

# Embodied Education and Technology-Mediated Educational Innovation: Theoretical and Operational Perspectives

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**Abstract:** Contemporary education faces a series of challenges that require a renewal of traditional teaching methodologies, to respond effectively to the needs of students and to social, cultural and technological transformations. The Embodied Education approach, which integrates the body and digital technologies into the learning process, emerges as an innovative proposal capable of overcoming the traditional separation between mind and body, theory and practice. This article explores the relationship between Embodied Education, disciplinary didactics and instructional technologies, analyzing the main embodied cognitive theories and their application in diversified educational contexts. Good practices are presented that demonstrate how the body, understood as a cognitive tool and agent of knowledge, can promote deep learning, motivation, inclusiveness and the development of transversal skills. In addition, the article addresses the challenges and opportunities arising from the integration of immersive and interactive technologies in education, and discusses the future prospects of embodied education, particularly in the context of inclusive school and teacher training. The embodied approach, which blends digital technologies, sensory experiences and bodily activities, represents a promising frontier for the renewal of teaching practices, promoting meaningful, interconnected and situated learning, in which the body, mind and environment interact in a dynamic and integrated way.



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## 1. Introduction

In the context of the educational transformations that characterized the beginning of the 21st century, the intersection of body, mind, and technology represents one of the most promising yet complex fields of didactic innovation

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(Agostini, & Francesconi, 2021). The evolution of digital technologies, combined with a renewed focus on the embodied experience of learning, has opened new trajectories for theoretical reflection and methodological experimentation within educational systems. Within this framework, the concept of Embodied Education emerges, which is an educational paradigm that recognizes the active role of the body in cognitive processes and knowledge construction, overcoming the traditional mind-body dichotomy and promoting a holistic approach to teaching and learning (Ionescu, & Vasc, 2014).

Based on the premises of embodied cognitive sciences, the Embodied Education paradigm focuses on how the body, understood not only as a biological support but as a sensory-motor, perceptual, and expressive device, actively participates in the elaboration of thought, the understanding of abstract concepts, and the structuring of disciplinary knowledge (Fugate et al., 2019). This approach is rooted in a long tradition of thought spanning phenomenology, cultural psychology, and neuroscience, proposing a vision of the human being as an embodied, situated, and interactive entity. At the same time, it connects to the most recent innovations in the educational field, particularly those related to the pedagogical use of digital technologies, immersive devices, and interactive platforms (Macrine, & Fugate, 2021; Zhou et al., 2021).

The growing development of educational technologies has profoundly changed the ways knowledge is transmitted and constructed. From being ancillary tools to the traditional lecture, technologies have gradually transformed into cognitive environments capable of amplifying experience, fostering interaction, stimulating creativity, and enabling new forms of expressive languages (Ioannou, & Ioannou, 2020). Technology-enhanced learning can no longer be thought of in purely instrumental terms but requires a broader rethinking of educational dynamics, pedagogical relationships, and learning spaces. In this perspective, the challenge is not only to integrate technologies into school and university contexts but also to design educational experiences capable of significantly activating the bodily, cognitive, and emotional dimensions of learning (Ciccarelli et al., 2024).

The convergence between Embodied Education and Educational Technologies also brings into play the theme of disciplinary teaching methods, namely the specific ways in which knowledge is taught, learned, and transformed across different areas of the school and academic curriculum (Sriraman, & Wu, 2020). This issue is not marginal: each discipline carries its own language, epistemology, and specific way of relating to the world and experience. Integrating the embodied approach into disciplinary knowledge means asking how the body can contribute, for example, to understanding mathematical concepts, reflecting on history, critically reading literary texts, or engaging in artistic production. It also means exploring how technologies can mediate these experiences in new ways through simulations, virtual environments, multisensory interfaces, and mobile devices, opening up novel forms of didactic interaction (Rosa, & Tafuri, 2023).

In an educational context marked by complexity, fragmentation, and discontinuity, heightened by recent health emergencies and rapid digital transformations, it is increasingly urgent to build pedagogical models capable of integrating body and technology in a coherent and systemic vision (Di Tore et al., 2013). Adopting an embodied perspective allows for a rethinking not only of what is learned but also of how it is learned, returning centrality to lived experience, situated interaction, and embodiment as an epistemic dimension. At the same time, the critical and conscious use of educational technologies can promote access to new

forms of participation, inclusion, and personalized learning, overcoming transmissive and standardized approaches (Schilhab, & Groth, 2024).

