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REVIEW

# The Evolution of Didactic Strategies in the 21st Century: A Review of Innovative Approaches in Immersive Environments

## La evolución de las estrategias didácticas en el siglo XXI: Una revisión de enfoques innovadores en entornos inmersivos

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## ABSTRACT

**Introduction:** didactic strategies have significantly evolved in the 21st century, driven by pedagogical shifts and technological advances. Among these, immersive environments offer new ways of active, visual, and multisensory learning that challenge traditional teaching structures. This article reviews innovative didactic approaches developed in educational contexts mediated by immersive technologies.
**Method:** a narrative review of scientific literature published between 2018 and 2024 was conducted using databases such as Scopus, Springer, and peer-reviewed journals. The study analyzed theoretical models and practical experiences regarding the integration of active methodologies—such as PBL, gamification, and flipped classroom—in immersive virtual environments, with emphasis on school-level and hybrid settings.
**Results:** the reviewed studies highlight that implementing active methodologies in immersive environments enhances student engagement, promotes meaningful participation, and supports situated content comprehension. Additional benefits include the development of soft skills, peer collaboration, and personalized learning pathways. Major challenges involve teacher training, proper instructional design, and equitable access to technology.
**Conclusions:** didactic strategies in immersive environments represent a significant shift in 21st-century educational practices. Their effective implementation requires pedagogical vision, teacher mediation, and policies that support innovation, inclusion, and sustainability. Further applied research and specialized teacher training in immersive pedagogy are strongly recommended.

**Keywords:** Didactic Strategies; Educational Innovation; Immersive Environments; Educational Technology; Active Methodologies.

## RESUMEN

**Introducción:** las estrategias didácticas han evolucionado significativamente en el siglo XXI, impulsadas por cambios pedagógicos y avances tecnológicos. Entre estos, los entornos inmersivos ofrecen nuevas formas de aprendizaje activo, visual y multisensorial, que desafían las estructuras tradicionales de enseñanza. Este artículo revisa enfoques didácticos innovadores que se desarrollan en contextos educativos mediados por tecnologías inmersivas.

**Método:** se llevó a cabo una revisión narrativa de literatura científica publicada entre 2018 y 2024 en bases como Scopus, Springer y revistas indexadas. Se analizaron estudios teóricos y experiencias prácticas sobre la integración de estrategias activas —como ABP, gamificación y aula invertida— en entornos virtuales inmersivos, con énfasis en niveles escolares y contextos híbridos.
**Resultados:** los estudios revisados destacan que la implementación de metodologías activas en entornos inmersivos mejora el compromiso del estudiante, promueve la participación significativa y favorece la comprensión situada de los contenidos. Además, se observan beneficios en el desarrollo de habilidades blandas, la colaboración entre pares y la personalización del aprendizaje. Los principales retos incluyen la formación docente, el diseño instruccional adecuado y las condiciones de acceso equitativo a la tecnología.
**Conclusiones:** las estrategias didácticas en entornos inmersivos representan una evolución significativa en las prácticas educativas del siglo XXI. Su implementación efectiva requiere visión pedagógica, mediación docente y políticas que integren innovación, inclusión y sostenibilidad. Se recomienda profundizar en la investigación aplicada y fortalecer la formación docente especializada en este campo.

**Palabras clave:** Estrategias Didácticas; Innovación Educativa; Entornos Inmersivos; Tecnología Educativa; Metodologías Activas.

## INTRODUCTION

Over the last few decades, educational environments have undergone a profound, almost radical shift driven by the rapid pace of digital technology and the training demands of an increasingly interconnected world. In this new scenario, traditional methodologies, focused on one-way content delivery and student passivity, have begun to lose their relevance. Little by little, they have given way to much more active approaches, where participation, collaboration, and direct experience are central elements of the educational process. In other words, the change has been technical and pedagogical. And necessary.

Metaverses, artificial intelligence applied to teaching, virtual reality. All these emerging technologies have positioned themselves as catalysts for new forms of teaching. It is not just a matter of adding tools to the classroom but of redesigning the very act of teaching. Placing the student at the center, allowing them to experiment, interact, and construct meaning from experience. Thus, immersive technologies complement educational practice and transform it, challenge it, and expand it.

