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Rethinking educational space in initial teacher education: between design, inclusion, and professional identity

Ripensare lo spazio educativo nella formazione iniziale degli insegnanti: tra progettazione, inclusione e identità professionale

Maria Rosaria Strollo, Francesca Buccini
Università degli Studi di Napoli Federico II

strollo@unina.it
francesca.buccini@unina.it

Doi: <https://>

ABSTRACT

Over the past decades, research on the renewal of school architecture has increasingly placed the relationship between physical space and learning processes at the center of pedagogical debate, promoting a rethinking of schooling through learning environments, both physical and digital. Drawing on the framework of Innovative Learning Environments (ILE), this paper presents a study conducted with 73 pre-service teachers within initial teacher education programs, as part of a course in Experimental Pedagogy. Participants were invited to reflect on the relationship between space, teaching, and inclusion. In particular, the study explores the meanings they attribute to learning environments and how these contribute to the construction of their professional identity. The data were analyzed through thematic coding supported by NVivo software. The findings show that

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engaging with learning environments fosters greater awareness among teachers of the pedagogical value of space and its impact on educational practices, contributing to the redefinition of their professional identity from an inclusive and transformative perspective.

Keywords: didactics, teacher training, inclusion, learning environments, active learning.

RIASSUNTO

A partire dagli ultimi decenni le ricerche sul rinnovamento delle architetture scolastiche hanno progressivamente collocato al centro del dibattito pedagogico la relazione tra spazio fisico e processi di apprendimento, promuovendo un ripensamento della scuola a partire proprio dagli ambienti, sia reali che digitali. Assumendo il framework degli Innovative Learning Environments (ILE) il contributo presenta una ricerca realizzata con 73 docenti, nell'ambito del corso di pedagogia sperimentale, all'interno dei percorsi formativi abilitanti, i quali hanno stati inviati a riflettere sul rapporto tra spazio, didattica e inclusione. In particolare, la ricerca si interroga sul significato che essi attribuiscono agli ambienti e su come questi contribuiscano alla costruzione della loro identità professionale. I dati raccolti sono stati analizzati mediante il supporto del software NVivo. I risultati evidenziano come il lavoro sugli ambienti di apprendimento promuova nei docenti una maggiore consapevolezza del valore pedagogico dello spazio e del suo impatto sulle pratiche educative, contribuendo a ridefinire la loro professionalità in chiave inclusiva e trasformativa.

Parole chiave: didattica, formazione docente, inclusione, ambienti di apprendimento, didattica attiva.

1. INTRODUCTION

Teachers 'digital skills only acquire educational significance when they are re-understood as professional digital competence, i.e., situational pedagogical knowledge capable of guiding the choice and use of tools for the purposes of training, equity, and quality. It is not a question of adding up technical skills, but of building a project-based approach that combines learning theory, disciplinary teaching methods, and ethical responsibility: "we need to move away from understanding digital competence as a set of generic skills [...] and toward an understanding of PDC that includes both generic and specific teaching-profession skills" (Lund *et al.*, 2014, p. 284). If education takes place within a framework where. "Technology is omnipresent in our rapidly changing digital world" (Gabriel *et al.*, 2022, p. 85). Professional digital competence thus becomes the means through which

teachers transform the omnipresence of technology into intentional learning environments capable of protecting attention and motivation and fostering autonomy and responsibility. The direction of education policy is equally clear: the Organization for Economic Cooperation and Development reminds us that what matters is not “how much,” but “how”: “How digital tools are used, and which tools are used are key” (Gottschalk & Weise, 2023, p. 9). This competence takes shape as design-based expertise, enabling teachers to interpret educational contexts, make informed pedagogical choices, and continuously adapt teaching strategies in response to emerging evidence (Lund *et al.*, 2014). Digital transformation, as Ionescu and Moraru remind us, is not something added to schooling but rather something that reshapes it from within because “Digital technology and inclusiveness are two movements that question the foundations of societies and education systems” (Ionescu & Moraru, 2023, p. 236). The metric is not online time, but the quality of tasks (research, collaboration, formative feedback, metacognitive reflection). Digital inclusion is also a matter of values. As Mintz *et al.* (2024, p. 116) argue, “digital inclusion is not a value neutral term”. Consequently, professional digital competence should integrate ethical principles such as equity, accessibility, and data protection into pedagogical decision-making. Thus, professional digital competence “emerges as something much more than a skills-based competence” (Lund *et al.*, 2014, p. 296): it is a complex skill that integrates theory and practice in the form of reflective design. Universal Design for Learning promotes multiple means of engagement, representation, and action, encouraging the design of flexible and accessible learning environments (Siddiqi, 2024).