This article aims to explore the theoretical and operational connections between Embodied Education, didactic innovation, and technological mediation, with the goal of outlining an interpretative framework capable of guiding educational design in formal and informal contexts. Specifically, it will focus on three main axes: (1) the reconstruction of the epistemological foundations of the embodied approach, referring to the contributions of cognitive sciences, phenomenological pedagogy, and educational neuroscience; (2) the analysis of the potentials and limitations of educational technologies in promoting embodied, interactive, and participatory learning; (3) the proposal of models and operational strategies for integrating the embodied approach into disciplinary teaching, through concrete examples, case studies, and best practices.

The intention is not to propose a single or prescriptive formula but to offer a theoretical-practical framework that can support critical reflection and methodological innovation by teachers, trainers, educators, and researchers. The challenge, indeed, is not only technological or methodological but profoundly cultural: it involves a paradigm shift in how we conceive learning, knowledge, and the role of the educational subject.

In this regard, the article addresses a broad, interdisciplinary audience, including scholars of education sciences, pedagogues, experts in learning technologies, trainers, and policymakers. In the first part, a theoretical reconstruction of the evolution of the concept of Embodied Education will be presented, highlighting how it differs from more traditional educational approaches and how it integrates with the situated learning perspective. The pedagogical implications of embodiment will be analyzed, particularly with reference to the centrality of experience, the role of movement, and the affective and relational dimension of learning.

In the second part, the potential of educational technologies – especially immersive and interactive ones – in supporting embodied learning will be explored. Tools such as augmented reality (AR), virtual reality (VR), body-based interfaces, wearable devices, and collaborative digital platforms will be considered, highlighting their possibilities for sensory-motor activation, multimodal representation of knowledge, and shared knowledge construction.

Finally, the third part of the article will be dedicated to analyzing significant teaching experiences where the embodied approach has effectively integrated with technologies in different disciplinary contexts. Through the study of concrete cases and an examination of the strategies adopted, the aim will be to highlight how it is possible to design educational activities that synergistically value the body, relationship, and technology in ways that align with educational objectives. Specifically, operational models and tools for didactic design will be proposed, useful for guiding educational actions in an embodied and technologically mediated key.

Thus, the article aims to contribute to the reflection on contemporary didactics, suggesting that the meeting of embodiment and technology, far from being a contradiction, could represent an opportunity to rethink educational processes in depth and to develop more inclusive, dynamic, and meaningful educational practices. This meeting, however, requires solid theoretical awareness, articulated methodological competence, and an ethical commitment to building learning environments that are truly centered on the subject and its evolutionary potentials.

## 2. Embodied Education: Theoretical Foundations

The reflection on Embodied Education has its roots in a paradigmatic shift that, starting in the 1980s, affected cognitive sciences, prompting a deep revision of the computational model of the mind (Lindgren, & Johnson-Glenberg, 2013). According to this classical model, the mind was conceived as an abstract symbolic processor, operating according to formal logics and independent of the bodily and sensorimotor dimensions of experience. This paradigm, inspired by the metaphor of the computer, influenced learning psychology and teaching for decades, with significant consequences for educational design, which focused on processes of transmission and memorization of information (Cipollone et al., 2023).

However, with the rise of Embodied Cognitive Sciences (Johnson, & Lakoff, 2002; Varela et al., 2017), an alternative vision developed, questioning the separation between mind and body, proposing an integrated approach where cognition is rooted in the morphological characteristics of the organism, its perceptual and motor abilities, and the environmental context in which the individual is situated. In this perspective, the body is no longer seen as a mere vehicle for the mind, but as a constitutive element of thought itself. Knowing does not occur exclusively through disembodied mental operations, but results from a dynamic interaction between the agent and the world, mediated by action and perception.

Embodied Cognition emphasizes that meaning, understanding, and mental representation cannot be dissociated from sensory and motor experience (Paloma, & Tafuri, 2016). For example, abstract concepts such as time, space, affection, or causality are structured based on primary bodily schemas (image schemas) and conceptual metaphors derived from embodied experience. This implies that learning is not a purely mental process, but an embodied, situated, and culturally mediated activity. Consequently, education must take into account the active role of the body and the environment in organizing knowledge and in shaping the individual.

