

Lessons Learned from the Creation Process of an Educational Game at the Intersection of Art, Science, and Medicine

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Abstract. Introduction: *Artworks can represent diseases, symptoms, treatments, and clinical conditions while also being affected by artists' illness. Objective:* This paper analyzes the creation process of *Enigma das Artes* to extract transferable design lessons for interdisciplinary educational games based on visual cultural collections. **Methodology:** *We adopt an experience report approach supported by documentary triangulation, using timelines, meeting minutes, design documents, phase specifications, presentations, development conversations, and evaluation planning records to reconstruct the project's trajectory. Results:* The analysis identifies four transferable design negotiations that structured the process: interpretive, curatorial, visual and technical, and legal negotiations.

Keywords *scientific communication; interdisciplinary design*

1. Introduction

Educational games and games with a purpose have been used to support teaching, learning, awareness raising, and scientific dissemination. When a game articulates traditionally separate areas, such as Art History, Medicine, scientific communication, and interaction design, its development also becomes a problem of interdisciplinary translation. This is the case of *Enigma das Artes*, a digital educational game based on the association between artworks and clinical or scientific descriptions.

The premise of the game is that artworks can be read as aesthetic objects and as historical and cultural records capable of suggesting diseases, symptoms, treatments, clinical conditions, and effects of disease on artists. From this premise, the game proposes a playful and interpretive activity in which players associate images of artworks with

textual descriptions. The artifact, therefore, depends on making visual cultural materials readable, playable, pedagogically organized, technically legible, and legally usable.

This article presents an experience report on the documented creation process of [Enigma das Artes](#). The unit of analysis is the design process through which an interdisciplinary idea was transformed into a structured artifact, rather than the measurement of learning outcomes or user reception. Questions of usability, reception, and educational effectiveness remain relevant for subsequent empirical evaluation, while the present report focuses on artifact stabilization and design-process knowledge.

The main finding of the report is that interdisciplinary educational games based on artworks require four interconnected design negotiations. The **interpretive negotiation** concerns how artworks become readable evidence for players. The **curatorial negotiation** concerns how the artistic corpus supports thematic coherence, progression, and replayability. The **visual and technical negotiation** concerns how interface, image treatment, and implementation preserve legibility and playability. The **legal negotiation** concerns how image rights shape what can be included, displayed, credited, and distributed. By reconstructing these negotiations through project documentation, the article extracts transferable lessons for teams working with educational games, visual cultural collections, scientific communication, and interdisciplinary artifacts.

2. Methodology

The method adopted is the **experience report**, a qualitative approach focused on the reflective analysis of professional and academic practices from the perspective of participants directly involved in the process. This framing is appropriate because we examine how an interdisciplinary educational-game artifact was conceived, negotiated, documented, and stabilized over time. The article is framed as an experience report rather than as a case study because its analytical standpoint is internal to the documented development process, whereas a case study would require greater methodological distance between the researchers and the phenomenon under investigation.

The unit of analysis is the documented creation process of [Enigma das Artes](#). The study focuses on decisions, difficulties, reformulations, and solutions that emerged while transforming artworks, medical meanings, interface constraints, and image rights into a playable educational structure.

A strategy of **documentary triangulation** was adopted to strengthen the reliability of the report. The analysis articulates different types of documents produced during the project, including timelines, meeting minutes, [SIAC](#) presentations, phase specification documents, partial GDDs, achievement-system documents, evaluation-planning records, and internal development communication. These materials were used to compare what was initially conceived, what was recorded as a decision, what was later implemented, and what was reformulated during development.

The identification of recurrent decision points across the document families guided the analytical procedure. These decision points were grouped into four design negotiations that structure the argument of the article: (i) the **interpretive negotiation**, concerned with how artworks became readable evidence for players; (ii) the **curatorial negotiation**, concerned with how the artwork corpus was selected, grouped, sequenced, reserved, and

transformed into progression; (iii) the **visual and technical negotiation**, concerned with how interface, image standardization, feedback, persistence, and implementation constraints shaped the playable artifact; and (iv) the **legal negotiation**, concerned with how image rights, credits, provenance, and permissions affected the corpus and the information architecture of the game.