1.1 Embodied digital skills: body, presence, onlife, and multimodal learning. Digital inclusion requires an embodied alphabet of teaching professionalism

In hyperconnectivity, identities and relationships are onlife: “It may well be a mistake to try to separate the online and offline worlds” (Muñoz-Rodríguez, 2021, p. 20). Digital technology does not replace bodies, it re-choreographs them: postures, gazes, gestures, rhythm, arrangement of materials, rules for using screens. The ethics of presence takes care of attention and conversation in a society where “Under the fiction of being accompanied by perpetual connectivity, individuals generate instantaneous virtual identities” (Muñoz-Rodríguez, 2021, p. 3): educational practices must recompose speed and depth, immediacy and reflection, multi-tasking and concentration. In this sense, embodiment is not ornamentation, but a cognitive condition for learning together: we understand through the body, the voice, the gaze, the gesture; we construct meaning in space, with objects and with others; we give stability to ideas with rituals that give rhythm to time and order attention (Muñoz-Rodríguez, 2021, p. 5). The teacher’s embodied digital skills are, then, a grammar of micro-educational interfaces. Embodied competence is expressed through pedagogical routines that regulate interaction, participation, attention, and reflection within digitally mediated learning environments. In the sociocultural context, digital artifacts are mediators.: “digital technology becomes what is often referred to as cultural tools or artifacts” (Lund *et al.*, 2014, p. 285). Teachers guide students in using digital artefacts as tools for inquiry, collaboration, and knowledge construction, fostering participation within hybrid learning environments. Immersive technologies can amplify presence, situated anchoring, and multi-modality when integrated into an intentional pedagogical design (Kaimara, 2023, p. 5). Learning environments therefore emerge as relational and pedagogical ecosystems in which bodies, technologies, spaces, and interactions dynamically shape educational

participation and meaning making. The embodied perspective aligns with Universal Design for Learning by promoting multimodal learning environments that provide multiple means of engagement, representation, and expression. Within this framework, educational quality depends on intentional pedagogical design rather than on technology itself. Embodied approaches also support multimodal forms of expression, such as digital storytelling, fostering participation, accessibility, and inclusion across diverse learning profiles (Manganello & Baldacci, 2024). In pluralistic classrooms, these practices prove particularly effective in including those with different language skills, those who learn better through visual or kinaesthetic channels, and those who need more time. Embodied learning also values reflection, dialogue, and meaningful interaction, creating educational spaces in which technology supports rather than replaces human relationships (Muñoz-Rodríguez, 2021). Artificial intelligence can support accessibility and personalization when integrated into pedagogically meaningful learning environments (Salas-Pilco *et al.*, 2022). Ultimately, embodied digital competence develops through situated professional learning, collaborative practice, and reflective communities. Rather than depending on technological equipment alone, it requires teachers to intentionally design inclusive and multimodal learning environments in which digital tools support participation, accessibility, and meaningful learning (Gabriel *et al.*, 2022; Ionescu & Moraru, 2023). Although previous research has widely explored professional digital competence and innovative learning environments, less is known about how pre-service teachers interpret educational spaces and how these representations shape their understanding of inclusion and professional identity. Addressing this gap, the present study adopts a qualitative phenomenological approach to investigate how teachers enrolled in initial teacher education conceptualise educational spaces as environments for inclusive teaching and professional learning.

