



Art Didactics and New Technologies in Primary School Field Practice: Augmented Reality Application for Multimodality

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Abstract

This paper is a result of a field application carried out in a public school in the city of Thessaloniki, Greece. We aimed at integrating an augmented reality application in the primary school curriculum. The role of Art Education in nowadays mostly has to do with specific tasks, traditional art methods and materials that will always have their place in the curriculum. Art education is a fundamental aspect of a well-rounded education. It goes beyond merely teaching artistic techniques; it instills valuable life skills, fosters creativity, and contributes to personal growth, cultural understanding, and societal enrichment. Digital technologies, especially in the post covid and postdigital era, have influenced both the education system in general and art didactics as well. The research question of the paper is how new technologies and applications are reinventing and reshaping art education. The use and the study of specific artworks is carried out in a way for the multisensory experience of contemporary cultural reality. The key is to find a true balance between the field art practice and the high-end tech integration. How can we address old school artworks and artistic content in a multimodal way? Can we address a class free lesson in school? By addressing this empirical, applied learning experience, we tried to facilitate student with the technology integration.

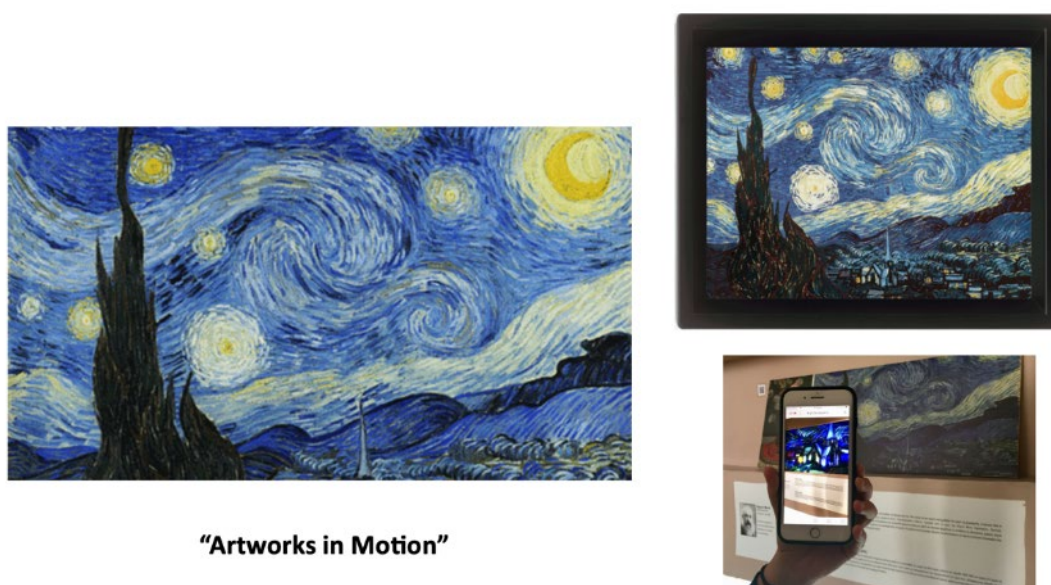
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1. Introduction

Initially social semiotics as a literacy of the images (Kress, 1996) offers a conceptual and methodological framework for the reception of artworks as signs of communication. Despite the aesthetic particularities, which characterize a historical work of art in the context of the visual narrative, the visual testimonies are narrated and construct post-historical derivatives for the receivers.

The methodology we use refers to the approach and techniques used to study and analyze multimodal modes of communication or information, such as text, images, audio and videos. It involves integrating and interpreting these different modalities to gain a more comprehensive understanding of the given phenomenon.

