

The Role of Visual Media in Didactic Innovation: Insights from Experimental Pedagogy[†]

Alberto Fornasari

Department of Education, Psychology and Communication Sciences, University of Bari “Aldo Moro”,
70122 Bari, Italy; alberto.fornasari@uniba.it

[†] Presented at the Learning and Teaching Strategies Mediated by Visual Education: Horizons of Research and Action (ASTERA 2025), Bari, Italy, 2 October 2025.

Abstract

This contribution reports on a Visual Education pilot intervention implemented within the TFA program at the University of Bari (2025). Using a single-group research design ($N = 216$), the study examines the effects of integrating concept maps, infographics, and videos on disciplinary knowledge, the quality of participants’ outputs, and trainees’ perceptions. Preliminary findings suggest that visual tools may support content comprehension and organization while simultaneously highlighting the importance of structured and reflective visual design in teacher education.

Keywords: visual education; teacher education; experimental pedagogy

1. Introduction

In contemporary educational contexts, teaching–learning processes increasingly unfold within multimodal environments, characterized by the systematic integration of verbal and visual languages. Texts, images, videos, and digital artifacts jointly contribute to meaning-making, shaping a learning experience in which knowledge is not conveyed through a single channel but rather emerges from the interaction among multiple representational modalities. Such integration profoundly reshapes the cognitive processes involved in learning, as understanding derives from the combination of textual information and visual stimuli, which cooperate in the construction of more articulated and stable mental models. From this perspective, Visual Education can be conceptualized as an instructional approach that values visual languages as tools for learning, representing, and communicating knowledge. It extends beyond the merely illustrative use of images by systematically embedding concept maps, infographics, videos, and digital media into educational design, thereby influencing the cognitive and metacognitive processes that underpin comprehension, organization, and information retention [1].

The literature on multimedia learning provides a broad and multifaceted interpretative framework, as it investigates, on the one hand, how individuals process information presented through multiple modalities (text, images, audio, video) and, on the other hand, which design conditions make such integration genuinely effective. Within this perspective, the Cognitive Theory of Multimedia Learning advances a clear core principle: learning does not improve “automatically” when images or videos are added; rather, it improves when words and visuals are designed to function together in ways that align with learners’ cognitive processes [2]. The central assumption is that humans possess partially distinct processing channels—for instance, a predominantly verbal channel and a predominantly



Academic Editors: Berardinetti
Valentina, Giusi Antonia Toto and
Piepaolo Limone

Published: 16 July 2026

Copyright: © 2026 by the author.
Licensee MDPI, Basel, Switzerland.
This article is an open access article
distributed under the terms and
conditions of the [Creative Commons
Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

visual one—and that learning is enhanced when information is distributed and coordinated across these channels in a coherent manner, enabling learners to construct a more stable and integrated mental representation of the content. This enhancement, however, crucially depends on adherence to cognitive constraints.

From an operational standpoint, multimedia materials must be designed with the awareness that attentional resources and working memory capacity are limited: when content is presented in a redundant, fragmented, or overly dense manner—for instance through non-pertinent graphical elements or explanations that are not synchronized with visuals—there is a risk of diverting resources away from meaningful processing. At this stage, the distinction between what supports learning and what hinders it becomes crucial. Effective instructional design therefore seeks to minimize extraneous cognitive load while preserving mental resources for what truly matters, such as selecting relevant information, organizing it, and integrating it with learners' prior knowledge [3,4]. It follows that the issue is not one of media expansion per se, but rather of greater pedagogical intentionality in how media are orchestrated and presented to learners.

Particular emphasis is therefore placed on the notion of generative processing. Learning becomes deeper when learners do not merely receive information but are enabled to actively construct meaning through a set of cognitive processes aimed at connecting different parts of the content, integrating text and images, and linking new material to prior knowledge. Moreover, generative processing is more readily activated when instructional materials are clear, concise, and well-structured, and when learners can focus their attention on core conceptual relationships rather than on peripheral details or an overabundance of stimuli [3,4].

Research on multiple representations emphasizes that images, diagrams, and graphs can facilitate the construction of mental models by enabling the depiction of information and relationships that would be more difficult to visualize and cognitively manipulate through verbal form alone—provided, however, that learners are supported in correctly interpreting each representation, and above all, in translating and coordinating information across different representational formats [5,6]. The challenge does not lie in the individual diagram or image per se, but rather in the cognitive transition required to align what the text explains with what the schematic displays, or to understand how two representations convey the same concept in different forms. Observation must therefore be transformed into a cognitively oriented act aimed at deeper understanding [5], while avoiding the risk that multiple representations are processed superficially, yielding little or no gain in comprehension [2–5].