On a pedagogical level, this vision aligns with a series of approaches that have valued the bodily dimension of education long before cognitive science formalized its principles. Phenomenological Pedagogy (Merleau-Ponty et al., 2013), active education (Dewey, 1938), psychomotor education, and movement pedagogy have highlighted, in different ways, the importance of the body as a tool for exploration, expression, and mediation of the world. In this sense, Embodied Education can be considered as a point of convergence between the new developments in cognitive sciences and a pedagogical tradition that has long recognized the educational value of lived experience and doing (Kersting et al., 2021).

One of the most significant implications of this approach concerns the role of action in learning. According to Situated Action Theory (Antonaccio et al., 2017), knowledge is not something static that can be transmitted and acquired in a decontextualized manner, but is built through the interaction between the subject and the environment, through practical activity. Learning, in this perspective, means acting meaningfully in a context, exploring, manipulating, making mistakes, and correcting oneself. Embodied learning thus promotes the construction of knowledge that is deeply rooted in experience and, therefore, more stable, transferable, and motivating.

The importance of embodiment in education has been further reinforced by studies in educational neuroscience, which have shown how learning processes involve multisensory and motor brain networks, demonstrating the close connection between movement, emotion, and cognition. For example, research on mirror neurons (Rizzolatti, & Sinigaglia, 2006) has shown that observing an action activates the same brain areas involved in performing it, suggesting that learning through

imitation, simulation, and bodily participation has solid neural foundations. Similarly, it has been shown that motor activities, such as gestures, can facilitate the memorization and understanding of abstract concepts, especially in children during developmental stages.

In light of this evidence, Embodied Education is conceived as an educational paradigm that integrates theoretical knowledge with concrete experience, stimulates active student engagement, and promotes learning through the relationship between body, environment, and culture. Far from being a marginal proposal or reserved for specific educational contexts (such as physical education, arts, or laboratory education), it challenges teaching in a broad sense, requiring a profound reorganization of how educational activities are designed, evaluated, and interpreted (Damiani, 2017).

It is important, however, to clarify that Embodied Education is not limited to an education "through the body," as seen in psychomotor education or educational dance, but implies an education of cognition through embodiment. In other words, it is not just about moving, but about learning with and through the body, making the body itself an epistemic mediator. This requires specific didactic and methodological awareness, capable of enhancing the interaction between gesture, perception, emotion, and reflection. It is not enough to "do practical activities"; contexts and devices must be designed to foster authentic embodied learning, deeply connected to experience and understanding (Gerofsky, 2015).

Another central aspect of Embodied Education is its situated and relational dimension. The body, in fact, never exists in isolation, but is always immersed in a physical, social, and symbolic environment that shapes and constitutes it. Embodied learning is, therefore, situated learning, occurring in real or simulated contexts, through interaction with people, objects, tools, and meaningful environments. This calls for overcoming abstract and decontextualized learning environments, such as those often characteristic of traditional lectures, in favor of dynamic, multisensory, and interactive environments that stimulate active student participation (Abrahamson et al., 2023).

In this direction, the contribution of Experiential Pedagogy is also relevant, which values learning as a reflective process on lived experience. Embodied Education shares with this approach the idea that education should start from doing to arrive at thinking, that experience should be organized to promote conceptual elaboration, and that the body should be recognized as a vehicle for knowledge, meaning, and identity. This approach proves particularly effective not only in the early years of schooling but also in adult education, university teaching, and non-formal learning contexts (Alibali, & Nathan, 2012).

Finally, Embodied Education also has important ethical and inclusive implications. Recognizing the role of the body in education also means recognizing the diversity of bodies, experiences, and ways of learning. This involves paying special attention to inclusion, valuing differences, and creating environments capable of welcoming the plurality of lived experiences. The body is never neutral: it is marked by gender, culture, ability, and personal history. An embodied education, aware of these aspects, can foster more equitable, respectful, and participatory educational practices, contributing to the formation of critical and aware individuals (Beate Reinertsen, 2016).

In summary, Embodied Education represents a theoretical and pedagogical perspective capable of deeply renewing contemporary teaching. It proposes a view of learning as an embodied, situated, relational, and experiential process, integrating theoretical knowledge and practical activity, reflection and corporeality, individuality

and context. This vision engages in dialogue with educational technologies, as will be seen in the next section, insofar as these technologies can enhance, represent, and amplify the embodied experience, generating innovative, inclusive, and transformative learning environments.