Figure 1. Digital Content and Field Practice of the AR Application



2. Materials and methods

The educational activity was supposed to engage the students of the 4th Public School in Sykies (Thessaloniki) with the theory and history of art and the original artistic creation. The field application took place during the 2022-2023 school year. A 12/class school in capacity, with 189 students and 29 people in the teaching staff. It is an outgoing, inclusive school that participates in actions for ecology, culture and the arts. It has several participations in mobilities abroad (Comenius and Erasmus +). The field application is based on participatory teaching methods, exploratory learning and working in groups by the students. Teaching is also based on the use of digital, written and visual sources. As for the pedagogical background, it takes into account the need for students to move in the path to find - process - create new knowledge, developing relevant skills and strengthening their abilities, in accordance with theories such as that of "Learning by Design" (Learning by Design) (Kalantzis & Cope, 2004). The students explore the educational sources, reshape them based on specific requests and contribute to teaching by producing their own material.

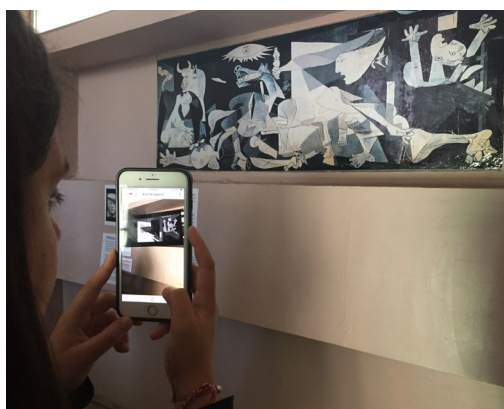
2.1 New technologies for dissemination and evaluation

In recent years, the definition of digital literacy has gone through a stage of continuous reform and redefinition, so that it acquires a specific identity. The origin of the modern version of the term¹ is attributed to Paul Gilster (1997), who mentioned that people from passive receivers of information, turned into something totally different. They become energetic, by having an active role to discover, evaluate and utilize the received information in the new networked digital environment (networked digital environment). This specific scientific framework is known as digital literacy, referring to the fact that it is not only a simple skill, but the ability of functional use of the new digital media (Eshet-Alkalai, 2004). In modern societies, the terms "*digital literacy*" and globalization are related. At European and international level, each state sets as one of its fundamental objectives, the strategic of citizen encouragement for lifelong learning, which will be adapted to their daily needs, in their professional environment and will even "meet" the demands of the new economy (BECTA, 2004). New Technologies are therefore a necessity in schools, universities, the workplaces, in everyday activities and their agenda is to facilitate learning (Eynon, 2009). But at this point we must highlight a fact that was reinforced during the pandemic. Social inequalities, which due to an economic component, resulted in us also getting to know the term digital divide² (Selwyn & Facer, 2007).

Figure 2. Augmented Reality (AR) application test run



Figure 3. Students' worksheets, on the subject of Pablo Picasso's visual work, Guernica



¹ At Gilster, P. (1997). *Digital literacy*. New York: Wiley Computer Pub.

² refers to the differences observed between those who have (haves) and those who do not have (have nots) access to digital media, such as computers, and those who use and do not use ICT and online applications (Belanger, Carter, Mills, 2010).

Digital literacy refers to the ability to effectively use digital technologies to locate, evaluate, create, and communicate information. Our goals include to develop critical thinking skills. Students should learn how to evaluate the credibility and reliability of digital sources and to distinguish between fact and opinion. We want to enhance communication skills. Students should learn how to effectively communicate and collaborate with others using digital technologies. We want our students to improve digital skills. An important aspect is to promote digital citizenship and fostering creativity. Students should learn how to use digital tools to express their ideas and creativity, and to produce and share digital content. Overall, the goals of digital literacy education are to prepare students to be competent and responsible users of digital technologies in their personal and professional lives.

2.2. Multimodality

In the field action, it is more often to use multimodal "texts" and multimodal material. Students will approach critically with the dramatization and production of visual material and visual messages. The conditions in nowadays, technologically and service-wise, create new horizons in teaching with the use of multimodal texts and students handle the multitude of multimodal material that they daily see (Print, television, teletext, video clips, Internet, etc.) (Hondolidou, 1996).

In summary, multimodality defines the process of designing, producing and handling a communication product, with the use and combination of different semiotic modes. These products are differentiated according to the presentation of information regarding:

- The production tools of the representations (graphic materials, digital software, internet, PC, video, etc.),
- The way the information is arranged (horizontal or vertical text orientation, single or double columns),
- The way of its representation (verbal or virtual).

