SciArt Case study

Piloting and Implementation of the SciArt activities in Portugal, Porto

[June, 2025]

SCIART

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Contents

Piloting of the SciArt activities in Portugal, Porto

Location of the Implementation

The SciArt pilot implementation in Portugal took place in the Northern region, specifically in the district of Porto. The main educational partner was Agrupamento de Escolas Eugénio de Andrade (AEEA), located in Porto, the second largest city of Portugal, with a densely populated multicultural metropolitan area and a strong educational network with several primary and secondary schools. This school was supported by the Municipal Museum of Esposende (MME) and by the Centre for Intercultural Studies of the Polytechnic University of Porto (CEI-P.PORTO).

School Profile

AEEA is a public-school grouping, formed by four basic education schools – three for pre-school and 1st cycle education and one with students from the 5th to the 9th grade, providing education at the primary and lower secondary levels.

The institution serves a diverse urban student population in Porto, specifically 1129 children /students and 63 classes: 8 pre-school classes, 30 for the 1st cycle, 15 for the 2nd cycle, and 10 for the 3rd cycle.

The mission of AEEA is to provide future citizens with the skills and knowledge that allow them to fully exploit their abilities, integrate the society in an active way and make a contribution to the country's economic, social and cultural life. The school is strongly committed to innovation and inclusion, fostering creativity, teamwork, and respect for diversity through interdisciplinary projects, collaborations and Erasmus+ Programs.

Teaching Staff Involved

The SciArt Project was implemented by a multidisciplinary team from AEEA, each educator bringing specific expertise to the initiative:

- Ana Maria de Sousa Monteiro, a physical education teacher and Principal's Assistant, holds a degree in Physical Education (University of Porto, 1989) and a specialization in School Administration (P.PORTO, 2016), contributing leadership and coordination support.

- Anabela Ferreira Mota, a geography teacher and project coordinator, earned her degree in Geography from the University of Porto in 1987 and has extensive experience in managing interdisciplinary projects.

- António Batista Carvalho, a History teacher and Citizenship and Development coordinator, graduated in History (University of Porto, 1983), with further specializations in Conflict Management (Lusófona University, 2012) and School Administration (2013). He has over 30 years of experience and has held several public and school leadership positions.

- Adelina Maria Madureira Ferreira, an Arts teacher, holds a degree in Interior Design and a post- graduate diploma in Industrial Design (IADE-Lisbon, 1989), with professional experience in architecture and equipment design.

- Ângela Saraiva, a technological education teacher, graduated in Civil Engineering and holds professional qualifications in the disciplines of technological education and mathematics. She currently holds the position of Class Director Coordinator. She has over 25 years of teaching experience and professional experience in civil engineering.

- Malvina Costa: Malvina Maria Silva Ferreira da Costa, a Physics and Chemistry teacher, holds a degree in Chemistry with a scientific specialization from FCUP – the Faculty of Sciences of the University of Porto. Later, she went on to complete a qualification course in Educational Sciences at UAb - Open University. She is currently the coordinator of the tutoring program.

- Susana Ferreira, a Natural Sciences teacher with over 20 years of teaching experience. She graduated in Biology and Geology teaching from the University of Minho in 2003, and completed her Master's degree in Evolution and Origin of Life at the same institution in 2007. During her academic journey she focused on studying the evolution of the early Earth and the conditions favorable to the origin of life, which culminated in the publication of "Environments and Life on Earth: The first 4.0 Ga" (2008).

- The team of educators from AEEA also included Paula Lima Assunção Ribeiro, Marcela Cardoso and Miguel Rodrigues, with a multidisciplinar background and a long experience in inclusion and diversity in educatiuon.

The team worked collaboratively, integrating historical, artistic, and aesthetic knowledge to support the students' holistic development.

Student Participation

The implementation of the pilot was done with an 8th grade class of 20 students.

Artifacts Under Investigation

List of the artifacts used in the implementation of the pilot:

- Denário de Júlio (silver, 46-45 b.c.), Museu Municipal de Esposende, Portugal
- Prato de Esmolas de S. Cristovão (brass, 16th-17th centuries), Museu Municipal de Esposende, Portugal
- Joelho de popa – cadaste (wood, 16th-17th centuries), Museu Municipal de Esposende, Portugal

Classroom Activities

1. Planning and Preparation

The pilot began with a comprehensive planning and organization phase, which was fundamental to ensure coherence across the different curricular units involved. Teachers who had not participated in the training held in Greece were first provided with the necessary training to align with the SciArt approach and its objectives.