The presentation of the results was organized in **three acts** to give narrative unity to the report. *Act I*, the preparation, covers the emergence of the design problem, the formation of the team, and the construction of a shared interdisciplinary vocabulary. *Act II*, the creation of the game, analyzes how the four negotiations shaped phases, interface, achievements, visual identity, technical implementation, and image-use decisions. *Act III*, the ending, marks the stabilization of the artifact as a structured design while preserving the openness of future extensions.

The inference produced by this work is analytical and qualitative. The article aims to make explicit design-process lessons for teams and researchers working with educational games, visual cultural collections, scientific communication, and interdisciplinary artifacts. Its contribution lies in showing, based on triangulated documentation, how an interdisciplinary educational game was stabilized under interpretive, curatorial, visual, technical, pedagogical, and legal constraints. The four negotiations are therefore treated as analytical categories derived from recurrent process evidence, rather than as post hoc labels imposed on the artifact.

2.1. Documentary Corpus

The documentary corpus comprises four families of records produced throughout more than a year and a half of development. These materials were selected because they document different stages of the same design process: the chronological evolution of the project, the formulation of mechanics and phases, the curatorial and pedagogical organization of the artwork corpus, and the coordination of implementation decisions. Table 1 summarizes these families and their analytical role in the report.

The corpus is representative rather than exhaustive. Intermediate files, duplicated versions, auxiliary notes, and partial records were considered only when they helped compare intentions, document decisions, implement solutions, and later reformulations. This selection criterion keeps the analysis focused on the stabilization of design-process knowledge rather than on the complete archival inventory of the project.

Table 1. Document families used in the experience report

Document family	Examples	Analytical function
Chronological records	Project timelines, dated summaries, and version records.	Reconstruct the sequence of decisions, team changes, public presentations, releases, and artifact stabilization.
Design and implementation documents	Partial GDDs, phase specifications, achievement documents, interface notes, and technical records.	Identify how mechanics, phases, achievements, screens, persistence, and progression became stable design decisions.
Curatorial and pedagogical documents	Artwork lists, phase documents, textual justifications, image-use notes, and evaluation planning records.	Analyze how artworks were selected, grouped, sequenced, replaced, or excluded according to pedagogical, visual, and legal constraints.
Development communication records	Internal messages and coordination records among project members.	Recover implementation decisions, unresolved tensions, and coordination issues that do not appear in formal documents.

3. Related Work

A first group of related works consists of experience reports and internally positioned process studies, even if some of them are described as case studies. These works are closest to the present article because they analyze the development process from the standpoint of teams or institutions directly involved in the artifact's creation, using the final game mainly as evidence of design decisions, constraints, and lessons learned. In museum and art contexts, [Bahia 2023] examines the Nubla project at EducaThyssen as a process of exploring video game language within art-museum education, while [Gestwicki e McNely 2012] analyzes an educational museum game through a design-thinking process. [Souza et al. 2025] and [Calhabeu e Lima 2025] also foreground development trajectories, constraints, and lessons learned, respectively, in educational virtual reality and independent game development in an academic setting. Together, these works support the methodological position adopted here: the relevant object includes the final artifact and the documented process through which design choices become stable.

A second group consists of more distanced case studies of educational, scientific, museum, or cultural-heritage games. These studies usually describe the artifact, its design method, and sometimes its evaluation, but their analytical standpoint is external to the process. [Bailey 2026], [Kantorski et al. 2025], [Antoniou et al. 2013], and [Tang 2025] are useful comparators because they examine how content is translated into game structures, mechanics, interfaces, and visitor or learner experiences. Their common characteristic is the concern with alignment between domain knowledge and playable form. The present article differs from them by emphasizing artifact stabilization through documentary triangulation and by extracting lessons from the negotiations.

A third group is composed of gray literature and professional postmortems, including interviews, developer blogs, and lessons-learned. Works such as [Sheffield 2008], [Stock 2006], and [Pilestedt 2011] are relevant because they show how game-development knowledge often circulates through retrospective accounts of design decisions, production constraints, failures, and trade-offs. Their main characteristic is the insider perspective on process, usually with strong practical value but limited methodological explicitness. The present article borrows this sensitivity to development experience but reframes it academically through documentary triangulation, explicit analytical categories, and a focus on transferable design-process knowledge.

