeper level, it may excessively concentrate on cognitive processes, potentially neglecting the holistic aspects of learning that encompass emotional, social, and physical elements—essential for a comprehensive learning experience. By prioritizing personalized learning paths and the individual construction of knowledge, there is a risk of learners achieving only a fragmented grasp of subjects, especially without a coherent structure or synthesis provided by the curriculum or facilitator. In this framework, learners might feel detached from the learning process, perceiving knowledge as an external object to be acquired rather than as an emergent, relational phenomenon shaped by their dynamic interactions with the environment.

Maturana's approach invites us to completely rethink learning, returning it to its foundational, broad-based roots. For Maturana, learning is not an intentional act; it is a natural function of all living systems simply by virtue of being alive. Life itself is synonymous with learning—there is nothing mysterious or special about it. Learning is inherently egalitarian, not tied to any specific role or status. Also, it is not competitive or a commodity, but rather a basic biological process. According to Maturana, learning is uniform; there are no special types of learning for different disciplines, as even disciplines do not exist in isolation.

Both verbal and mathematical learning, which are also rooted in language, do not require unique pedagogical approaches. In fact, pedagogy itself may be unnecessary; all that is needed is praxis and interaction within the environment. Humans are fundamentally solipsistic; nothing is transmitted directly into the system, yet it reshapes itself based on external coupling. Nothing is captured by the individual system, but its interactive journey continually molds it in unpredictable ways. We can only hope that redundant interactions will accumulate, creating a direction in autonomous change that aligns with our aspirations. We aim not to teach specific content, which is non-existent, but to foster relationships free from disciplinary constraints. Ideally, we wish for students to adopt the role of teachers themselves, reflecting interactional behavior rather than mastering the content of disciplines like philosophy or mathematics.

In this context, it is crucial to understand the limitations of language and its tendency to create categories. Categories foster recognition and unity, yet they also carry inherent risks. They can compress and obscure diversity, exaggerate divisions when amplified, and discriminate by prioritizing some elements over others. The term "category" (from the Greek katēgoria, originally meaning "to speak against") evolved from a tool of accusation to one of classification, though its inherent fluidity remains. When misused, categories can fracture reality, reducing it to isolated parcels rather than a cohesive whole. Importantly, these categories represent active roles—dynamic, emergent performances—not fixed statuses. They are not static objects, but rather ongoing processes shaped by an individual's interactive work within their environment.

This perspective suggests an integrationist view of language, a radical departure from traditional Western assumptions about language and communication which abandons the idea of communication as a 'sender-receiver' process, rejects code-based and rule-based models of language, questions the existence of any natural or universal distinction between language and non-language, and discards the notion of separate, independent 'channels' of communication (Jones & Read, 2023; Severo et al., 2022). The radical integrationist alternative treats communication as an open-ended continuum of integrated activities, shaped by the initiative of socio-historical individuals (Pablé, 2022). This means that there is continuous and simultaneous creation of meaning at all levels of interaction, both verbal and nonverbal, that all signs are products of the communication situation, and that there are no autonomous, context-free signs. This approach aligns with Maturana's view of learning as an emergent, integrated process inherent to living systems, emphasizing the holistic, interconnected nature of knowledge acquisition and the fluidity of communication (Kravchenko, 2022; Raimondi, 2022).

Learning, in Maturana's view, is not normative, it does not occur only when institutions or standards dictate. Learning is constant, a manifestation of any change or adaptation, a product of interaction. It is not merely cognitive, as cognition cannot be separated from other traits for analysis. Learning is inherently experimental and risky, with outcomes that are unpredictable. Yet, adaptations can be either alignments or oppositional, and if we aim for alignment, we must cultivate fields of trust for interactions to occur, although success is not guaranteed.

Finally, we cannot view ourselves as external observers in the learning process; we are as much a part of the learning interaction as any other entity, emerging from within these interactions. The process involves not just rational or cognitive faculties but a holistic integration of our emotional and cognitive selves, underscoring the interconnected nature of our living/learning experiences. Acknowledging the previous necessitates educational technologies that are both adaptable and responsive. When digital tools account for the learner's full context, including emotional well-being, personal interests, and social interactions, they foster an environment where learning evolves dynamically rather than remaining a static accumulation of information. Instead of treating learners as passive recipients, technology should empower them as active, embodied contributors to their educational journey. This approach requires designing systems and environments that go beyond mere content delivery to actively promote engagement on multiple levels.

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