2. RESEARCH

The creation of inclusive learning environments, in line with Universal Design for Learning (UDL) principles, represents a major priority in contemporary education, as it is essential for promoting accessible and inclusive teaching capable of enhancing each student's potential and participation. Within this perspective, learning environments are not conceived as neutral containers, but as pedagogical mediators capable of influencing interaction, participation, accessibility, and the construction of meaningful learning experiences.

The growing attention devoted to Innovative Learning Environments (ILE) has progressively emphasized the relationship between physical, digital, and hybrid spaces and educational processes, encouraging a rethinking of teaching practices through more flexible, participatory, and student-centered approaches. UDL encourages teachers to adopt a systemic perspective in which teaching is intentionally designed to reduce barriers to learning and enhance the potential of each student (Hall *et al.*, 2012; Meyer *et al.*, 2014; Novak, 2019).

The research presented below offers important reflections for the education of future teachers, who are increasingly called upon to develop professional competences related not only to the use of digital technologies, but also to the pedagogical design of inclusive learning environments. To be truly meaningful, these competences cannot remain limited to abstract theoretical knowledge; rather, they must be translated into educational practices grounded in flexible, reflective, and creative approaches capable of promoting inclusive learning processes.

The research, conducted as part of the Experimental Pedagogy course within the initial teacher education programs (30 and 60 credits), involved 73 pre-service teachers who were invited to reflect on the relationship between educational spaces, teaching practices, technology, and inclusion. In particular, participants were encouraged to explore the pedagogical dimensions of physical, digital, and hybrid learning environments and their impact on participation, accessibility, and educational relationships.

Considering the research objectives and drawing on the phenomenological perspective proposed by Van Manen (1990), the study focused on the interpretative dimension and on the attribution of meaning to lived educational experiences, with the aim of deepening the understanding of how future teachers perceive learning environments and their role within inclusive educational practices.

Operationally, the collected texts were analyzed using NVivo software (Lewins & Silver, 2009) which supported both the organization and thematic exploration of the material, making it possible to identify emerging themes (core categories). The exploration of the data through NVivo enabled an analytical approach focused on thematizing the object of investigation in order to understand its meanings and pedagogical implications, consistently with the adopted methodological framework.

3. METHODOLOGY

Phenomenological research, as proposed by Van Manen (1990), recognizes lived experience as a privileged source of knowledge. In educational research, this perspective attributes central importance to teachers' professional experiences, considering them essential for understanding the complexity of school life and for guiding educational interventions aimed at improving the quality of learning environments.

From this perspective, educational spaces, physical, digital, and hybrid, are understood as active dimensions of educational experience capable of influencing participation, relationships, accessibility, and inclusion. The analysis of lived experiences therefore made it possible to explore how teachers' design choices concerning educational environments influence students' sense of belonging, engagement, and participation, contributing to the development of more meaningful and inclusive educational practices (Mortari, 2007; Tarozzi & Mortari, 2010; Mortari *et al.*, 2024).

Data analysis, carried out using NVivo software, allowed for the systematic organization and interpretation of the collected material while also supporting thematic exploration. The analysis began with repeated readings of the participants' narratives in order to identify meaningful units related to the research objectives. These units were subsequently coded through an inductive open coding process, generating an initial set of descriptive nodes. Conceptually related nodes were then continuously compared and progressively grouped into broader thematic categories through an iterative process of refinement. Finally, the relationships among the emerging categories were examined, leading to the identification of four core categories, namely recurring conceptual nuclei that synthesised the principal dimensions emerging from participants' reflections on learning environments and inclusive educational practices (Richards, 1999; Pacifico & Coppola, 2010).

The use of NVivo proved to be not only an effective operational support for managing a large corpus of qualitative data, but also a useful tool for the progressive development of classification schemes and the systematization of information (Lewins & Silver, 2009; Pagani, 2020).

