

3D Digital Reconstructions as an Educational Resource for Teaching Classical Disciplines: The Case of Strabo and Alexandria in Egypt

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Abstract: This study analyses the educational potential of integrating digital technologies, specifically three-dimensional reconstructions of ancient cities based on scientific and archaeological criteria, into the teaching of classical subjects. The proposed teaching pathway, designed for third-year students at the IIS "De Filippis - Galdi" in Cava de' Tirreni, is structured in four phases: 1) a philological and content-based analysis of passages from Strabo concerning the description of Alexandria; 2) a guided viewing of an archaeological lecture aimed at providing historical and topographical context for the text; 3) the exploration of audiovisual materials featuring 3D reconstructions of the city, including the selection and critical commentary of representative screenshots; 4) the administration of a questionnaire intended to assess: students' subjective perception and their actual comprehension of the content. The underlying hypothesis of this approach is that the use of three-dimensional reconstructions, when embedded in a structured and pedagogically coherent learning path, constitutes an effective resource for promoting a conscious understanding of classical civilization.

Keywords: Interdisciplinary Education; Cultural Heritage education; 3D environments

1. Introduction

The evolution and progressive integration of information and communication technologies within educational contexts have caused a profound and structurally significant transformation in the way school teaching is configured, impacting not only the teaching tools adopted but also the cognitive, methodological, and relational dynamics that underpin the entire formative process and redefine the modes of interaction between teachers, learners, and knowledge. This scenario increasingly makes evident the urgency to abandon traditional pedagogical models, still firmly anchored to transmissive, linear, and rigidly structured logics, in order to move towards more flexible and dynamic approaches, capable of critically and consciously integrating the potential offered by educational technologies, aimed at a deep renewal of teaching.

In this perspective, a systemic and adaptive approach is outlined, within which *didattica semplessa* is configured not as a prescriptive or rigidly codified model, but as a flexible epistemological and methodological framework, oriented to conceive education as a dynamic, complex, and continuously evolving process, which requires interpretative tools capable of combining analytical rigor and adaptability with respect to the changing conditions of the context. This approach is based on the vision of the



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didactic system as a complex adaptive system: a network of non-linear interactions among subjects, tools, contexts, and knowledge, within which the educational act is not reducible to the simple transmission of predefined knowledge but constitutes the generative core around which teaching and learning processes are organized, in an emergent and situated way. (Sibilio, 2014).

In this regard, the critical and conscious integration of digital technologies assumes a strategic role in designing learning experiences, as their use cannot be reduced to a mere instrumental introduction in the classroom, but must be embedded within structured educational pathways aimed at enhancing the opportunities offered by multimedia and multimodality in teaching and learning processes (Sibilio, 2020); understood, despite their close interrelation, as dimensions endowed with their own specific characteristics, multimedia environments, through the integration of text, audio, images, and video, foster diversified cognitive engagement; at the same time, multimodality activates multiple sensory and communicative channels, allowing learners to construct meaning inclusively and actively (La Manna, Zappalà, & Sibilio, 2024). Learning becomes more meaningful when the integration of multimedia and multimodal strategies stimulates multiple sensory channels and different forms of intelligence, thereby promoting an inclusive and effective educational experience (Gardner, 1983; Meyer, 2005).

Although this complexity may seem difficult to manage, it is based on a dynamic between simple and complex elements, made interpretable thanks to fundamental principles and functional modularity, which allow cognitive processes to be approached through “*semplex*” structures: articulated configurations but based on simple and flexible principles, capable of facilitating the acquisition and integration of knowledge, and making learning more accessible, adaptive, and resilient with respect to individual differences and contextual variations (Berthoz, 2011).

In the contemporary context, characterized by increasing communicative complexity and by an ever more intense interaction among various sensory channels through which knowledge is constructed, the need to recognize that digital media do not merely represent technical tools aimed at content transmission but rather genuine cultural environments capable of profoundly influencing perception, thought, and learning modalities becomes increasingly evident. Since every medium, far from being a neutral channel, significantly affects the form and process of assimilating the content it conveys, it is therefore urgent to promote an educational approach that, through multimodal communicative strategies, does not merely ensure accessibility to information but also fosters the development of critical and reflective awareness in the use of digital media. This approach enables individuals to understand the underlying logics of content production and dissemination and to exercise an active and conscious reading of such content (McLuhan, 1967; Rivoltella, 2016; Todino & Di Tore, 2025). To address the persistent challenges in the educational landscape, there is a growing trend towards the adoption of innovative teaching approaches that integrate immersive digital environments into educational pathways. Among emerging technologies, three-dimensional reconstructions stand out as particularly promising tools, as they allow the structuring of richer, more inclusive, and engaging learning experiences. These experiences activate students’ deep understanding through modes that combine active exploration with reflective elaboration of content, thereby fostering a multisensory and intermodal interaction that values diverse forms of intelligence and