Visual Education thus stands at the intersection of cognitive psychology, educational sciences, and visual culture, emphasizing the fact that the brain tends to remember and understand information more effectively when it is associated with meaningful visual stimuli. This assumption finds further support in Dual Coding Theory, according to which verbal and non-verbal coding can cooperate in sustaining memory and information retrieval [7]. At the same time, the effectiveness of visual devices requires careful instructional design: concept maps and infographics are not neutral, but rather structure pathways of information selection, organization, and integration, with potential implications for both comprehension and motivation. In this regard, the work of Kress and van Leeuwen [8] highlights how visual texts are governed by specific grammars and how contemporary literacy increasingly demands multimodal competencies, which inevitably shape modern teaching practices. Simply presenting images is not sufficient; learners must be supported in thinking with images and in constructing visual artifacts that are both cognitively functional and communicatively clear.

The present contribution examines, from an empirical–experimental perspective, the integration of Visual Education within a pilot intervention conducted in a TFA program at the University of Bari “Aldo Moro”. The study aims to explore potential effects on disciplinary learning, the quality of participants’ outputs, and trainees’ perceptions, situating the intervention within the current state-of-the-art and reporting preliminary findings, in line with an ongoing research project.

2. Theoretical Framework and State-of-the-Art

The growing attention to visual education is supported by several strands of research, which within Visual Culture Studies and Bildwissenschaft, describe a profound transformation in the status of images and modes of seeing. From this perspective, Dondero [9] and Dondero and Reyes-Garcia [10] show how images actively participate in the production of knowledge and meaning, while Mitchell [11] highlights the performative and cultural dimensions of the visual. In educational contexts, this transformation points to a specific training need related to ways of seeing and experiencing images [12,13].

Visual education, understood as an instructional practice, engages processes of perception, attention, categorization, memory, and information processing, thereby shaping the organization of knowledge. Clark and Lyons [14] emphasize how visualization can support comprehension and decision making, while Rivoltella [15] highlights its mediating, anticipatory, and modeling functions in relation to knowledge, which are particularly salient in digital contexts. From a psychological standpoint, cognitive load theories indicate that instructional design must strike a balance between complexity and guidance: reducing extraneous load and managing intrinsic load are crucial to preventing visual supports from becoming sources of overload [16,17].

To gain a more nuanced understanding of the impact of visual media, it is useful to recall the distinction between the “decorative” and the “instructional” use of images: effective visualization is that which guides the selection of relevant information, facilitates its organization, and supports its integration with prior knowledge [4,6]. Research on images in educational texts indicates that functional illustrations, when accompanied by clear cues and aligned with task objectives, can foster learning; conversely, redundant or non-pertinent visuals may distract learners and undermine comprehension [18]. From this perspective, Visual Education is operationalized through the use of specific tools and techniques, such as mind maps, infographics, flashcards, storyboarding, and labeling. Maps promote hierarchical or networked structuring of knowledge by making conceptual relationships explicit; infographics enable information to be condensed and more easily navigated; flashcards support active memorization; and storyboarding integrates content with narrative, rendering knowledge use more concrete and applicable [19]. At the level of information design, works such as Tufte [20], and more broadly, the literature on visual design in education underscore the importance of clarity, conciseness, and graphical coherence in order to reduce communicative noise and enhance the readability of instructional materials.

In light of the evidence emerging from the literature, the state-of-the-art converges on two main assumptions:

- Visual media can enhance comprehension and retention when they are designed in alignment with cognitive constraints;
- Visual competence must be intentionally developed, as multimodality does not automatically translate into learning.
- It is within this theoretical space that the intervention presented below is situated.

3. Research Design and Preliminary Results

The study aims to explore the effects of a Visual Education pathway implemented within the Tirocinio Formativo Attivo (TFA), a university-based teacher qualification program designed for graduates and oriented toward the development of pedagogical, instructional, and disciplinary competencies. The intervention was launched in 2025 with students enrolled in the TFA at the University of Bari “Aldo Moro” and is structured around three main objectives:

1. To assess improvements in disciplinary knowledge;
2. To analyze the quality of visual products through an authentic task;
3. To capture trainees’ perceptions through a questionnaire.

The present contribution reports data from a preliminary phase of the study, while the research is still ongoing. A single-group experimental design was adopted, involving a sample of 216 trainees. The procedure unfolded across successive phases. In the initial phase, baseline disciplinary knowledge was assessed using a standardized test (range 0–100). This was followed by a training phase based on a traditional instructional approach, primarily relying on text-based materials.

At the end of this phase, an intermediate test was administered, after which Visual Education strategies were systematically introduced through the use of concept maps, infographics, and instructional videos.

The overall intervention lasted eight weeks and was organized into synchronous sessions. Inclusion criteria comprised the regular attendance of training activities and the provision of informed consent (Figure 1).