Semantic analysis made it possible to segment the texts into meaningful units from which, through an open coding process, codes (nodes) and categories were constructed (Clarke *et al.*, 2015; Fernández Scagliusi & Llorente Cejudo 2025) allowing for a detailed representation of the educational and environmental dimensions of inclusion. Throughout the analytical process, NVivo supported the organisation, retrieval, comparison, and visualisation of the coded material, whereas the interpretation of the data remained grounded in the researchers' continuous engagement with participants' narratives, in line with the adopted phenomenological perspective.

4. RESULTS

Based on the collected texts, the qualitative analysis explored four dimensions related to participants' reflections on learning environments, inclusion, and the educational use of digital technologies:

- Learning environments and the teacher–student relationship.
- Inclusive learning environments: opportunities and barriers.
- Teachers' role in designing inclusive learning environments.
- Professional growth and educational innovation through learning environments.

Through an open and interpretative coding process, the main recurring conceptual nuclei (core categories) emerged inductively.

Using NVivo, participants' reflections were organized into interconnected thematic categories, visually represented in the concept maps presented below.

The first core category, “Learning environments and the teacher–student relationship” (Figure 1) expresses the awareness that the quality of the educational relationship remains the main mediator of teaching-learning processes, especially in digital contexts.

Five related thematic categories develop around this central core:

Inclusion and adaptation to special needs, which highlights how the conscious use of technology, through the personalization of learning-teaching paths, can promote inclusion and meet special educational needs.

Personalization refers to the possibility of designing flexible, student-centered learning experiences through digital technology, modulating tools, times, languages, and resources.

Communication and new tools reflect the change in the ways teachers and students interact, for example, through the introduction of digital platforms and environments.

Challenges and balances of technology, focuses on the potential and critical issues of digital technology, recognizing the need to maintain a balance between technological and human mediation.

Changes in traditional roles, highlights the ongoing change in the teaching profession and the different perception of students, who are recognized as active participants in the learning process.

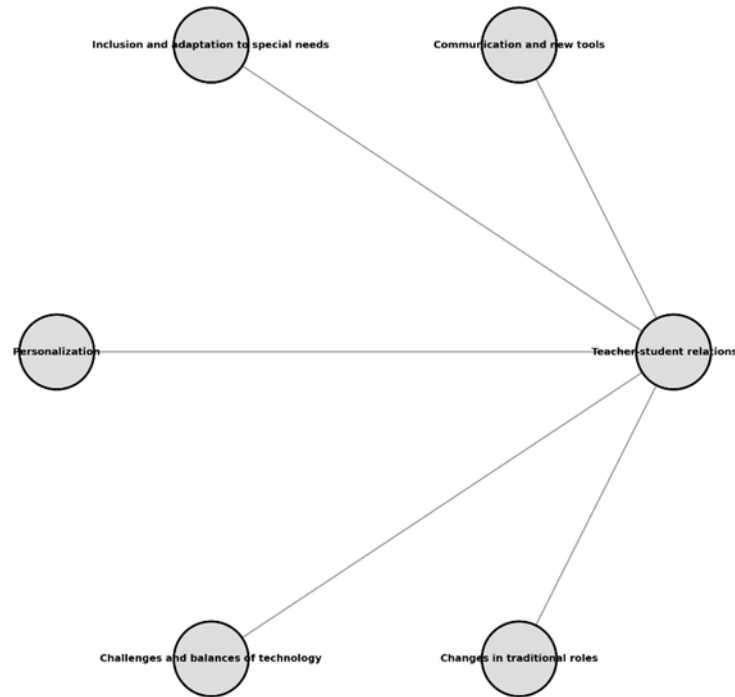


Fig 1.: Core Category “Learning environments and the teacher–student relationship”