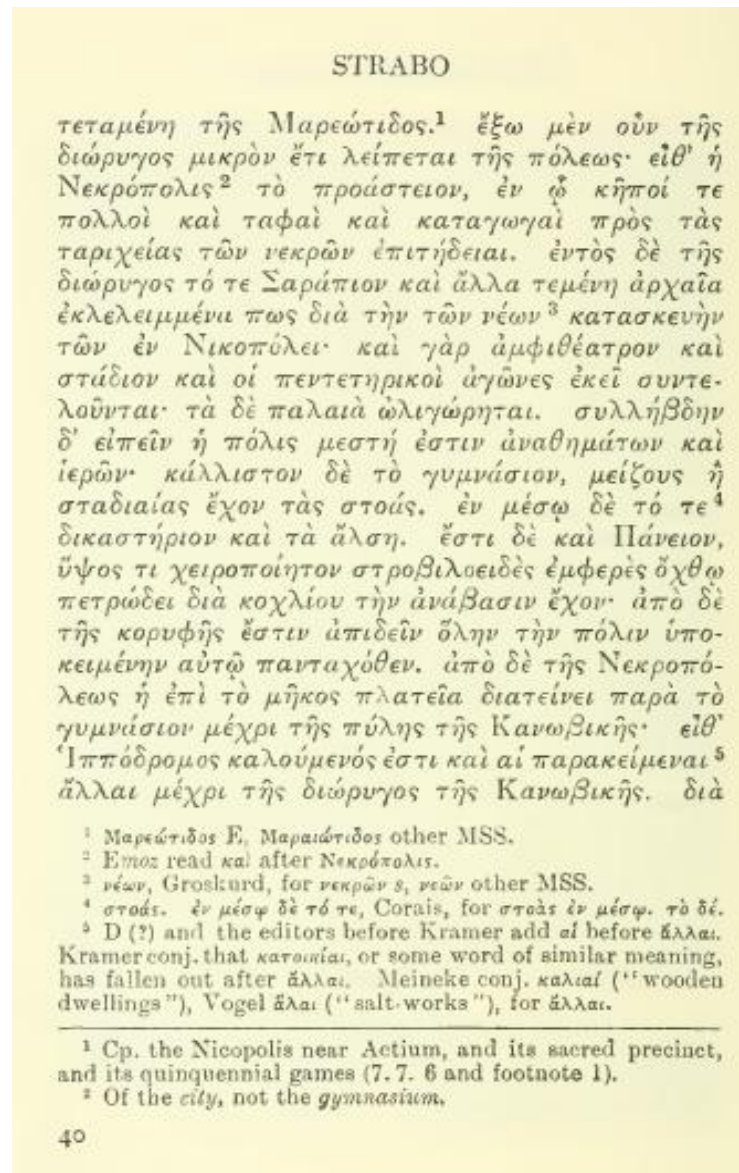
promotes knowledge acquisition from an authentically experiential perspective (Gardner & Hatch, 1989).

Within the outlined framework of reference, alongside the integration of immersive digital environments and three-dimensional reconstructions that make learning richer, more inclusive, and more engaging, there is a growing interest in educational research towards innovative teaching strategies such as *gamification* and educational games, whose potential proves particularly significant in the contexts of classical language teaching and cultural heritage education, since such practices, far from being mere playful expedients, are part of a broader educational paradigm shift oriented towards multimodal learning, in which the construction of meaning emerges from the dynamic interaction between texts, images, sounds, spaces, and bodies, thus configuring learning experiences fully consistent with the forms of communication typical of contemporary times (Colace, Todino, & Zollo, 2025).

Nevertheless, despite the growing theoretical support and academic interest in such approaches, the systematic integration of 3D environments in school settings remains limited, hindered by the lack of structured and replicable teaching models as well as the absence of a clearly defined pedagogical framework to guide their practical application. Consequently, it is necessary to undertake a broader and more in-depth reflection not only on the modalities of implementing immersive technologies in teaching-learning processes but also on their strategic role in the enhancement, preservation, and transmission of cultural heritage, which, moving beyond being a mere object of study, becomes a living and shared experience within new educational spaces (Todino, Pitri, Fella, Michaelidou, Campitiello, Placanica, Di Tore, & Sibilio, 2025; Todino & Campitiello, 2025).