The produced multimodal material is not a sum of semantic parts but a new semantic event (Cope & Kalantzis, 2000). Virtual representations serve different cognitive and metacognitive functions in the processing, intake and enjoyment of the verbal text, when they coexist with it (Carney and Levin, 2002).

2.3. The problematic for Augmented Reality (AR) applications

Augmented reality (AR) is an interactive experience that combines the real world and computer-generated content. The content can span multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory³. AR can be defined as a system that incorporates three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects (Claypool, Claypool, 2010).

The problematic for Augmented Reality (AR) applications for multimodality revolves around addressing the challenges and complexities associated with integrating multiple modalities within an AR experience. Multimodality refers to the combination of different sensory modalities such as visual, auditory, haptic, and even olfactory inputs to enhance the user's perception and interaction with the augmented environment. While multimodal AR has the

³ At Cipresso, Pietro, Giglioli, Irene, Alice Chicchi, Raya, iz, Riva, Giuseppe (2011). "The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature". *Frontiers in Psychology*. 9: 2086. doi:10.3389/fpsyg.2018.02086

potential to create more immersive and engaging experiences, there are several key issues that need to be addressed:

Interaction Design: Designing intuitive and efficient interaction techniques for multimodal AR can be challenging. Users may need to interact with the virtual objects or elements using different modalities simultaneously or sequentially.

Sensory Integration: Combining various sensory inputs in a coherent and synchronized manner is crucial to create a believable multimodal AR experience. Integrating visual, auditory, and haptic feedback in real-time, while maintaining consistency and avoiding sensory overload or conflicts, requires careful calibration and synchronization.

Contextual Awareness: Multimodal AR applications need to be aware of the user's context and environment to provide relevant and personalized experiences.

Hardware Limitations: The hardware devices used for AR, such as headsets, glasses, or mobile devices, may have limitations in capturing and delivering multimodal inputs. (Caudell, Mizell, 1992).

User Experience: Creating a compelling and enjoyable user experience is a critical factor in the success of multimodal AR applications (Catmull, Clark, 1978).

Accessibility and Inclusivity: Multimodal AR applications should consider accessibility requirements for users with different abilities, such as those with visual or hearing impairments (Bass, Weber, Zhu, 2015).

Addressing these challenges requires a multidisciplinary approach, involving expertise in human-computer interaction, computer vision, audio processing, haptics, machine learning, and other relevant fields. Overcoming these problems will pave the way for more sophisticated and natural multimodal AR experiences that can revolutionize various domains, including entertainment, education, healthcare, and industrial applications (Beeson, Zimmerman, Livesay, Ross, Livesay, Livesay, 2006).

3. Discussion

In the post-digital era, art education continue to play crucial role in our society, in a rapidly evolving landscape shaped by digital advancements. Here are a few thoughts on the intersection of arts and education in this era:

1. **Expanded access:** The digital age has democratized access to arts and education. Online platforms, virtual classrooms, and digital resources have made it easier for people around the world to engage with artistic expressions and educational content. (Botsch, Wiratanaya, Kobbelt, 2002).
2. **Blurring boundaries:** The post-digital era has seen the blurring of boundaries between traditional art forms and new media. (Jones, Goregaokar, 2020).
3. **Multidisciplinary collaboration:** The post-digital era encourages multidisciplinary collaboration between artists, educators, scientists, and technologists.
4. **Digital literacy and media literacy:** In the post-digital era, it is essential to equip students with digital literacy skills and media literacy (Bailey, Miyata, 2017).
5. **Adaptability and resilience:** The post-digital era is characterized by rapid technological advancements, which necessitates adaptability and resilience in both arts and education (Ahn, Pellicone, Butler, 2014).