The second core category “Inclusive learning environments: opportunities and barriers” (Figure 2), highlights the dual nature of digital tools, which are perceived, on the one hand, as potentially facilitating devices and, on the other, as bringing new barriers. The NVivo analysis shows that the opinions of the teachers involved, in addition to highlighting the potential offered by digital technology, also reveal a certain level of awareness of the inequalities and critical issues that arise from its use. Among the main facilitators that promote inclusion, the value of ICT for personalizing digital content and the effectiveness of augmentative and alternative communication (AAC) tools in promoting the participation and autonomy of students with special educational needs emerge. Technologies are thus perceived as a real amplifier of inclusion; tools capable of supporting differentiated teaching by adapting to the learning rhythms and needs of each student, enhancing their potential. At the same time, significant barriers and inequalities are emerging due to the uneven distribution of digital resources and the lack of adequate training. These factors make the real inclusion of technologies more complex, limiting their inclusive potential. Teachers also point out the existence of a digital divide that is not only infra-structural but also cultural, which influences student participation and the overall quality of the educational experience. Overall, this perspective presents a mature and critical view of technological innovation: digital technology is interpreted as a space for educational mediation whose effectiveness depends on the teacher's pedagogical skills and their ability to balance innovation and tradition.

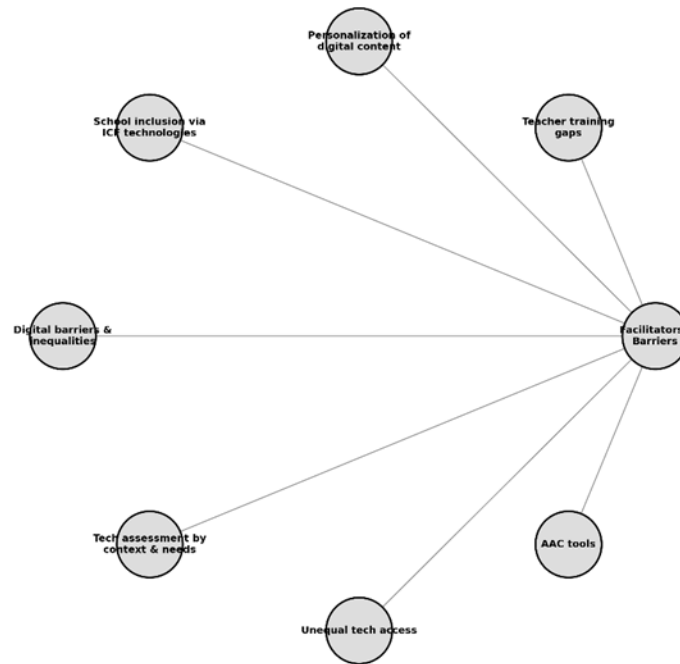


Fig. 2.: Core Category “Inclusive learning environments: opportunities and barriers”

The third core category “Teacher’s role in designing inclusive learning environments” (Figure 3), explores how digital technology is redefining the teaching profession, further enhancing its role as mediator, guide, and creator of learning processes. The first core, personalization of learning, highlights the ability of teachers, through the conscious use of digital technology, to adapt times, tools, and strategies to the needs identified by the context. Digital technology is therefore perceived as a useful resource for supporting personalization and individualization in teaching, if it is accompanied by responsible pedagogical reflection. The second core concept, inclusion through technology, highlights the potential of technologies as tools for access and participation, as they can expand educational possibilities. In this perspective, the teacher takes on the task of translating technological innovation into opportunities, selecting and modulating tools according to the context. The dimension of conscious institutional design emphasizes the importance of intentional instructional design: teachers do not simply integrate digital tools but plan their use in a way that is consistent with the educational objectives and needs of the class. Technology thus becomes an integral part of a targeted pedagogical design. Finally, the mediation and critical guidance aspect presents the image of the teacher as a reflective and critical guide, capable of guiding students in the conscious use of digital technology, including through the promotion of metacognitive and reflective skills. Overall, this category outlines a new profile for teachers, who are committed to responding, including through innovation, to the needs of individual students, promoting processes of cultural and social growth.