### 3. Educational Technologies and Educational Innovation

The integration of technology into teaching represents one of the most significant challenges and opportunities in contemporary education. In an era marked by the pervasiveness of digital technology, pedagogical reflection is called not only to understand the impact of technology on learning but also to rethink teaching practices and models in light of the transformative possibilities offered by such tools (Dijkstra et al., 2014). Far from being merely support devices, educational technologies form genuine learning environments capable of shaping the ways of teaching, learning, communicating, and constructing meaning. In this perspective, educational innovation is not reducible to the adoption of technological tools but involves a comprehensive redefinition of the roles of the teacher, the learner, and educational practices, oriented towards a more participatory, experiential, and situated paradigm (Kosmas, & Zaphiris, 2018).

In the context of Embodied Education, technologies can play a crucial role in promoting embodied, multisensory, and interactive forms of learning. Recent developments in augmented reality (AR), virtual reality (VR), educational robotics, tangible interfaces, and wearable technologies offer unprecedented possibilities for the user's bodily and immersive involvement, enabling educational experiences that transcend the barriers between physical and symbolic space, between doing and thinking, and between concrete and abstract. In this sense, technologies not only support learning but become cognitive and bodily extensions that amplify the perceptual, motor, and symbolic abilities of the individual (Tran et al., 2017).

One area of reflection concerns the use of immersive technologies to facilitate the understanding of complex concepts through experiential simulation. Virtual reality, for example, allows interactive and engaging exploration of simulated environments, making disciplinary content that would otherwise be abstract or difficult to represent more accessible. Through VR headsets, students can "enter" a cell, closely observe a work of art, travel through the solar system, or interact with historical phenomena. This type of experience, when designed according to solid pedagogical principles, can promote meaningful learning by supporting attention, motivation, and memory processes, as well as stimulating critical thinking through reflection on the lived experience (Black et al., 2012).

Alongside VR, augmented reality enhances the real world by overlaying digital information on the physical environment, offering a mixed interaction between the virtual and the real. In the field of science, for example, AR can be used to visualize molecular motions on a laboratory table or to make magnetic field lines visible in a physics lesson. These applications reinforce the idea that learning is not confined to the textual or symbolic dimension, but can occur in a situated, embodied, and manipulative manner. In this sense, technologies can act as epistemic mediators that enhance the cognitive and perceptual capacities of the learner (Nooteboom, 2012).

Another emerging field is that of tangible interfaces and educational robotics, which emphasize the bodily and interactive dimension of learning. Tangible interfaces are based on the use of physical objects to interact with digital content, allowing for hands-on learning where manipulative action promotes conceptual understanding. In educational robotics, students program small robots to perform

specific actions, developing problem-solving, computational logic, and collaboration skills. These activities involve direct bodily and action-based engagement in the learning process, consistent with the principles of Embodied Cognition (Riva, 2008).

Wearable technologies, such as smartwatches, biometric sensors, and smart headsets, open up further possibilities for monitoring and customizing the learning experience by taking into account the user's physical and emotional conditions. From an embodied perspective, such tools enable the integration of bodily data into the educational process, promoting greater self-awareness and mindfulness of one's psychophysical state during learning. For example, in physical education or mindfulness contexts, the data collected can be used to adjust the intensity of exercises or stimulate reflection on the relationship between the body, emotion, and concentration.

However, the introduction of technology into education is not without its challenges and requires careful pedagogical reflection. Educational innovation is not exhausted in the availability of technological tools, but depends on the quality of their pedagogical integration, teacher training, instructional design, and awareness of the underlying epistemological assumptions. In this sense, there is a need to move from instrumental use of technology to reflective and transformative use, taking into account the relational, bodily, and cognitive dynamics activated in learning contexts (Sullivan, 2018).

The risk of uncritical use of technology lies in the creation of hyper-digitalized and disembodied educational environments, where interaction is reduced to passive consumption of content or automated navigation through platforms. This approach not only contradicts the principles of Embodied Education but may also lead to forms of alienation, isolation, and fragmentation of the educational experience. To avoid such risks, it is essential to adopt a design perspective focused on educational ergonomics and the quality of the user experience, understood not only in technical terms but also pedagogically, emotionally, and bodily (Zhu, & Jung, 2024).

Moreover, the use of technology in teaching requires a rethinking of learning assessment models. Traditional assessment practices, often based on standardized tests and written exams, are inadequate for capturing the embodied, situated, and processual dimensions of learning mediated by technology. Therefore, it is necessary to develop authentic, formative, and multimodal assessment strategies that recognize the experiential dimension, reflection, the ability to act in context, and competence in the critical and creative use of digital tools.