4. Act I, the Preparation

The first act corresponds to the emergence of the project as an interdisciplinary design problem. Before implementation, the team had to transform a broad idea, the relationship between artworks, diseases, symptoms, treatments, and artists' conditions—into a playable educational structure. This initial movement involved the formulation of the proposal, the preparation of the first design documents, the invitation of collaborators from complementary areas, and the formation of a team capable of articulating Art, Health, Game Design, and Computing.

The first nucleus of the team was composed of researchers with complementary expertise in health sciences, art history, and game design/software development. This composition was later expanded through undergraduate research fellowships assigned to students from Design, Computing, and Art History. The resulting team structure was

important because the project required different forms of work that could not be reduced to programming: artwork curation, historical interpretation, textual writing, visual design, interface implementation, and technical integration. Thus, team formation was itself part of the design process because each area introduced constraints and criteria that shaped the artifact.

At this stage, the central challenge was not only to select relevant artworks but also to decide how they could become part of an interactive educational experience. The interdisciplinary arrangement created a productive tension: medical and artistic expertise had to be translated into playable structures, while game design decisions had to remain intelligible and acceptable to specialists from outside the game field. This tension helped define the main negotiation space of the project, involving interpretive precision, pedagogical sequencing, visual legibility, implementation feasibility, and legal conditions for image use.

The first playable prototype materialized this negotiation in a minimal form, using a simple matching mechanic to test whether the association between artwork and clinical condition could sustain interaction. From that point on, the project adopted an iterative regime in which conceptual refinement, artwork selection, interface decisions, and implementation evolved together. Therefore, the preparation phase was not just preliminary. It established the interdisciplinary structure and the design vocabulary that would shape the whole artifact.

5. Act II, the Creation of the Game

The second act corresponds to the creative and productive core of the project. In this stage, [Enigma das Artes](#) ceased to be a conceptual hypothesis and became a structured system of phases, screens, rules, texts, visual assets, and progression decisions. The documents from this period show that creation did not advance through a single design line, but through the articulation of four negotiations: curatorial, interpretive, visual and technical, and legal.

The curatorial negotiation appears most clearly in the organization of the artwork corpus. The team gradually abandoned the idea of presenting artworks as an undifferentiated sequence and began to structure them into themes, subgroups, normal phases, special phases, starting artworks, and reserve artworks. This transformation also defined difficulty, progression, re-playability, and the conditions under which the player would encounter each type of visual and clinical relation. The final configuration, with 8 normal phases and 2 special phases, therefore, represents the stabilization of a curatorial structure into a playable progression system.

The interpretive negotiation concerned how the artworks would become readable evidence for the player. Each phase had to balance thematic coherence, visual clues, clinical meaning, and the risk of excessive ambiguity. The surprise viral epidemic phase, released after phase 4, and the evolution of the artist's disease phase, released only after the conclusion of all phases, show that the order of access was also part of the meaning of the game. The progression was used to distribute novelty, complexity, and interpretive culmination at specific moments of the experience.

Visual and technical negotiation appears in the construction of the interface and in the standardization of the images. The [SIAC](#) presentations show that the game adopted

a visual identity based on school elements, such as a notebook, post-its, brushes, simple buttons, and contrasting colors. These choices were not decorative. They transformed the game space into an environment of study and annotation, while also making the matching mechanic visible and accessible. At the same time, development conversations recorded technical decisions about achievement persistence, INI files, state machines, phase organization by CSV, configuration screens, sound control, and the behavior of persistent objects between *rooms*. These details show that legibility, progression, and implementation feasibility had to be solved together.

The legal negotiation became visible in the way the game handled image credits, licenses, and documentation of use. Because the corpus depended on artworks with different reuse conditions, the interface could not be designed only around pedagogical clarity or visual appeal. It also had to include mechanisms for showing credits, licenses, and provenance information. Thus, the legal status of images affected not only the selection of artworks but also the structure of screens and the informational layers attached to each work.

The achievement system connected these negotiations to the player's sense of progress. The achievements were formalized around four main objectives: completing the Melancholy collection, finishing the normal phases without error, finishing the special phases without error, and finishing the game. They were not designed only as external rewards. They encouraged repetition, careful observation, refined performance, and exploration of artworks that might not appear in a single linear walkthrough. In this sense, the achievements converted curatorial reserves and thematic collections into replayable interpretive goals.