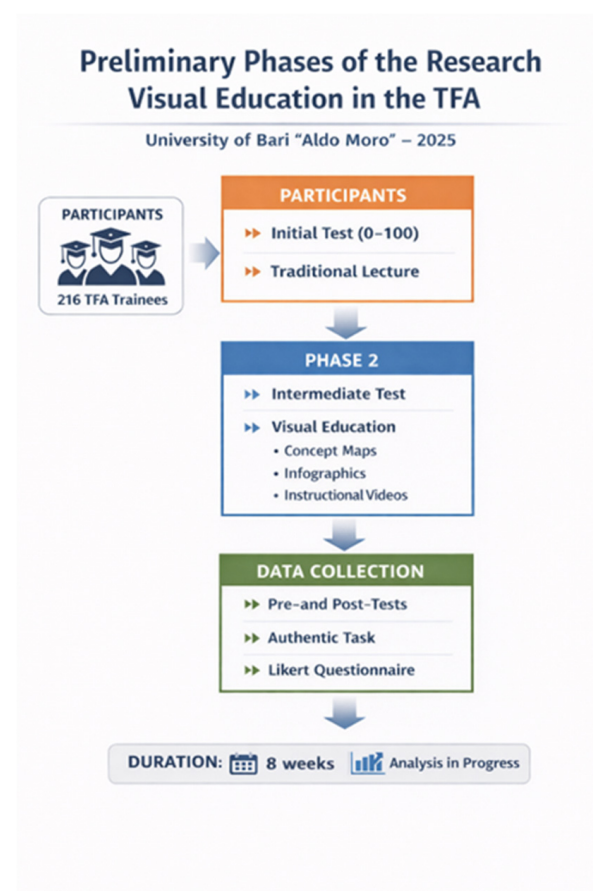


Figure 1. Schematic representation of the preliminary phases of the experimental design adopted in the Visual Education study within the TFA program (University of Bari “Aldo Moro”, 2025).

Data were collected using differentiated instruments in order to capture complementary dimensions of the learning experience:

- Pre- and post-knowledge tests (0–100), administered in parallel forms;
- An authentic task (0–15), assessed through a rubric focused on content, organization, and clarity, aimed at examining both the level of knowledge acquisition and its translation into a communicable product;
- A Likert-scale questionnaire (1–5) addressing clarity, usefulness, and perceived support, supplemented by an open-ended question.

The planned analyses include descriptive statistics (means, standard deviations, minimum and maximum values), rubric-based analysis of the authentic task, and qualitative analysis of open-ended responses. Data collection for this initial tranche has been completed, while quantitative and qualitative processing is currently underway using statistical software (Jamovi version 2.3.28).

At this stage, some preliminary qualitative evidence can be reported. In line with the research hypotheses, concept maps and infographics are frequently perceived as functional in supporting content organization and facilitating comprehension. These indications appear consistent with the role attributed to visual representations in the construction of schemas and mental models, as well as in supporting information selection and organization processes [4,5].

However, some critical issues also emerged, particularly with regard to the perceived length of videos and the cognitive demands associated with autonomous map construction for a minority of trainees. These findings underscore the importance of conciseness, content segmentation, and the level of guidance provided to learners in order to contain extraneous cognitive load [17]. This, in turn, highlights the need to design visual materials that are essential, progressive, and supported by appropriate scaffolding strategies.

As the research is still ongoing, the present contribution should be regarded as an interim report of findings. Full analyses and definitive quantitative results will be presented in a subsequent dedicated publication.

4. Conclusions and Research Perspectives

Positioned at the intersection of instructional innovation and empirical evidence, the present contribution advances an interpretation of Visual Education as a strategic component of educational design, particularly within initial teacher education contexts. Preliminary findings suggest that visual tools such as concept maps and infographics are perceived by trainees as functional devices for supporting comprehension and organizing content, confirming the potential of visual representations to sustain knowledge structuring processes and to foster greater awareness of conceptual connections. At the same time, the critical issues identified—especially with regard to video length and the cognitive load associated with autonomous map construction—indicate that the effectiveness of Visual Education is strongly contingent upon the quality of instructional design, requiring concise and progressive materials accompanied by appropriate forms of guidance, particularly in professional training settings.

The study presents limitations that must be acknowledged: the research context is confined to the TFA program at the University of Bari, the duration of the intervention is relatively short (eight weeks), and the single-group experimental design does not currently allow for robust causal inferences. Looking ahead, it therefore appears advisable to develop studies employing controlled experimental designs, to introduce longitudinal analyses, and to involve more diverse samples, in order to examine the stability of the observed effects and the transferability of findings across different educational and training contexts.