From the teacher's perspective, the integration of technology involves a transformation of the professional role, from that of a transmitter of knowledge to that of a facilitator of learning experiences. This requires specific competencies not only technical but also pedagogical, communicative, and epistemological. Initial and in-service teacher training should, therefore, include pathways that promote critical digital literacy, the design of technologically mediated learning environments, and awareness of the body and interaction as central dimensions of teaching practice (Wilson, & Golonka, 2013).

The collaborative and connective dimension of learning, enhanced by technology, represents another element of innovation. Digital environments such as collaborative platforms, educational social media, online communities, and virtual learning spaces allow for the co-construction of knowledge, sharing of experiences, and the creation of networks between students, teachers, and experts. In this perspective, learning is seen as a distributed, intersubjective, and continuous process, extending beyond the spatial and temporal boundaries of the classroom and articulated in blended, hybrid, and transmedia environments (Smart, 2014).

In other words, educational technologies offer significant potential to support and transform educational processes, provided they are critically and consciously integrated within solid pedagogical frameworks, such as that of Embodied Education. They can become powerful tools to make learning more engaging, inclusive, embodied, and situated, fostering an education centered on experience, relationship, and active participation. The challenge today is not so much to "digitize" teaching, but to humanize the use of technology, restoring the role of the body, environment, and culture as protagonists in the construction of knowledge

#### **4. Embodied Cognition and Situated Learning: Implications for Subject-Specific Teaching**

In recent decades, the paradigm of Embodied Cognition has introduced a significant shift in cognitive science and education, leading to a profound revision of traditional conceptions of learning (Rivoltella, 2012). The idea that cognition is not merely an abstract mental process, but is rooted in bodily experience, situated action, and interaction with the environment, challenges the classical cognitive approach, which tended to separate thought from the body, mind from the world, and the individual from the context. In this perspective, learning emerges as a dynamic, embodied, and distributed process, in which the learner constructs knowledge through active, sensory, and motor engagement in social and cultural practices.

The theory of Embodied Cognition naturally converges with the approach of Situated Learning, which posits that knowledge is inseparable from the context in which it is acquired and is constructed through participation in authentic, shared, and culturally meaningful practices. Learning is not merely the acquisition of information, but a process of legitimate peripheral participation (Gomez Paloma et al., 2016) within communities of practice, where individuals learn through observation, imitation, collaboration, and reflection on action. The interaction between these two paradigms provides a solid theoretical foundation for rethinking subject-specific teaching in embodied and situated terms, overcoming the remaining dichotomies between theory and practice, mind and body, school and life.

In the context of subject-specific teaching, the integration of these approaches requires reconsidering the ways in which content is presented, the languages used, and the experiences offered to students. In particular, there is a need to develop teaching practices that emphasize embodiment, concrete manipulation, movement, the use of space, and social interaction as essential resources for learning. This approach contrasts with the transmissive view of knowledge, instead promoting a pedagogy of experience, action, and interaction, capable of making knowledge construction processes meaningful and lasting (Gomez Paloma, 2013).

For instance, consider the teaching of mathematics. Mathematics is often perceived as an abstract discipline, distant from everyday experience and embodiment. However, numerous studies have demonstrated that mathematical thinking has embodied roots, based on motor schemas, bodily metaphors, and spatial interactions. The use of manipulatives, physical representations of operations, playful activities, and movement in space can help students understand complex concepts such as symmetry, proportion, or three-dimensional geometry. In this sense, the body becomes an epistemic mediator that allows students to experience and internalize mathematical structures through action.

Similarly, in the teaching of science, the embodied and situated approach makes learning more concrete and engaging. Laboratory activities, the construction of physical models, interactive simulations, and field experiences represent

opportunities where students learn by doing, observing, and interacting with natural phenomena. The body is continuously involved in gestures, perceptions, manipulations, and explorations, enabling a deeper understanding of scientific phenomena. Science, thus conceived, is no longer a static body of knowledge to be transmitted, but a dynamic process of inquiry, experimentation, and dialogue with reality (Ceciliani, 2018).

Humanities teaching, such as history, philosophy, or literature, can also benefit from an embodied and situated approach. In history, for example, the use of role-playing, dramatizations, and environmental reconstructions allows students to step into the shoes of historical figures, empathizing with the dilemmas, emotions, and decisions of the past. In this case, embodiment is not just an expressive channel but a cognitive tool that allows students to process the meaning of historical events in a deeper way. In literature, reading aloud, theatrical performances, and bodily analysis of poetic or narrative texts foster an embodied aesthetic experience, where meaning is constructed through rhythm, voice, gesture, and emotional interaction (Pastena et al., 2015).