Following this preparatory stage, the teaching team engaged in a coordinated planning process, defining the activities to be developed in each discipline and ensuring an interdisciplinary framework

between subjects. Teachers collaboratively mapped the timeline, estimating the time required for each stage and activity, and coordinated the articulation between subjects, always maintaining the SciArt methodology as a central pillar.

Regular monitoring meetings were conducted to ensure that all deadlines were met, necessary adjustments were made, and the pilot was progressing as intended. A critical decision at this stage involved selecting the artifacts to be studied and defining the expected final product. These choices were grounded in knowledge acquired during the training and helped establish a clear timeline and workflow for the project while aligning technical and human resources.

2. Introduction to Cultural Heritage and Exploration

The next stage focused on student engagement and initial exploration. The project was formally introduced to students, beginning with an exploration of the concept of cultural heritage and its connections to science and art. This was first done through a visit to the Municipal Museum of Esposende.

During this visit, students were introduced to the selected artifacts: a *prato de esmolas* (alms plate), a *denário de Júlio César* (denarius coin of Julius Caesar), and a *cadaste* (bracelet-like object).

During the visit, students were divided into groups and engaged in direct observation and interpretation activities, guided by the project members from the museum. Afterwards, students filled in the First Impressions and Description worksheets. Teachers highlighted strong student motivation when combining scientific analysis with artistic and historical interpretation. They noted that students felt a sense of ownership when working with authentic artifacts.

These initial observations led to thoughtful reflections and discussions where students were able to start hypothesizing about the objects' functionalities, origins, materials, and historical contexts, and provided a strong foundation for further investigation in the classroom.

3. Scientific Investigation and Interdisciplinary Development

Building on their initial insights at the museum, students engaged into more detailed scientific investigations during their Natural Sciences and Physics-Chemistry classes. Using archaeometric methods and tools provided through the SciArt platform – such as Augmented Reality simulations and visualizations for optical microscopy, X-ray diffraction (XRD), and Fourier-transform infrared

spectroscopy (FTIR) – they analyzed the artifacts' composition and materiality, and attempted to identify their geographical origins and approximate dating. This deeper exploration confirmed or refined many of their original museum-based observations. Through these analyses, students were able to get an insider perspective on methods normally associated with professional research, which allowed them to deepen their understanding of how scientific evidence is collected and interpreted in cultural heritage contexts.

Alongside the scientific analysis, discussions and reflections continued across subjects. Interdisciplinary collaboration was evident as students from History, Art, and Technology contributed their perspectives on functionality, symbolism, and the broader socio-cultural contexts of the objects. In History, students began crafting historical narratives focusing on each artifact's potential journey, usage, and societal role. They also compared the artifacts' relevance in past and present contexts, reflecting on their social, political, and economic dimensions. In the Arts class, they sketched the objects and composed artworks that explored the aesthetic dimensions and symbolism of the artifacts. Technology Classes served to learn about the platforms Story Jumper and ARTutor, and to develop the multimodal e-books.

The synergy between subjects was evident: historical narratives were enriched by scientific data, artistic reinterpretations complemented material analysis, and technological skills provided the means for integration. This iterative process highlighted how knowledge is constructed differently but also how disciplines can converge to form holistic understanding.

Throughout the various curricular units, students also successfully completed Work Sheets 1, 2, 3, 4 and 5. As such, the implementation of the project followed the sequence of steps outlined in the SciArt Lesson Plans, beginning with the "Engage and Explore" stages during the initial visit to the Museum. Students then progressed to the "Explain and Elaborate" phases through scientific investigation and interdisciplinary discussions in the classroom, before concluding with the "Evaluate" phase, where they presented their multimodal e-books and augmented reality products.

By the end of this phase, students had not only acquired new knowledge about academic contents but also developed new skills of inquiry, analysis, and synthesis. They learned to interpret data critically, connect different disciplinary perspectives, and communicate findings in creative and accessible ways.

Creative and Technological Outputs

In the Visual Arts classes, students developed creative compositions that reinterpreted and explored the artifacts and their experience in a more visual format, showcasing their understanding of the project through various artistic techniques, such as drawing, collage, and mixed-media compositions. These creative exercises allowed them to explore the symbolic, aesthetic, and cultural dimensions of the objects, while also fostering skills of observation, imagination, and reinterpretation.

In the Technological Education class, students were introduced to digital storytelling platforms such as StoryJumper and ARTutor. With these ICT tools, students engaged in the creation of a multimodal e-book, which became the central output of the project.