An important milestone for our project was a custom made educational tool. We created an augmented reality application, in which the students had the chance to use multimodal material for the artworks in public space. They had access in audio-visual content related to the thematic that refers to the research questions above. Furthermore it is necessary to use together, as one, visual, auditory, reading/ writing and kinaesthetic elements to embed students in interactive learning environments where they feel connected with each other and the educational content (Deterding, Dixon, Khaled, Nacke, 2011). Overall, arts and education in the post-digital era⁴ offer exciting possibilities for creativity, collaboration, and learning. By embracing digital tools, expanding access, and fostering interdisciplinary connections, we can create a vibrant ecosystem that nurtures artistic expression and educational growth in a rapidly evolving digital landscape.

In the field application we noticed that students are looking forward in new technologies in school for various reasons, many of which are influenced by the evolving digital landscape and the benefits that technology can bring to the learning process. Some of the key reasons include:

1. **Engagement:** New technologies can make learning more interactive and enjoyable. Students are often more motivated to participate when they can use gadgets, educational apps, or multimedia presentations, as it provides a break from traditional textbook-based learning.
2. **Personalization:** Technology enables personalized learning experiences. With adaptive learning software and online resources, students can progress at their own pace, receive customized feedback, and focus on areas where they need more support.
3. **Access to Information:** The internet and digital tools offer vast amounts of information at students' fingertips. This access to a wealth of knowledge can enhance their understanding of various subjects and enable them to explore topics beyond the curriculum.
4. **Collaboration:** Technology facilitates collaboration among students. Online platforms, cloud-based applications, and communication tools allow students to work together on projects, share ideas, and collaborate with peers, even if they are physically distant.
5. **Real-World Skills:** Integrating technology into education helps students develop skills that are increasingly important in the modern job market, such as digital literacy, problem-solving, critical thinking, and technological proficiency.
6. **Future Readiness:** As technology continues to shape various industries and aspects of society, students recognize the importance of being familiar with technological tools and advancements to be prepared for the future.
7. **Efficiency:** Technology can streamline administrative tasks, communication between teachers and students, and the organization of coursework, leading to more efficient workflows and time management.
8. **Interactive Learning:** Virtual reality (VR), augmented reality (AR), and simulation tools offer immersive and interactive learning experiences that can enhance understanding and retention of complex concepts.

⁴ Giorgio Agamben (2002) describes paradigms as things that we think with, rather than things we think about. Like the computer age, the postdigital is also a paradigm, but as with post-humanism for example, an understanding of postdigital does not aim to describe a life after digital, but rather, attempts to describe the present-day opportunity to explore the consequences of the digital and of the computer age. While the computer age has enhanced human capacity with inviting and uncanny prosthetics, the postdigital may provide a paradigm with which it is possible to examine and understand this enhancement.

9. Eco-Friendly Solutions: Technology can reduce the reliance on paper-based materials, leading to more environmentally friendly practices in schools.
10. Inclusivity: Technology can create more inclusive learning environments, making education accessible to students with disabilities or those facing geographical or socio-economic barriers.

Despite the numerous advantages of integrating technology in education, we noticed that it's essential to strike a balance and ensure that its usage is purposeful, well-regulated, and aligned with educational objectives. Also, not all students may have equal access to technology, which highlights the need for equitable technology integration strategies in schools.

4. Conclusion

Integrating high-tech applications into the school curriculum offers several compelling advantages that make them necessities in today's educational landscape. With the field application we witnessed the turn to relevance to the Digital Age. We live in a digital era where technology is pervasive in all aspects of life. Preparing students for the real world requires equipping them with digital literacy and proficiency in using technology effectively. A great milestone for education is customized learning, because with these applications we saw that technology enables personalized learning experiences tailored to individual student needs, learning styles, and paces. We had the opportunity in accessing to a wealth of resources. The internet and digital platforms provide access to a vast array of educational resources, ranging from research articles and documentaries to online courses and tutorials. High-tech applications can facilitate efficient access to these resources.

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3. Students: The young minds of our primary school who eagerly embraced the use of new technologies in their learning. Their curiosity, adaptability, and willingness to explore these innovations inspired us to continually improve and tailor our approach.
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Together, the collective efforts of these individuals and groups have empowered our primary school to embrace new technologies, fostering a dynamic and innovative learning environment for our students. We are truly thankful for their contributions to the success of this venture.

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