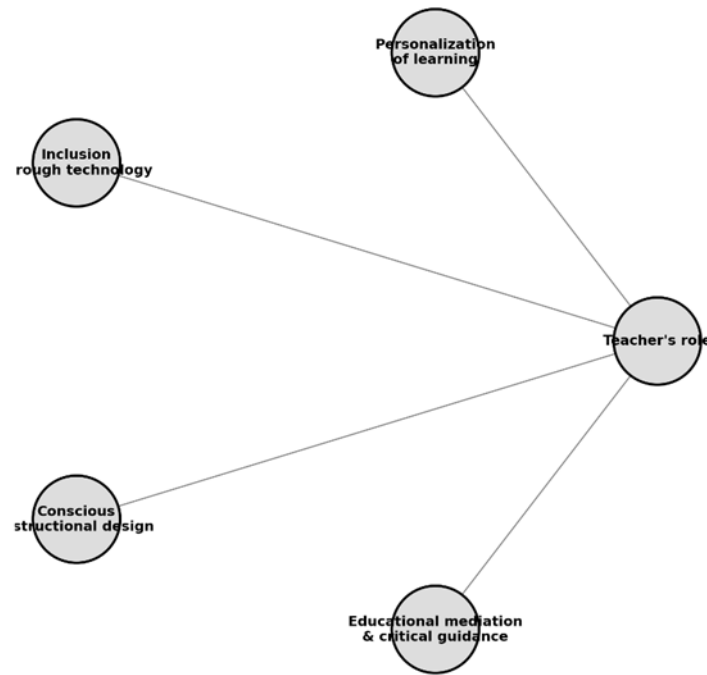


Fig. 3.: Core category “Teachers’ role in designing inclusive learning environments”

The fourth category “Professional growth and educational innovation through learning environments” (Figure 4) brings together teachers’ reflections on the perceived advantages of including digital technologies in educational processes. Analysis of the narratives highlights how the use of digital technology is not only a challenge but also a driver of professional growth, curiosity, and personal motivation. The first conceptual core, curiosity and motivation, shows how the introduction of technology promotes openness to innovation and stimulates the desire to experiment with new teaching languages. The second core, commitment and continuous updating, highlights how the conscious use of digital technology requires a constant commitment to training and updating; a process of continuous learning perceived as a qualifying element of professional identity. Finally, the node need for dialogue and collaboration emphasizes the importance of collegiality: digital innovation stimulates the sharing of practices, the building of learning communities, and a renewed sense of professional belonging. Finally, the challenge of technology integration reminds us that digital inclusion is not without its difficulties, but requires time, reflection, and resources. However, it is precisely the daily confrontation with these challenges that provides an opportunity for growth and professional development. Overall, this category provides a positive and reflective view of the experience and teachers’ use of digital technology: innovation is perceived as a transformative opportunity capable of strengthening motivation, commitment, and collaboration, contributing to the construction of a pedagogical culture that is more open to innovation.

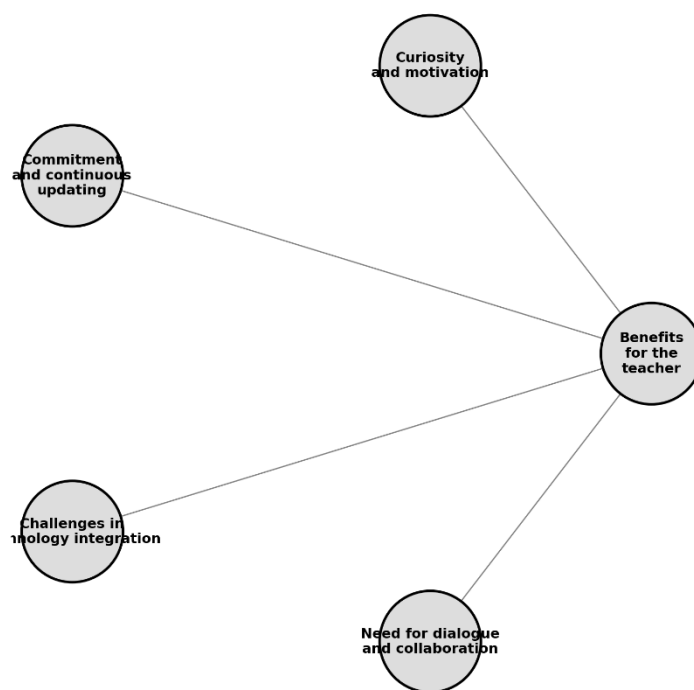


Fig. 4.: Core Category “Professional growth and educational innovation through learning environments” (benefits for the teacher)

5. DISCUSSION

The findings provide further evidence that learning environments should not be understood merely as physical or digital settings, but as pedagogical ecosystems in which educational relationships, technologies, and teaching practices interact to shape participation and inclusion. This perspective is consistent with the framework of Innovative Learning Environments and Universal Design for Learning, which emphasize the importance of intentionally designing educational contexts capable of reducing barriers and supporting meaningful learning experiences (Hall *et al.*, 2012; Meyer *et al.*, 2014).