The pedagogical strategies being developed today no longer respond solely to behaviorist models. They are based on trends such as constructivism, the sociocultural approach, and connectivism, which value student participation, dialogue, context, and networking. In line with this logic, project-based learning, gamification, collaboration, and the flipped classroom have become fundamental tools—not because they are fashionable but because they work. They enable more meaningful learning and, above all, are adaptable to physical, virtual, or hybrid environments.

There is no doubt that the pandemic accelerated many of these processes. What once seemed optional suddenly became essential. However, the current challenge goes beyond simply virtualizing classrooms. The challenge lies in integrating these technologies in a pedagogically intentional way. With substance. With purpose. Augmented reality, interactive 3D environments, and collaborative virtual worlds offer more than just novel interfaces: they offer the possibility of learning from another place. Of learning from experience, from the body, from play, from interaction with others in spaces that, although digital, are deeply human.

This article systematically reviews how teaching strategies have evolved in the 21st century, focusing on those developed within immersive environments. A narrative review of recent literature analyzes the most relevant trends, conceptual contributions, and concrete experiences that articulate technology and pedagogy in a transformative way. The aim is to understand what has already been achieved and anticipate where education could go in the coming years, especially in contexts mediated by emerging technologies.

At the same time, the tensions involved in this transformation are recognized, from teacher preparation to technological accessibility and pedagogical sustainability, including how we assess learning in these new scenarios. The intention is to offer a critical, not triumphalist, view. A reflection that serves as a guide for teachers, researchers, and educational designers who are rethinking their practice from innovative approaches, consistent with the challenges of the present but also with the possible futures of education.

### From traditional teaching to 21st-century didactics

For a long time, teaching strategies were marked by a model focused almost exclusively on the teacher. It was the teacher who knew, who spoke, who guided the entire process. On the other hand, the student occupied a relatively passive role: listening, memorizing, and responding. The relationship was hierarchical and vertical. Behaviorist theories supported this logic, which viewed learning as a mechanical reaction to an

external stimulus, where repetition was synonymous with learning.[1] Entire generations of educational models were built on this basis.

However, starting in the second half of the 20th century, new approaches that challenged this narrow view began to emerge. Piaget's theories, emphasizing the active construction of knowledge, and Vygotsky's proposals on the importance of the social environment and mediation marked a turning point.[2] The idea that learning is not simply receiving information but instead constructing it, processing it, and connecting it with experience gained momentum. With it, teaching methods also began to change.

In the 21st century, this process of transformation has deepened even further. The demands of today's increasingly digital, uncertain, and interconnected world have forced us to rethink teaching from other perspectives. It is no longer enough to transmit content. We need strategies that develop critical thinking, creativity, problem-solving, and teamwork. We also need to adapt to new contexts and learn continuously. This requires methodologies that are flexible, participatory, and open. That is why approaches such as project-based learning, the flipped classroom, the collaborative approach, and universal learning design have gained ground.[3] These are not magic formulas, but they are possible ways to address the present educational challenges.

What is changing in this new teaching approach is not just the methodology. The underlying logic is changing. The idea of what it means to teach and what it means to learn is changing. Knowledge is no longer a static goal but a dynamic, shared, situated process. A process in which students have agency, protagonism, and voice. And teachers, far from losing relevance, take on a more complex role: that of mediator, guide, and designer of experiences that invite students to think, do, and transform.

**Technology-mediated pedagogy**

Digital technologies have profoundly and permanently changed how we teach and learn. At first, these tools were seen only as a complement—external and practical but not essential. However, over time, and especially with the advancement of the Internet, mobile devices, and digital platforms, ICTs have shaped learning environments. It was no longer just a matter of incorporating technology into the classroom but of rethinking it, of redesigning pedagogy from new logic, more connected to how knowledge circulates today.[4]

This gave rise to the concept of digital pedagogy, which is not limited to the instrumental use of tools but involves a profound articulation between teaching principles and the potential of technology. This pedagogy recognizes that digital is not just a medium but a legitimate environment where knowledge is constructed, dialogue, and creation happens. Therefore, it is a space in which pedagogical conditions must be in place to foster meaningful, autonomous, and collaborative learning. It requires solid teacher training, a critical understanding of the digital environment, and the ability to design proposals that do not depend solely on the resource but on the educational intention behind it.[5]

In this new landscape, connectivism, a theory proposed by Siemens in 2005, provides a vision particularly suited to the dynamics of the digital age. This perspective posits that knowledge is not contained in a single mind but is distributed across networks: between people, texts, platforms, and algorithms. Learning means establishing connections between these nodes, navigating this complexity, and building one's paths within this constantly changing information ecosystem.[6] Teaching strategies that fit into this logic must facilitate this navigation. They must teach how to connect, filter, and decide what is worth pursuing and what is not.