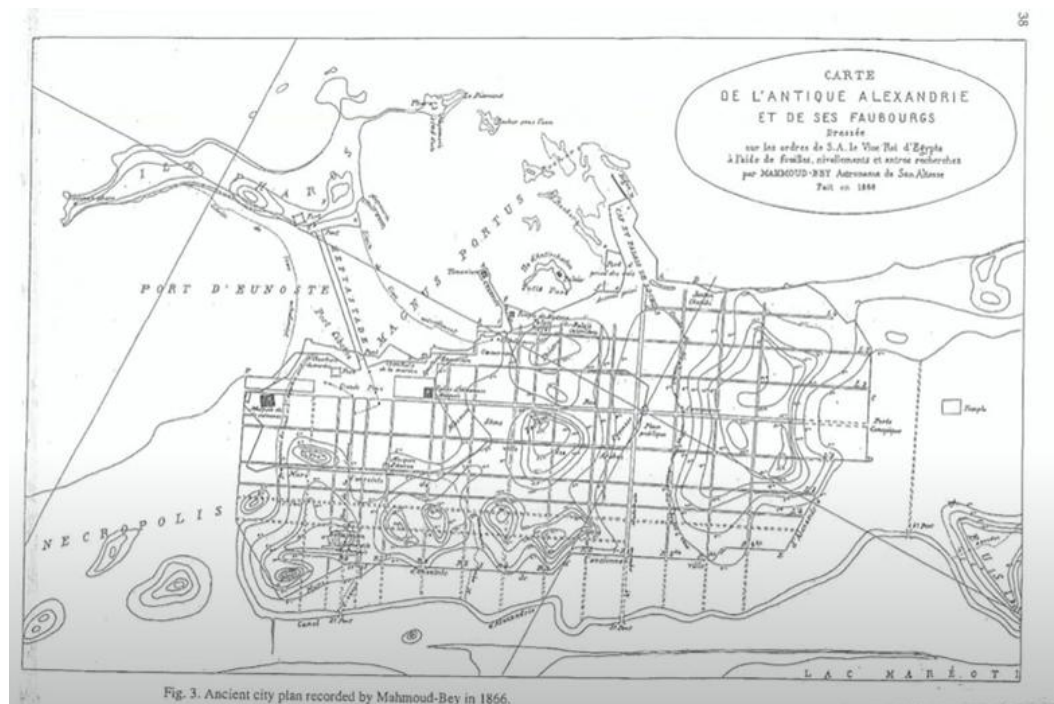
In response to the increasingly urgent need to overcome a traditional conception of humanistic education, an interdisciplinary teaching module was developed at the IIS “De Filippis Galdi” in Cava de’ Tirreni, focusing on the figure of the ancient geographer Strabo and the city of Alexandria (Strabo, 1967). The aim of the intervention was to integrate digital tools and humanistic approaches, promoting a form of active and multidimensional learning, conceived as an educational experience capable of simultaneously activating various semiotic codes, communicative modes, and cognitive dimensions (Rivoltella, 2016).

Figure 1: Description of Canopic Way by Strabo. Source: Strabo (1967). The geography of Strabo (H. L. Jones, Trans., Vol. 8). Harvard University Press.



The learning pathway was structured through the integrated use of historical sources, digital reconstructions in video format (Daydream Gaming, 2024; Kings and Generals, 2023), and a videoconference based on historical-archaeological research materials (Mavrogiannis, 2023a, 2023b). Students were engaged in a process of critical exploration and active reworking of the content, within a dynamic learning environment where knowledge emerged from the continuous interaction between tools, content, and learning subjects.

Figure 2: Topographic map of Canopic way. Source: Mavrogiannis, T. (2023). Conferenza su Alessandria d’Egitto. <https://youtu.be/Iu9jrLGnOM>



In this sense, the experience was a genuine educational project, understood as “*a predetermined activity in which the dominant intention is a real quality that guides procedures and gives them meaning*” (Kilpatrick & Monroy, 1962, p. 370). From a cognitive perspective, it encouraged the development of divergent thinking, as the comparison between texts, lessons, and digital representations stimulated in students flexibility, originality, and the ability to explore multiple solutions, breaking the patterns of linear thinking, since, as observed, <<*creative minds are rarely tidy; their strength lies precisely in alternative thinking and in the ability to see multiple paths where others see only one*>>(Guilford, 1950, p. 444). Furthermore, the combination of ancient sources and 3D environments prompted students to reformulate hypotheses, identify connections, uncover contradictions, and produce informed interpretations and personal solutions (De Bono, 2015).