Intermediate public presentations of the project functioned as moments of partial stabilization. They show which elements were mature enough to be communicated externally at each stage and which aspects still remained open. In the report, these presentations are therefore not treated only as dissemination events. They are evidence of how the team progressively stabilized the visual identity of the artifact, the pedagogical argument, the technical structure, and the curatorial organization before reaching the final version.

6. Act III, the Ending

The third act marks the stabilization of [Enigma das Artes](#) as a structured artifact. At this stage, the documents indicate a stable configuration of phases, starting and reserve artworks, special phase criteria, achievements, screen structure, and progression logic. This stabilization defines the artifact as a coherent design outcome of the process, with sufficient structure to support the extraction of transferable lessons. The following discussion abstracts these process observations into transferable design-process lessons.

7. Artifact Overview for the Process Analysis

This section presents the artifact elements needed to understand the process analysis: the matching mechanic, phase structure, visual interface, achievement system, and credit/provenance structure.

The main mechanic of [Enigma das Artes](#) is the association between an artwork and a textual description related to a disease, symptom, treatment, clinical condition, or

condition affecting the artist. On the main screen, the player sees an artwork on one page of an illustrated notebook and a candidate description on the other, as shown in Figure 1(b). The *MATCH* button materializes the interpretive action of the game, as the player must decide whether the visual evidence and the textual description correspond. After a correct association, the game presents additional information about the artwork, the artist, the disease, and the treatment. Thus, the mechanic expresses the interpretive negotiation by transforming artworks into playable evidence.

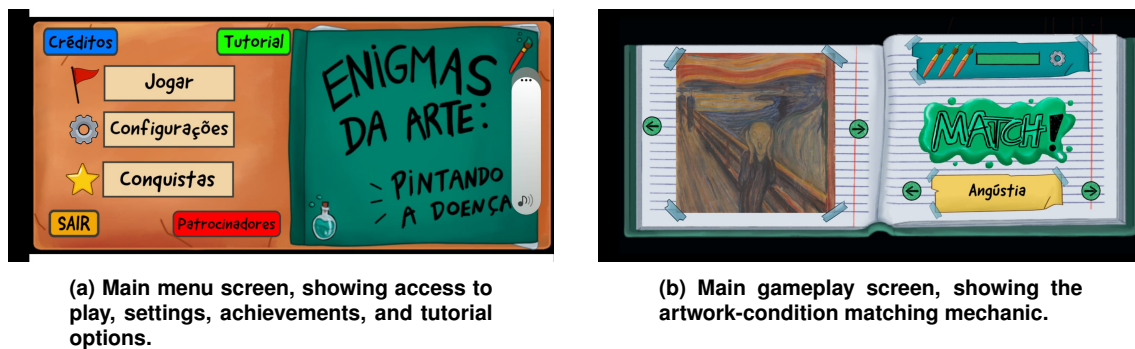


Figure 1. Two screens from **Enigma das Artes**.

The phase structure expresses the curatorial negotiation. The game organizes the artwork corpus into 8 normal phases and 2 special phases, with starting and reserve artworks distributed according to thematic coherence, difficulty, and progression. This organization shows how the corpus was transformed from a collection of artworks into a playable progression system.

The visual interface expresses the visual and technical negotiation. The notebook, post-its, brushes, buttons, and contrasting colors create a study-and-annotation environment that supports the educational framing of the artifact. At the same time, image standardization, cropping, positioning, zoom possibilities, phase organization, persistence, configuration screens, and sound controls show how visual legibility and technical implementation were solved together. These decisions were necessary because many associations depend on localized visual traits that must remain readable within the interface.

The achievement system connects curatorial and interpretive decisions to player progression. The four main achievements involve completing the Melancholy collection, finishing normal phases without error, finishing special phases without error, and finishing the game. These achievements encourage careful observation, replayability, and exploration of reserve artworks that may not appear in a single playthrough. In this sense, achievements transform thematic collections and curatorial reserves into replayable interpretive goals.