All of this requires a shift in focus. It is no longer about teaching content alone, but about developing skills for learning in open contexts, with multiple sources, formats, and voices. A pedagogy that embraces digital technology as a structural part of the educational act cannot be limited to digitizing what was previously done on paper. It must transform the very experience of learning to make it more critical, active, and interconnected.

**Immersive environments and new teaching possibilities**

Among the emerging technologies that have been gaining ground in education, immersive environments have begun to occupy a prominent place. They are a visual novelty and a new way of inhabiting knowledge. These three-dimensional spaces, where students are represented by avatars or interact through augmented, virtual, or mixed-reality devices, allow something that few tools achieve: learning from direct experience. From the body, from action. Not just thinking about a situation but being in it, solving it from within, and interacting with others in real-time, as if it were the real world, but without its physical limits.[7]

This immersion is not a mere aesthetic detail. It transforms the possibilities of applying active teaching strategies. For example, project-based learning takes on a different dimension when students can design prototypes, simulate scenarios, and collaborate on problem-solving in an environment that responds to their actions, changes, and challenges. The same is true of gamification. When transferred to an immersive space, play becomes more than a metaphor. It becomes an enveloping experience with missions, roles, reward dynamics, cooperation, strategy, and conflict resolution.[8]

Therefore, these spaces reinforce key elements that underpin many of today's active methodologies: social presence, synchronous interaction, and the possibility of building together. In immersive environments,

collaboration is not optional. It is a structural part of the experience. Students negotiate, explore, make mistakes, and adjust. This aligns with situated learning, which is best when knowledge is connected to practice, context, and a clear purpose.

As if that were not enough, these technologies also open an essential door to inclusion. The personalization of the environment, symbolic representation, and the possibility of accessing complex simulations without real physical resources. This responds to the principles of Universal Design for Learning (UDL), which proposes making forms of access, expression, and participation more flexible. In this sense, immersive environments are not just attractive or "modern" spaces; they can be fairer, more accessible, and more equitable.[9] And that, in an educational system like ours, is hugely valuable.

**Project-based learning in immersive environments**

Project-based learning (PBL) has proven to be one of the most powerful methodologies for fostering autonomy, applied research, and the connection between school knowledge and real-world problems. It is not just a technique; it is a way of thinking about teaching from experience, the creation of meaningful products, and collaborative work. When this strategy is transferred to immersive environments, its potential is greatly amplified. Because students no longer plan or imagine, they can build, experiment, and make decisions within virtual contexts that simulate complex, diverse, and changing scenarios.

A concrete example is provided by the study by Parong and Mayer (2021), in which secondary school students participated in a three-dimensional virtual ecosystem focused on climate change. Each student took on a different role, such as scientist, politician, or citizen, and had to collaborate with their peers in making environmental decisions within that simulated world.[10] What was interesting was the subject matter and how the immersive environment allowed for the representation of ecological variables, the simulation of consequences, and the experimentation with solutions. All of this is in real-time—all of this as a team.

This ability to intervene directly in an environment, observe the immediate effects of one's actions, and review what worked and what did not makes the metaverse a highly valuable pedagogical setting for PBL. It breaks down the distance between theory and practice. Reflection does not come after but occurs during the action; while decisions are being made, mistakes are being made, and a new path is being tried.

In addition, this type of approach generates more active and distributed participation. Everyone has a role; everyone contributes from their perspective. This strengthens academic content and social skills, critical thinking, and a sense of belonging in adolescent students. In short, PBL in immersive environments is no longer just a strategy. It becomes a comprehensive educational experience.

**Gamification and narrative immersion**

Gamification has gradually positioned itself as a powerful strategy for motivating students and maintaining their attention. Through game dynamics, challenges, rewards, levels, or roles, it transforms the educational space into a much more engaging and participatory experience. However, the effect is intensified when this strategy is implemented in immersive environments. Because the game ceases to be a metaphor or a symbolic dynamic, it becomes an immersive, three-dimensional experience where the student not only plays but inhabits the narrative.