In foreign language teaching, the role of the body is even more evident. Language acquisition theories emphasize the importance of action, situated context, and social interaction in developing communicative skills. Teaching activities that involve movement, gestures, role-playing, and the use of space promote a more intuitive and practical understanding of linguistic structures. Learning thus takes place through an embodied use of language, which is not learned as a static object but as a living tool for communication and relationship (Calò et al., 2017).

This reconsideration of subject-specific teaching also implies a redefinition of educational contexts. Traditional classrooms, conceived as static spaces oriented toward frontal teaching, often fail to support embodied and situated approaches. It is necessary to rethink the learning environment as a flexible, dynamic, and modifiable space, where the body can move freely, interact with materials, explore the surroundings, and participate in multisensory experiences. The use of external environments, such as museums, laboratories, parks, businesses, and urban spaces, can also become an integral part of subject-specific teaching, promoting contextualized and authentic learning (Zambianchi, & Scarpa, 2020).

In this scenario, the role of the teacher takes on a new configuration. The teacher is no longer merely a transmitter of content but a designer of experiences, a facilitator of processes, and a mediator between body, mind, and environment. Teachers must be able to orchestrate complex teaching situations, where knowledge is built through action, dialogue, and reflection. This requires specific training that values the teacher's bodily, relational, and design skills, supporting them in the transition to an embodied pedagogy (Ferri, 2022).

Finally, it is important to emphasize that the integration of Embodied Cognition and Situated Learning in subject-specific teaching is not a peripheral or niche operation, but a necessary response to the challenges of contemporary education. In an increasingly complex, interconnected world characterized by rapid changes, students need to develop skills that go beyond mere theoretical knowledge: critical thinking, adaptability, emotional intelligence, and a sense of body and environment. Embodied and situated teaching, in this sense, offers a pedagogical horizon capable of integrating knowledge, skills, and existential dimensions, restoring to schools their fundamental function of shaping whole, conscious, and active individuals in the construction of their knowledge.

## 5. The Integration of the Embodied Approach and Educational Technologies in Educational Practices

The integration of the embodied approach and educational technologies into educational practices is not a theoretical abstraction but finds concrete application in numerous innovative experiences conducted at various levels of the educational system, both in school and university contexts. Analyzing case studies and best practices not only highlights the feasibility and effectiveness of such approaches but also helps to understand how they can be designed, implemented, and adapted according to specific disciplinary needs, available technologies, and students' requirements (Leitan & Chaffey, 2014).

One of the first areas where the embodied approach has found systematic application is in primary education, particularly through practices related to mathematics and physical education. An emblematic case is the "Math & Movement" project, developed in the United States, which combines structured physical activities with basic mathematical concepts. Students learn operations, number sequences, geometry, and measurements through ground games, physical courses, and body patterns. Research connected to the project has shown significant improvements in content learning, as well as greater motivation and attention from students (Lindberg et al., 2010). The body is not only a vehicle for movement but becomes a cognitive tool that supports understanding, abstraction, and memorization.

Another significant example concerns the use of historical dramatization as an embodied strategy in history education. In some secondary schools in the United Kingdom, teachers and students collaborate in the creation of historical reenactments, building physical environments, costumes, and sets that allow them to "enter" the historical events being studied. Students assume roles, participate in debates, and confront moral dilemmas from the past. This type of experience, which combines physical performance, critical reflection, and collaboration, fosters a more empathetic and profound understanding of the historical context. In this case, the body becomes an "embodied witness" through which access is gained to the existential dimension of history (Shapiro, & Stolz, 2019).

In the university context, the Embodied Learning Lab at Aalborg University (Denmark) has developed an innovative training model for future teachers, based on the integration of bodily experience, design thinking, and digital technologies. Participants engage in immersive workshops where they explore the relationship between movement, space, and learning, using tools such as augmented reality, motion sensors, interactive surfaces, and gamification platforms. The lab becomes an experimental ecosystem where knowledge is built through bodily experience and multimodal interaction. Data collected shows that such experiences produce positive effects not only in terms of content learning but also in pedagogical awareness and the ability to design effective learning environments (Shapiro, & Spaulding, 2014).