The entire course was grounded in the idea of learning as a transformative experience, in which students become active protagonists in a continuous process of exploration, comparison, and critical re-elaboration of content, within a learning environment conceived not as a place for the frontal transmission of knowledge but as a dynamic and interactive space where understanding takes form through the interplay among tools, contexts, and people (Harel & Papert, 1991). The learning environment was not built around a frontal transmission of knowledge but conceived as a dynamic space where knowledge takes shape through the integration of ancient sources, digital reconstructions, and interdisciplinary stimuli, fostering meaningful interaction among tools, contexts, and learner (Dewey, 1938). Experience shows that the integration of

traditional and digital approaches, particularly 3D technologies, effectively promotes student engagement and critical engagement with cultural heritage.

2. Materials and Methods

The educational experiment was conducted during the 2025–2026 academic year at the “De Filippis Galdi” Secondary School Institute in Cava de’ Tirreni (SA), involving a third-year class of the Classical High School. The initiative aimed to promote the integration of innovative digital tools within the teaching of humanities disciplines. The experiment was designed not only to facilitate the acquisition of specific knowledge related to disciplinary content but also to encourage the development of transversal skills such as critical thinking, analytical ability, and proficiency with digital tools through an active, participatory, and multidimensional teaching approach capable of fostering authentic student engagement.

To evaluate the overall effectiveness of the experimental pathway, three online questionnaires were designed and administered using Google Forms and made available through open-source tools, thus ensuring not only full accessibility of the resources employed but also the replicability of the educational intervention. The first two questionnaires were addressed to the class composed of 21 students, while the third was intended for the teacher, with the aim of collecting structured feedback from both perspectives involved (University of Salerno, 2025a, 2025b, 2025c).

The first questionnaire, titled “*Learning and 3D Technologies: Your Experience,*” was designed to collect both quantitative and qualitative data regarding the impact of using three-dimensional technologies on the learning of classical subjects. Various aspects were investigated, such as the perception of the quality of the materials presented (including videos and the conference), the ease of use of the digital tools, the degree of emotional and motivational engagement elicited by the activities, as well as their effectiveness in facilitating the understanding of the content covered.

The second questionnaire, named *Understanding Ancient Alexandria through Text, Images, and 3D Environments*, had the main objective of evaluating the effectiveness of the integrated approach adopted, based on the synergy between textual sources especially the excerpts from Strabo and three-dimensional digital reconstructions. The questions were organized into evaluative sections, including specific items concerning the selection of monuments or locations represented in the videos, which students were required to analyze and interpret considering the knowledge acquired during previous activities.

The third and final questionnaire, called “*Teacher’s Satisfaction Questionnaire,*” was addressed to the teacher and aimed to gather a thorough evaluation of the entire pathway, with particular attention to the coherence among the different didactic components classical text, videoconference, audiovisual materials and to the level of student participation and engagement compared to traditional teaching methods.

The combined use of the three instruments made it possible to collect solid and structured data, allowing for the development of an overall assessment of the educational intervention and initiating a reflection on the prospects of educational models in the humanities disciplines.

3. Results

This section presents the main findings derived from the analysis of three questionnaires designed to evaluate the effectiveness and student satisfaction of an edu-

cational programme integrating 3D technologies into the teaching of classical literature.

3.1. Evaluation of the Learning Experience

This section explores the impact of 3D technologies on learning, based on student and teacher questionnaire responses.

3.1.1. Questionnaire Analysis

- *Questionnaire 1 – Use of 3D Technologies in the Learning Process*

This questionnaire aimed to investigate students' perceptions of how 3D videos supported their understanding of ancient Alexandria's history. The results indicate that 3D videos significantly aided comprehension, with nearly half of the students (47.6%) rating them as very useful and a further 52.4% considering them moderately useful. Additionally, the findings highlight a positive impact on student engagement, with all participants reporting increased involvement: 66.7% felt highly engaged, while 33.3% experienced moderate engagement.