A good example of this idea is the ClassCraft project, a platform that transforms the classroom into a collaborative adventure. In it, each student takes on a character with specific skills and must solve missions alongside their team to achieve academic goals. Interestingly, by integrating this approach with virtual reality, the environment becomes even more powerful: the scenarios take on depth, the body becomes involved, and presence is intensified.[11,12] All of this contributes to a greater sense of immersion. Students do not observe from the outside; they enter, participate, and act.

At the same time, gamification in metaverses allows the pace of learning to be adjusted, reward systems tailored to individual progress to be incorporated, and challenges that require collaborative work to be overcome to be designed. This is particularly effective with teenage students, who tend to show high levels of commitment when game dynamics are structured with rules and explicit educational purposes. Most importantly, these experiences combine game mechanics with educational narratives. Stories give meaning to activities, build continuity, and make learning more than just completing tasks; they enable students to advance within a world with rules, roles, and consequences. When well designed, this motivates students and teaches them to make decisions, think strategically, collaborate, and reflect on the process itself.

**Collaborative learning in virtual worlds**

Collaborative learning has always been one of the most valued strategies in education, especially for its ability to encourage interaction, joint knowledge construction, and the development of social skills. In immersive environments, this strategy remains relevant and takes on new dimensions. The possibility of interacting through avatars, solving problems in groups, and creating collective products within virtual worlds

generates a collaborative experience that is different, richer in certain aspects, and also more challenging.

One study that has explored this dynamic is that of Davis and Antonenko (2020), who observed how secondary school students interacted in immersive environments with different roles, common goals, and shared feedback.[13] The results show that collaboration is strengthened when tasks are well-designed and roles are clearly defined. There is more participation, active listening, and a greater willingness to work as a team. In addition, soft skills such as empathy, shared leadership, and the ability to argue ideas without imposing them are developed.

Immersive environments also have the advantage of removing specific barriers that often limit participation in a traditional classroom. These barriers include shyness, fear of making mistakes in public, and pressure from the judgment of others. Instead, students can express themselves more freely using avatars, which offer a symbolic representation of the self. They do not feel as exposed, which promotes equity in participation. Everyone has the opportunity to participate, propose, and build.

Another significant advantage is the simultaneity of actions. In these spaces, several students can work simultaneously on different task elements without having to take turns or wait passively. This speeds up processes and allows for more dynamic coordination, similar to how people collaborate in real professional environments. But of course, all this depends on the design. It does not happen automatically and requires planning, teacher support, and clear objectives.

In short, virtual worlds offer fertile ground for collaborative learning. They do not replace it; they enhance it. Provided that it is approached from a pedagogical and human perspective. From the idea that learning with others, in any environment, remains one of the most potent ways of learning.

**Flipped classroom with immersive technologies**

The flipped classroom strategy has transformed the traditional logic of school time. It proposes that students explore theoretical content independently, usually before the synchronous meeting, so that the time spent together can be devoted to practical, collaborative activities that allow them to apply, discuss, or deepen their understanding of the concepts learned. In itself, this methodology already implies a significant change in teaching dynamics. But when combined with immersive technologies, that change becomes even more powerful.

Instead of studying content through a video or static reading, students can access virtual laboratories, three-dimensional environments, and simulations. These are spaces where knowledge is not observed from the outside but experienced from within. This was precisely what the studies by Pellas et al. (2022) showed, which found that students who participated in immersive environments before face-to-face classes arrived with a higher level of preparation, more questions, more ideas, and a greater ability to collaborate.[14]

For example, a student who needs to learn about the circulatory system can explore a simulated human body before class, manipulate virtual organs, activate physiological processes, and observe their effects. Then, in the synchronous space, whether in person or online, that same student discusses with their peers, shares what they observed, contrasts hypotheses, and constructs more complete explanations. Classroom time becomes a space for thinking, not for transmission.

This integration between the flipped classroom and immersive environments improves conceptual understanding and strengthens autonomy. Students are forced to explore for themselves, make decisions, and actively prepare themselves to participate later. In addition, having previously experienced the content, they arrive with more tools to contribute, listen, and build collectively. The combination of the flipped classroom and immersive technologies does not replace the teacher's role but redefines it. Teachers are no longer the sole transmitters of knowledge; they become facilitators of experiences and guides to deeper, more experiential, and more meaningful learning processes.