The first core category confirms that the teacher–student relationship remains the central pedagogical mediator even within digitally enriched learning environments. Rather than replacing interpersonal interaction, technologies appear to strengthen educational processes only when embedded within relationships characterised by trust, dialogue, and reciprocity. This finding reinforces previous research highlighting that the educational value of digital technologies depends primarily on teachers' pedagogical competence rather than on the technologies themselves (Lund *et al.*, 2014; Gabriel *et al.*, 2022).

The second category highlights the coexistence of opportunities and barriers within inclusive learning environments. While participants recognised the potential of digital technologies to promote accessibility, personalisation, and participation, they also acknowledged the persistence of structural and cultural inequalities that may limit their inclusive potential. These findings support international evidence suggesting that digital inclusion requires not only access to technological resources but also

intentional pedagogical design and adequate teacher preparation (Gottschalk & Weise, 2023; Mintz *et al.*, 2024).

The third category extends previous studies by showing that participants increasingly perceive teachers not simply as users of digital technologies but as designers of learning environments. Educational space is interpreted as an active pedagogical resource that requires deliberate planning, critical mediation, and continuous adaptation to learners' needs. This finding reinforces the conception of professional digital competence as a design-oriented competence integrating technological, pedagogical, and ethical dimensions (Lund *et al.*, 2014).

Finally, the fourth category suggests that reflecting on learning environments contributes to teachers' professional growth by fostering curiosity, collaboration, and openness to innovation. More importantly, participants increasingly associated educational innovation with reflective practice rather than with technological novelty. This result suggests that professional development is promoted not by technology itself, but by opportunities to critically reinterpret educational practice through collaborative reflection.

Overall, the findings indicate that learning environments represent a strategic dimension of initial teacher education. Rather than focusing exclusively on digital competence, teacher education programmes should promote integrated pedagogical competences that enable future teachers to intentionally design inclusive, relational, and multimodal learning environments. In this perspective, technologies become meaningful only when embedded within educational practices that foster participation, accessibility, and professional responsibility.

6. CONCLUSION

The results of the research highlight how digital innovation, to be truly meaningful, must be accompanied by a profound rethinking of educational practice. Technologies can expand the possibilities for inclusion, personalization, and participation, but their effectiveness depends on the reflective and planning skills of teachers as well as on the quality of the educational relationships established in school contexts. Analysis of the four categories shows that digital technology is not simply a set of tools but a complex learning environment in which cognitive, emotional, social, and relational dynamics intertwine. From this perspective, learning environments, understood as physical, digital, and hybrid spaces, emerge as educational mediators capable of influencing participation, interaction, accessibility, and the construction of meaningful learning experiences. The study highlights how the design of inclusive learning environments cannot be reduced to the mere integration of technological tools, but requires a conscious pedagogical approach aimed at creating flexible, accessible, and student-centered educational contexts. In this context, the teacher takes on the role of facilitator and mediator, capable of guiding students towards the conscious use of technology while maintaining the human dimension of education at the center. Teachers are therefore called upon not only to manage digital tools, but also to intentionally design learning environments that foster inclusion, collaboration, participation, and wellbeing. From a training perspective, the results suggest the need for initial and in-service training courses that organically integrate digital, pedagogical, relational, and design competences related to learning environments. It is also essential to foster professional learning communities in which teachers can share experiences, strategies, and

critical issues related to the use of digital technology and the organization of educational spaces, contributing to the construction of a shared culture of innovation and inclusion.

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