- *Questionnaire 2- Understanding Ancient Alexandria through Texts, Images, and Digital Technologies*

This questionnaire explored students' interaction with textual sources, video lectures, and two 3D reconstructions. Results revealed that 80.9% of students recognised the technological and symbolic significance of the Lighthouse, 28.6% emphasized the cultural value of the Library, and 90.5% found the primary video both immersive and historically accurate.

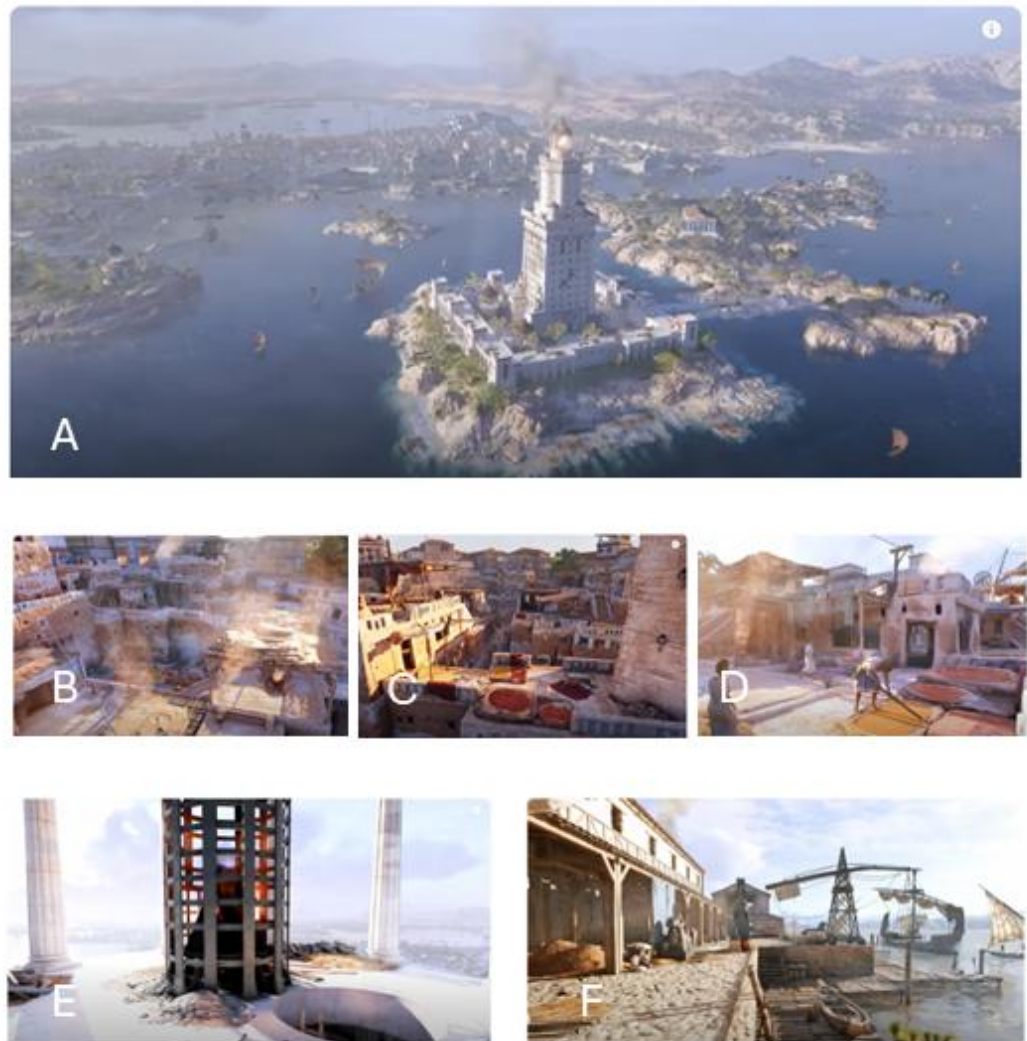
- *Questionnaire 3 – Teacher's Satisfaction Survey*

This survey gathered the teachers' perspective on the educational effectiveness of the integrated approach. The instructor noted an increase in student participation and interest, highlighting that the use of 3D reconstructions enabled students to engage actively and develop a deeper, more conscious understanding of classical civilisation.