**Universal Design for Learning (UDL) in immersive environments**

The Universal Design for Learning (UDL) approach proposes a profound change in how we think about teaching. Its central premise is that not everyone learns in the same way. Therefore, making the content, the means of participation, and ways of expressing what has been understood more flexible is necessary. Instead of designing for an "average" student, UDL proposes designing with diversity in mind. And that is where immersive environments can play a crucial role.

These digital spaces allow for multiple forms of representation: visual, auditory, and interactive. They also support different avenues of participation, adjustable levels of complexity, and diverse modalities for students to express what they know or have understood. There is no single way to access knowledge, nor is there a single valid way to demonstrate it. That is why immersive environments offer a real opportunity to put the principles of UDL into practice consistently and with scope.

For example, platforms such as CoSpaces Edu and Thinglink VR have been used successfully in inclusive proposals, where students with different needs can participate meaningfully in shared experiences. It is not

just a matter of adapting materials but of transforming the environment so everyone can be there, interact, and learn. For example, a student with reading difficulties can explore a visual scenario and receive auditory information, while another records an oral response instead of writing it down. Both participate—both build.[5]

Using these environments also promotes autonomy because they allow students to explore at their own pace, choose navigation routes, and make decisions. Not everyone will follow the same path, but everyone will be engaged in the experience. This flexibility does not mean disorder but openness. An openness to recognizing that difference is not an obstacle but a starting point. In short, integrating DUA with immersive technologies not only responds to a pedagogical need. It responds to an ethical question. To the conviction that all students, regardless of their abilities, styles, or contexts, deserve an education that truly includes them, recognizes them, and listens to them.

**Simulation and situated learning**

Simulation as a teaching strategy is not new. It has been used for years in professional training, especially in medicine, engineering, and applied sciences. Interestingly, this methodology has begun to expand to other levels, including secondary education, thanks to immersive environments. What once required complex and expensive infrastructure can now be done in accessible, safe, and adaptable virtual worlds.

These environments allow for constructing situated experiences, i.e., scenarios in which knowledge makes sense because it is linked to a specific action to a contextualized problem. Students don't just observe or listen; they act, make decisions, and face consequences. They do so within an environment that challenges them and forces them to think from a practical perspective, from a place of complexity.

A prime example of this strategy is VRLab Academy, a platform offering virtual reality scientific simulations. There, students can conduct laboratory experiments in teams, follow procedures, make mistakes without risk, and receive immediate feedback.[12] There are no hazardous substances and no high costs. However, there is active learning that stimulates a deep understanding of processes, not just memorization of steps. This type of situated learning has another significant advantage: it promotes transfer. When knowledge is constructed in contexts that simulate reality, even if they are digital, it is easier to transfer it later to real situations. The content does not remain isolated in memory.[7] It connects with the world, with life, with action. And that makes it more useful, more meaningful, more lasting.

At the same time, incorporating collaboration into these simulations further enhances the process. Students learn not only from what they do but also from what they negotiate, from what they observe in others, and from the decisions they make together. The experience becomes collective and shared, and that enriches it.

## CONCLUSIONS

Twenty-first-century teaching strategies have been slowly but surely moving away from models focused exclusively on content delivery. The classroom is no longer just a physical space, nor is the teacher the sole transmitter of information. Today, teaching involves designing experiences and creating conditions for students to build knowledge, relate it to their environment, and live it. In this transition, immersive technologies, particularly three-dimensional virtual environments, offer opportunities that previously seemed unthinkable.

It is not a question of replacing face-to-face teaching or falling into a fascination with digital technology for its own sake. It is about integrating, broadening horizons, and thinking about pedagogy from a more open, inclusive, and situated perspective. The experiences reviewed in this article show that strategies such as project-based learning, gamification, collaborative learning, the flipped classroom, and UDL can be significantly strengthened when applied in metaverses or immersive platforms. Not because technology is magic but because it can become a powerful means of teaching better when used well and thought out.

However, all this requires certain conditions. Continuous teacher training, equitable resource access, and intentional pedagogical designs are essential. It is not enough to have the tool; one must know how, when, and why to use it. It also requires a critical eye: not all immersive environments work the same way, nor do all students respond the same way. Therefore, evaluating, adjusting, and rethinking become part of the process.

Ultimately, immersive environments will not solve all the problems in education. But they can help us build a richer, more flexible practice that is more connected to the ways of learning that predominate today. The key is not to lose sight of the essential: that all educational innovation, to be meaningful, must be at the service of a meaningful, inclusive, and human learning experience.

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