Another promising field is foreign language teaching, where the embodied approach has been effectively combined with immersive technologies. The "Embodied L2 Learning" project conducted at the University of Groningen used 3D virtual environments, virtual reality (VR) headsets, and motion capture technologies to teach English as a second language. Students interacted with avatars and virtual objects, simulating real-life situations (e.g., ordering at a restaurant, asking for directions, shopping), using gestures and movements that reinforced learning of linguistic structures. The results highlighted greater lexical retention, improved fluency with idiomatic expressions, and higher communicative self-esteem among students (van der Schaaf et al., 2019).

In vocational training, the adoption of bodily simulation environments has led to best practices that enhance embodied and situated competencies. For example, in nursing and medical training, intelligent mannequins, virtual reality, and bodily simulations are used to practice complex clinical procedures. These technologies allow students to "experience" in a protected environment, make decisions, manage emotions, and reflect on their actions. In this context, the body is both an object of learning (anatomy, physiology, manipulation) and an epistemic subject (an agent who perceives, decides, and learns). Training thus becomes an embodied process that integrates theory, practice, and reflection (Harbourne, & Berger, 2019).

Another notable practice is the experiences conducted in outdoor schools, particularly in Scandinavia and Canada, where subject-specific teaching is often carried out through activities in nature. Learning takes place through walking, exploring, building, interacting with the environment, and reflecting in groups. Natural sciences, geography, environmental education, and even mathematics and language are taught in real and bodily contexts, where movement and direct contact with materials offer a profound opportunity for embodied learning. This approach not only promotes learning but also fosters psychological and physical well-being, concentration, and environmental responsibility (Zwaan, 2021).

Numerous embodied experiments have also been conducted in Italy. A significant example is the "Body, Emotions, and Learning" project, promoted by schools in the Trento province in collaboration with university researchers. The project introduced interdisciplinary activities in the curriculum that combine educational dance, theater, mindfulness, and educational robotics. The aim was to explore how the conscious use of the body can support disciplinary learning and emotional regulation. Qualitative results show an improvement in metacognitive skills, motivation, and student participation, as well as increased cohesion in class groups. The body, in this case, is not only a vehicle for learning but also a space for awareness and educational transformation (Farina, 2021).

A final case of interest is the use of Kinect technology and motion tracking systems for interactive educational activities in secondary schools. In some European institutions, educational software has been developed that can detect body movements and transform them into inputs for interaction with subject-specific content (Kosmas, & Zaphiris, 2018). For example, students can "draw" mathematical functions by moving their arms, explore geographical environments by walking on maps projected on the floor, or learn the physics of motion by replicating gestures and trajectories. The learning environment thus becomes a dynamic, multisensory interface, where the body moves, explores, and learns.

A comparative analysis of these cases highlights some common elements that characterize the best practices of embodied education:

1. Centrality of the body as a cognitive agent: In all experiences, the body is not just an executive tool but an integral part of the knowledge process.
2. Situated and authentic contexts: Learning takes place in meaningful, real or simulated environments that foster the connection between theory and practice.
3. Conscious integration of technologies: Technologies are not used as mere supports but as active mediators of the embodied experience.
4. Experiential instructional design: Activities are built according to a laboratory-based logic that values doing, reflection, and collaboration.
5. Formative and narrative assessment: Evaluation processes tend to value the learning journey, subjective transformations, and enacted competencies.

6. Targeted teacher training: Involved teachers are trained not only in technologies but also in the epistemological, bodily, and emotional aspects of teaching.

In conclusion, the cases analyzed demonstrate that Embodied Education, integrated with educational technologies and rooted in situated learning, is not only possible but represents a concrete opportunity to innovate subject-specific teaching. The adoption of such practices requires a cultural and organizational shift, involving curricula, teacher training, space arrangements, and an overall pedagogical vision. However, the observable benefits in terms of meaningful learning, motivation, inclusion, and well-being make this educational investment both desirable and necessary.

## 6. Conclusions and Future Perspectives

The contemporary educational landscape faces increasingly complex challenges, linked not only to the evolution of technologies but also to the growing diversification of student needs and the necessity of responding effectively to the demands of a rapidly changing world. In this context, the approach of Embodied Education, integrated with educational technologies, emerges as an innovative and promising proposal to renew traditional educational practices, overcoming the separation between body and mind, theory and practice, and learning and real life.

The evidence gathered through the presentation of case studies and good practices, described in the previous sections, confirms that the embodied approach not only represents a valid response to the critical issues of the educational system but also an opportunity to develop more effective, meaningful, and inclusive learning methods. The connection between body, mind, and environment is crucial for deep learning, which goes beyond the mere acquisition of content and involves the active, emotional, and social engagement of students.