3.2. Key Visual Elements Illustrating the Urban Structure of Ancient Alexandria

Beyond evaluating learning outcomes, the intervention facilitated a thorough analysis of ancient Alexandria's urban layout. This was achieved by integrating textual sources, visual materials, and a 3D digital reconstruction. Three key figures accompany the analysis, offering clearer spatial understanding and greater insight into the city's structure. Table 1 further summarises the principal architectural elements identified, detailing their functions and locations within Alexandria's urban fabric.

Figure 3: A) 3D reconstruction of the Lighthouse of Alexandria; B) urban fabric of Alexandria; C) streets of Alexandria; D) Tanneries similar to those actually in Fès; E) detail of Lighthouse; F) Alexandria Harbor. Source: Daydream Gaming. (2024). *Alexandria, Ancient Egypt 43 BCE – Cinematic Tour (AC Origins)*. <https://www.youtube.com/watch?v=XK8MFObWIu0&t=7694s>



This visual series offers a comprehensive look at ancient Alexandria's urban, cultural, and engineering landscape. It begins with Strabo's account of the Canopic Way (Figure 1) and its central role, followed by a topographic map highlighting key civic and religious connections (Figure 2). 3D reconstructions of the Lighthouse of Alexandria (Figures 3) emphasize its architectural brilliance and structural ingenuity. The city's daily life is depicted by narrow streets and traditional tanneries, reminiscent of those still operating in Fès, Morocco, where stone vats are arranged in a honeycomb pattern for artisanal leather processing using natural dyes. Finally, the harbor's strategic and commercial importance is illustrated.

Table 1. Main structural elements identified in the reconstruction of Alexandria

Architectural Element	Primary Function	Spatial Position
Lighthouse of Alexandria	Navigation and monumen- tal symbol	Eastern extremity of the is- land
Canopic Way	Principal urban axis	From the Necropolis to the Canopic Gate
Gymnasium	Education and civic assem- blies	Intersection of Canopic Way and L1/R1 ¹

¹ Data derived from 3D reconstruction, ancient literary sources, and audiovisual material presented in the video lecture.

4. Discussion

The results of the experimental project confirm the effectiveness of three-dimensional digital technologies in the teaching of classical subjects, with a significant increase in student engagement, improved understanding of content, and the activation of complex cognitive processes such as critical analysis and independent reworking of information.

The entire intervention fostered the active construction of meaning through language, storytelling, and the comparison of different cultures and expressive codes. Students were able to develop personal interpretations, justify their choices, and connect knowledge of the past with the tools of the present, thus activating a deep and conscious metacognitive process (Flavell, 2024). They didn't simply learn something about Alexandria, they learned through Alexandria: an ancient city that became, for them, a laboratory for historical, cultural, and technological exploration where the teacher doesn't merely transmit knowledge but becomes an architect of possible worlds (Berthoz, 2013).

The educational experience promoted an interdisciplinary approach, encouraging students' ability to integrate heterogeneous sources, formulate interpretative hypotheses, and critically justify their choices; however, the use of audiovisual materials in English sometimes limited comprehension, suggesting the opportunity to adopt Italian content or to implement more effective linguistic mediation strategies in future applications. It is also essential to further investigate the emotional impact of immersive environments, as carefully designed visual, narrative, and interactive stimuli can enhance motivation and engagement (Norman, 2004, Todino, Di Tore, Iannaccone, & Sibilio, 2025); such environments are conceived as educational ecosystems that integrate real and virtual dimensions, fostering authentic and situated learning (Di Tore, Campitiello, Todino, Iannaccone, & Sibilio, 2022). Therefore, the research perspectives to be developed should focus on the emotional impact of immersive environments and their role as educational ecosystems since the encouraging results emerging from the experimentation indicate that these areas are promising for promoting knowledge and critical thinking.

5. Conclusions

The integration of three-dimensional digital technologies within a structured and interdisciplinary educational framework represents a significant advancement in the teaching of classical subjects. The combined use of 3D technologies, videoconferencing, and philological analysis has enhanced students' understanding of historical and cultural content, promoting the construction of complex mental representations and enabling the integration of new knowledge with existing schemas through the organisation of verbal and visual stimuli (Mayer, 2005).

A significant increase in student engagement was observed, with learners recognising 3D technologies as effective tools for stimulating critical thinking and fostering active participation. This can be attributed to the capacity of interactive learning environments to enrich the overall educational experience (La Manna, Zappalà, & Sibilio, 2024). The findings of this study demonstrate that 3D technologies, when integrated into a well-designed educational programme, can effectively motivate students in the study of classical disciplines, while also supporting the development of critical and reflective thinking skills.

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