Student-Produced Multimodal and Augmented Artefacts

By the end of the implementation stage, students were able to develop multimodal e-books, that included text, images, audio, video and augmented reality, using the platforms Story Jumper and ARTutor. These multimodal e-books contained different formats, namely interviews, research reports, and documentary narratives.

The class created a final e-book that explores the artifacts through the Sciart Approach. This e-book is a collective narrative of the project's implementation, where students adopt the role of historians and scientists, and summarize the results of their scientific analyses and their journey of research, from the visit to the museum until the reinterpretation of artifacts.

A very relevant feature of the project was its commitment to accessibility and inclusivity. As such, students translated the e-books into English and Portuguese Sign Language (LGP) in order to enhance the accessibility of the contents produced.

This multimodal e-book functions as both a learning artifact and a pedagogical resource. It captures and details the interdisciplinary process of the SciArt project, documenting students' process in critical thinking, creativity, and digital literacy. It serves as a transferable model that can inspire similar initiatives in other schools and contexts.

All the e-books can be downloaded from the SciArt webpage

(https://sci-art.eu/resources/ ⟶ Mulimodal Outputs⟶ Portugal – Students' Multimodal Outputs).

Experiences from the implementation

A multidisciplinary team of teachers from Geography, History, Arts, and other areas worked as a team to implement the SciArt Project, using selected cultural artifacts as the basis for inquiry-based and interdisciplinary learning. Acting as facilitators, they guided students through research and creative tasks that integrated historical analysis, artistic interpretation, and scientific exploration.

The project fostered a dynamic and collaborative learning environment, where different subject areas came together in a meaningful way. Teachers reported high levels of student engagement and collaboration. While investigating selected artifacts, reflecting on their cultural significance, and documenting their work through multimodal e-books, students demonstrated and developed their creativity and critical thinking. Organization, leadership and time management were soft skills that were developed during this pilot.

Teachers observed that the combination of engaging with cultural artifacts, recreating scientific investigation, and performing critical interpretation fostered genuine curiosity and motivation for science and art combined. Students demonstrated pride in their work, especially when going through the process of seeing the artifacts first hand, and then integrating technology and augmented reality to decipher them. Following the Sciart methodology, students learned that science and art are complementary, and that creative expression can be a tool for understanding scientific and historical knowledge.

Not only that, but the implementation of the project highlighted the importance of soft skills such as teamwork, resilience and motivation, that facilitated the collaboration and efficient communication between and among teachers and students. Likewise, soft skills such as organization, leadership, time management and creative problem-solving were developed naturally throughout the several interdisciplinary tasks.

Along the pilot, several challenges emerged. One of the main difficulties was the limited timeframe to carry out all planned activities, due to the constraints of the school calendar and overlapping commitments. In face of these difficulties, teachers reflected that starting at the beginning of the school year, or extending the project over a longer period, would have facilitated the implementation process. In addition, coordinating interdisciplinary work across multiple subjects required careful planning and constant communication between teachers. Despite these challenges, the team's enthusiasm and dedication were instrumental in overcoming obstacles, fostering open

communication and maintaining the momentum of the project.

The pilot in Porto offered valuable insights into how interdisciplinary projects like SciArt can be successfully designed and implemented. Clear objectives, such as the creation of a multimodal e-book, provided students and teachers with a shared sense of purpose, while structured coordination meetings ensured that activities remained aligned across disciplines. Early training on digital tools, coupled with strong partnerships with cultural institutions, reinforced both the technical and contextual dimensions of the project. Most importantly, the deliberate inclusion of accessibility measures, such as translations into English and Portuguese Sign Language, highlighted the transformative potential of SciArt when inclusivity is embedded from the outset. Beyond the final outputs, the real value rested in the process: students learning to collaborate, negotiate, and reflect across different knowledge domains.

In the end, the SciArt Project proved to be a transformative educational experience. It showed students that science and art are complementary ways of exploring and understanding the world, both requiring curiosity, creativity and careful observation. For teachers, it reinforced the value of collaboration and innovation in education, laying a foundation for future interdisciplinary projects that promote scientific literacy, cultural awareness, and creative expression.

At the same time, the pilot raised important questions for future transferability. How can schools with fewer resources replicate this model of learning? How can this model of learning be replicated in schools located in complex multicultural contexts? What strategies can support integration into the school curricula without overloading teachers? How might assessment frameworks better recognize both scientific inquiry and artistic creativity? These and other questions point to the need for further experimentation and dialogue, ensuring that SciArt projects not only inspire isolated innovation but also establish sustainable practices in education.