The credit and provenance structure expresses the legal negotiation. Because the game uses artworks and digital reproductions with different reuse conditions, the artifact had to include ways to present credits, licenses, and image-use information. This element connects the interface to the intellectual-property problem discussed in the next section.

The artifact overview therefore shows how the final structure of the game materializes the negotiations identified in the documented creation process.

8. The Intellectual Property Problem

A major difficulty in constructing the art corpus was intellectual property. The team had to distinguish between two layers of rights: the rights attached to the artwork itself and the rights or restrictions attached to the photograph, scan, or digital reproduction used in the game. Many historical works were in the public domain, but their available images could still be controlled by museums, archives, estates, photographers, or digital repositories. This was even more complex for sculptures and contemporary works, in which both the object and its photographic reproduction could involve protected rights.

For this reason, the project adopted a conservative operational policy. Instead of relying on images found through general web searches, the team privileged sources with explicit reuse conditions, such as Wikimedia Commons, institutional collections, public-domain repositories, or direct authorization from rights holders. Several candidate works, including some with strong pedagogical value, had to be abandoned because permission was denied, fees were incompatible with the project, or reuse conditions were unclear. This affected not only the corpus but also the organization of phases, especially those related to the artist's diseases.

The project also obtained specific authorizations. Some artists, institutions, and rights holders allowed educational and non-commercial use of specific images, including works relevant to COVID-19 and Alzheimer's disease cases. These permissions required the game to incorporate credit lines, provenance information, and, in some cases, restrictions on promotional or secondary use. Thus, the complete artwork view became both a pedagogical feature and a documentation space for image rights.

The final corpus was the set of artworks able to satisfy curatorial, pedagogical, visual, technical, and legal constraints. This became one of the main lessons of the project: in educational games based on cultural heritage, intellectual property is not a peripheral production issue but part of the design problem itself.

9. Discussion

The development of [Enigma das Artes](#) makes visible a central problem in interdisciplinary educational games based on visual cultural collections. The main contribution of the case is the identification of transferable design-process knowledge for projects involving artwork, scientific communication, cultural heritage, and educational interaction.

Each lesson is presented as a design-process pattern, that is, as a recurrent relation between a documented design problem, the evidence of how the team addressed it, and the transferable insight that may guide similar projects. The term follows the design-pattern tradition of capturing reusable design knowledge from recurring problems and situated solutions [Alexander et al. 1977, Björk e Holopainen 2005], but is applied here to process-level regularities rather than to generic gameplay structures. Table 2 summarizes these patterns by separating the observed evidence in the documented process, the abstracted lesson, and the possible transfer to other projects.

The first transferable lesson is that images can operate as interpretive evidence rather than as decorative or illustrative resources. In [Enigma das Artes](#), the artwork becomes the object through which the player infers a relation between visual signs, historical context, disease, symptoms, treatment, or the condition of the artist. This design choice

Table 2. Design-process patterns extracted from the documented creation process

Design-process pattern	Process evidence anchor	Abstracted lesson	Possible transfer
Artwork as evidence	Phase specifications and interface records show the stabilization of the matching mechanic, in which artworks had to be associated with clinical descriptions before explanatory content was revealed.	Visual cultural materials can be designed as objects of inference when the mechanic requires observation, comparison, classification, and interpretation.	Museum games, medical education games, botany games, archaeology games, and history-of-science games.
Corpus as progression	Curatorial documents and phase records show the transition from an undifferentiated artwork sequence to normal phases, special phases, starting artworks, reserve artworks, thematic groups, and achievements.	Curation can operate as progression design when the selection, sequencing, reservation, and recurrence of content shape difficulty, replayability, and thematic coherence.	Games based on archives, collections, historical documents, medical images, maps, specimens, and cultural heritage materials.
Rights as design constraint	Image-use notes, authorization records, and corpus revisions show that reuse permissions, public-domain status, image quality, credit requirements, and restrictions on secondary use shaped what could be included.	Intellectual property should be treated as a design constraint because image rights affect corpus selection, interface structure, credit display, distribution, and documentation.	Educational games using artworks, museum collections, photographs, scans, public-domain repositories, or institutional visual assets.
Documentation as stabilization	Timelines, meeting minutes, design documents, presentations, and development communication made it possible to compare initial ideas, recorded decisions, implementation choices, and later reformulations.	Experience reports become more rigorous when process documents show how ideas, mechanics, content structures, and constraints evolve into stable design decisions.	Experience reports, internally positioned process studies, postmortem-inspired academic papers, and interdisciplinary design reports.

is relevant beyond the present case because many educational games that use visual collections still treat images as examples, backgrounds, or motivational elements. The case suggests a stronger design principle: when the image carries domain knowledge, the mechanic should require the player to observe, compare, classify, and interpret it before receiving the explanatory layer.