Taken together, these preliminary outcomes suggest that visual education cannot be reduced to a mere repertoire of operational techniques, but should instead be interpreted as a cultural and educational dispositif capable of supporting reflective teaching practices and fostering transversal competencies that are highly relevant for future teachers. Promoting visual literacy and conscious multimodal design ultimately entails engaging with a social dimension of knowledge: the capacity to understand, select, organize, and communicate complex information in accessible, critical, and inclusive ways, thereby contributing to the preparation of teachers who are able to design more mindful learning environments and to inhabit contemporary information ecosystems responsibly.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived for this study, as only aggregated and anonymous data on learning outcomes and participants' perceptions were collected, with no sensitive or identifying information gathered.

Informed Consent Statement: Informed consent was waived, as voluntary participation in the training activities and related assessments was considered implicit assent to the anonymous collection and use of the data for research purposes.

Data Availability Statement: The original contributions presented in this study are included in the article.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Rivoltella, P.C.; Panciroli, C. Visual media education: Audiovisuals and education in the post-media society (Visual media education: Audiovisivi e formazione nella società postmediale). *Sociol. Comun.* **2021**, *62*, 87–104. (In Italian) [[CrossRef](#)]
2. Mayer, R.E. The past, present, and future of the cognitive theory of multimedia learning. *Educ. Psychol. Rev.* **2024**, *36*, 8. [[CrossRef](#)]
3. Clark, R.C.; Mayer, R.E. *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*, 5th ed.; Wiley: Hoboken, NJ, USA, 2023.
4. Mayer, R.E. Incorporating motivation into multimedia learning. *Learn. Instr.* **2014**, *29*, 171–173. [[CrossRef](#)]
5. Ainsworth, S. DeFT: A conceptual framework for considering learning with multiple representations. *Learn. Instr.* **2006**, *16*, 183–198. [[CrossRef](#)]
6. Fornasari, A. Immersive technologies and innovation in educational contexts: An exploratory investigation at the University of Bari. *Nuova Second.* **2023**, *XLI*, 161–173.
7. Clark, J.M.; Paivio, A. Dual coding theory and education. *Educ. Psychol. Rev.* **1991**, *3*, 149–210. [[CrossRef](#)]
8. Kress, G.; van Leeuwen, T. *Reading Images: The Grammar of Visual Design*, 3rd ed.; Routledge: London, UK, 2020.
9. Dondero, M.G. *The Languages of the Image: From Painting to Big Visual Data (I Linguaggi dell'Immagine: Dalla Pittura ai Big Visual Data)*; Mimesis: Sesto San Giovanni, Italy, 2020. (In Italian)
10. Dondero, M.G.; Reyes-Garcia, E. Image formats: From photography to digital images (Les supports des images: De la photographie à l'image numérique). *Rev. Fr. Sci. Inf. Commun.* **2016**, *9*. (In French) [[CrossRef](#)]
11. Mitchell, W.J.T. Migrating images: Totemism, fetishism, idolatry. In *Image Science*; University of Chicago Press: Chicago, IL, USA, 2015; pp. 65–78.
12. Farné, R. *Visual Pedagogy: An Introduction (Pedagogia Visuale: Un'Introduzione)*; Raffaello Cortina: Milan, Italy, 2021. (In Italian)
13. Prosser, J. Visual methods and the visual culture of schools. *Vis. Stud.* **2007**, *22*, 13–30. [[CrossRef](#)]
14. Clark, R.C.; Lyons, C. *Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials*, 2nd ed.; Wiley: Hoboken, NJ, USA, 2010.
15. Rivoltella, P.C. *Educating for the Media: Tools and Methods for Training Media Educators (Educare per i Media: Strumenti e Metodi per la Formazione del Media Educator)*; EDUCatt: Milan, Italy, 2014. (In Italian)
16. Sweller, J. Cognitive load during problem solving: Effects on learning. *Cogn. Sci.* **1988**, *12*, 257–285. [[CrossRef](#)]
17. Sweller, J.; van Merriënboer, J.J.G.; Paas, F. Cognitive architecture and instructional design: 20 years later. *Educ. Psychol. Rev.* **2019**, *31*, 261–292. [[CrossRef](#)]
18. Levie, W.H.; Lentz, R. Effects of text illustrations: A review of research. *Educ. Commun. Technol. J.* **1982**, *30*, 195–232. [[CrossRef](#)]

19. Fornasari, A.; Conte, M.; Scarinci, A. Educational Technologies For The New Millennium. How To Rethink Teaching in The Post-Pandemic era: The Results of an Italian Research project. In Proceedings of the 12th International Conference on eLearning, Online, 23–24 September 2021; pp. 66–72.
20. Tufte, E.R. *The Visual Display of Quantitative Information*, 2nd ed.; Graphics Press: Cheshire, CT, USA, 2001.

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.