The principles of Embodied Cognition, though rooted in a solid theoretical tradition, find concrete practical application in various educational contexts, thanks to the use of innovative technologies that amplify the potential of the body as a cognitive tool. Educational experiences that use movement, dramatization, simulation, and physical interaction with the environment not only facilitate the acquisition of disciplinary content but also promote the development of essential transversal skills such as creativity, collaboration, problem-solving, and emotional awareness. Thus, teaching becomes an embodied experience, where every gesture, action, and thought are interconnected in a continuous process of discovery and reflection.

One of the most significant aspects of this perspective is the ability to respond to the needs of students with different learning styles. The embodied approach can be particularly effective for students who do not easily adapt to traditional teaching methods based on verbal and written methodologies. By including activities that stimulate movement, play, social interaction, and exploration, greater inclusivity is promoted, and inequalities in the educational process are reduced, offering all students the opportunity to express and develop their potential.

Another central point that emerged from this reflection concerns the transformation of the teacher's role. The teacher is no longer seen merely as a transmitter of knowledge but as a facilitator of experiences, a designer of learning environments that stimulate interaction, curiosity, and critical reflection. This approach implies that teachers must be trained not only in specific disciplines but also in pedagogical skills related to integrating corporeal and digital technologies, as

well as using teaching methodologies based on action and experience. This requires a significant investment in continuous professional development, so that teachers are prepared to face the challenges posed by adopting new teaching methods and technologies.

However, although the results from studies and experiments are promising, integrating the embodied approach into disciplinary teaching is not without challenges. The main difficulties include resistance to change, lack of adequate resources, the difficulty of designing educational activities that effectively integrate the body and technologies, and uncertainty about evaluation methods. Evaluation, in fact, represents one of the most complex aspects when it comes to embodied and situated learning, as the cognitive and affective processes involved are often difficult to measure using traditional methods. It is therefore essential to develop new assessment tools that consider not only tangible results but also processes, transversal skills, and students' personal growth.

Future prospects for Embodied Education are numerous and involve various areas of development, both theoretical and practical. Theoretically, one of the major challenges is to further explore the connections between embodied cognitive theory and educational neuroscience, in order to build an integrated model that can guide the design of teaching practices. Neurosciences are increasingly demonstrating that learning is not only a cognitive process but also a bodily phenomenon, where movement and interaction with the environment significantly impact how we acquire and retain information. In this sense, future studies could further explore how different forms of bodily engagement (from dance to manipulation, to interaction with technology) may differently influence the acquisition of skills in various disciplines.

Practically, one of the most promising directions concerns the use of immersive technologies, such as virtual reality (VR), augmented reality (AR), and gamification, to create learning environments that promote bodily interaction and the simulation of complex situations. The adoption of virtual environments that allow students to explore, move, and physically interact with digital content could represent a new frontier for embodied education. For example, creating "3D classrooms" where students can physically interact with mathematical, physical, or historical objects, as well as immerse themselves in naturalistic or historical scenarios, could stimulate experiential learning that surpasses the limitations of traditional frontal lessons.

Moreover, an interesting prospect concerns the adaptation of Embodied Education to the needs of inclusive schools. Teaching methodologies that combine body and technology could prove particularly effective in helping students with sensory, motor, or cognitive disabilities to develop transversal skills and access personalized learning paths. Technology, in particular, could serve as a mediator to overcome physical barriers, creating learning environments that meet specific accessibility and inclusion needs.

Finally, the implementation of embodied teaching on a large scale requires reflection on educational infrastructure, school organization, and public policies. Governments, educational institutions, and schools must promote the spread of these practices through support policies, investing in the necessary technologies but also in teacher training and the design of learning spaces that encourage movement, collaboration, and creativity. This implies a strategic vision that views education not just as a place for the transmission of knowledge, but as a dynamic and living environment where body, mind, and technology are closely interconnected.

In summary, integrating Embodied Education into disciplinary teaching represents one of the most promising pathways to respond to contemporary

educational challenges. Although there are still obstacles and difficulties to overcome, the results obtained so far and the future potential make this educational vision not only desirable but necessary. Body, technology, and environment are the fundamental resources on which to build meaningful learning that can meet the needs of the modern world, preparing students not just to know, but to live knowledge in an embodied and interconnected way.

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