The second transferable lesson is that curation becomes part of game design. The organization of the corpus into normal phases, special phases, starting artworks, reserve artworks, thematic groups, and achievements shows that content selection cannot be separated from progression, difficulty, replayability, and pedagogical sequencing. In this kind of artifact, choosing an artwork is also a design decision about when the player should encounter a concept, how much visual evidence is available, how difficult the association should be, and whether the same theme should return later as part of a broader collection or achievement. This finding is transferable to other games based on museums, archives, medical images, historical documents, maps, botanical specimens, archeological artifacts, or scientific collections.

The third transferable lesson is that intellectual property is part of the design problem. The final corpus was shaped by the relationship between pedagogical value, visual quality, technical usability, public-domain status, reuse permissions, institutional restrictions, credit requirements, and possible limitations on secondary use. Legal and curatorial constraints directly affected what could be included, how it could be displayed, and how credits had to be organized. For educational games based on cultural heritage, image rights should be considered from the beginning of the project, together with interface design, corpus construction, documentation, and pedagogical planning.

The fourth transferable lesson is methodological. The experience report becomes stronger when the development process is reconstructed through documents that register decisions, revisions, tensions, and stabilization moments. In this case, timelines, meeting minutes, design documents, phase specifications, presentations, and development conversations allowed us to observe how provisional ideas gradually became stable design decisions. Documentary triangulation helped identify not only what the final artifact contains, but also how its phases, achievements, interface choices, image policies, and pedagogical structure reached a stable configuration.

The value of these patterns lies in their situated transferability. They are not proposed as universal rules for all educational games but as process abstractions grounded in a documented trajectory of interdisciplinary design. Their relevance depends on the similarity between the conditions observed in this report and those faced by other teams: the use of visual cultural materials, the need to translate domain knowledge into interaction, the organization of a corpus into progression, the dependence on interface legibility, and the presence of legal or institutional constraints on image use. In this sense, the patterns function as analytical resources for comparison, planning, and reflection rather than as prescriptive formulas.

These four dimensions define the analytical scope of the report. The documents analyzed indicate that [Enigma das Artes](#) reached a structured artifact stage with defined phases, rules, achievements, screens, visual identity, and artistic corpus. This stage is sufficient for analyzing artifact stabilization and extracting transferable design-process knowledge. The value of the report lies in making explicit how a complex educational game can move from concept to structured artifact and how other interdisciplinary teams may face similar negotiations when transforming visual cultural materials into playable structures for scientific communication and interpretive learning.

10. Conclusion

This article presented an experience report on the creation process of [Enigma das Artes](#), treating the game as a documented case of interdisciplinary design stabilization. The analysis showed how an initial relationship between art and science was progressively transformed into a structured artifact through four design negotiations: interpretive, curatorial, visual and technical, and legal.

The contribution of the article lies in the transferable lessons extracted from this process. It shows that artworks can become playable evidence, that curation can operate as progression design, that interface and implementation decisions condition visual interpretation, and that image rights may shape not only production logistics but also corpus structure and information design. These lessons may inform other educational games based on museums, archives, medical images, historical collections, and cultural heritage materials.

The scope of the article is the analysis of design-process knowledge generated while transforming artworks, medical meanings, interface constraints, and image rights into a educational game. Questions about reception, usability, and learning outcomes remain relevant for future empirical studies, but the present contribution is located at an earlier level: understanding how interdisciplinary visual-cultural materials can be stabilized into playable structures for scientific communication and interpretive learning.

AI Disclosure Statement

During the preparation of this work, the authors used ChatGPT (OpenAI, version GPT-5.5) for research tasks, such as automatic classification and text analysis. While writing the paper, we also used it for language and style refinement and to simulated paper evaluation and find improvement points.

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