

Article

Heritage Education in the Digital Age: An Analysis of Public Perceptions of the Documentary *Amato Lusitano: Science and Humanism*

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Abstract

Communicating heritage to contemporary audiences, especially younger generations, is a central challenge in Heritage Education. This study aims to analyse audience perceptions of the documentary *Amato Lusitano: Ciência e Humanismo*—a cultural mediation tool designed and produced by the authors—and to verify the association of these perceptions with sociodemographic profiles. Framed within an action research methodology, the study combines artistic creation and empirical analysis of public reception. During the first screening, a questionnaire was administered to 55 viewers (37 students aged < 40), and data were submitted to an exploratory factor analysis. This revealed a two-factor structure, highlighting a primary factor—Communicative and Educational Effectiveness—with high internal consistency ($\alpha = 0.89$). Participants reported high agreement with this dimension, with statistically significant differences across generational groups ($p < 0.005$). Participants with less prior knowledge about *Amato Lusitano* showed a greater perception of novelty. Clarity of information and quality of the content were the most valued aspects. In contrast, duration and accessibility emerged as areas for improvement. The potential of the documentary as a heritage education resource for initial teacher training is evident. It is necessary to develop more modular, dynamic content ecosystems tailored for young audiences.

Keywords: heritage education; cultural mediation; digital humanities; documentary film; *Amato Lusitano*; audience perception; action research

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1. Introduction

1.1. The Challenge of Heritage Conservation in the Digital Age

The conservation of cultural heritage in the digital age is one of the main challenges to cultural sustainability and the transmission of collective memory. Heritage, as an expression of a community's identity and a link between the past, present, and future, now faces the risk not only of physical degradation of its material supports but also of symbolic erosion of its relevance in the collective imagination, especially among younger

generations, whose cultural consumption habits are dominated by digital narratives. The fusion of tradition, culture, and legacy with interaction and technology provides an attractive system that serves both as an artistic expression and as a fundamental tool for dissemination in cultural institutions [1].

The Beira Interior region in Portugal has a cultural, natural, and scientific heritage of enormous richness and diversity, which is often overlooked by major national and international promotional circuits. It was in this context that the *IDeAL–e-Amato Lusitano: educational itineraries in regional heritage* research project emerged. It is based on the premise that digital technology can be a strategic ally in safeguarding and promoting regional heritage through education and innovation.

The project focused on a figure of universal stature, João Rodrigues de Castelo Branco (1511–1568), better known as Amato Lusitano. A physician, scientist, botanist, and humanist, Amato Lusitano is an exponent of the European Renaissance, whose life and work embody the triumphs and tragedies of the 16th century. His magnum opus, *Centúrias de Curas Medicinais* (Centuries of Medicinal Cures), is a milestone in the history of medicine for its empirical methodology and detailed description of 700 clinical cases, anticipating evidence-based medicine by centuries [2–5]. In addition to his scientific genius [6], his ethical dimension—marked by his refusal to discriminate against patients based on religion, origin, or social status—remains remarkably relevant today [7,8].

Indeed, his oath of compassion and his devotion to healing and ethical integrity transformed the very essence of medicine, placing him alongside figures such as Jacob Zahalon and Abraham Zacuto as one of the Jewish physicians of the Renaissance who illuminated the path between science and ethics [9].

Despite his historical and scientific relevance [10–12], Amato Lusitano remains unknown to the general public, including in Portugal and in his hometown (Castelo Branco [13,14]). To fill this knowledge and representation gap, one of the IDeAL project's pillars was the production of the documentary *Amato Lusitano: Science and Humanism*. Conceived not as a mere biographical record but as an immersive and aesthetically engaging audiovisual narrative, the documentary sought to stimulate empathy, intellectual curiosity, and dialogue among science, art, and heritage.

This study aims to analyse audiences' perceptions of the documentary *Amato Lusitano: Science and Humanism* and to examine whether these perceptions are associated with sociodemographic profiles.

Despite growing academic interest in digital humanities and heritage education, research tends to address the creation of digital products and the study of their public reception separately, leaving gaps in the articulation between these dimensions, especially in the context of regional heritage enhancement. To fill this gap, the study combines action research in audiovisual creation with empirical analysis of public reception, thereby contributing to the development of heritage communication practices in the digital age.

To achieve this goal, the study includes a public validation stage for the documentary, focusing on analysing the audience's perceptions of its clarity, scientific relevance, and educational value. This empirical phase allows us to assess the documentary's communicative and educational effectiveness and identify different patterns of reception among academic and generational groups. This validation process, through public consultation, not only guides the development of the digital object but also allows for a discussion of the role of audiovisual media as a strategy for cultural mediation and scientific dissemination, contributing to new approaches to communicating regional heritage to diverse audiences.

1.2. Heritage, Memory, and Digital Humanities

The creation of the documentary *Amato Lusitano: Science and Humanism* was supported by an interdisciplinary theoretical framework that brings together heritage studies, documentary film theory, the historiography of science, and educational sciences. Within this conceptual framework, it is essential to recognise that the contemporary meaning of heritage has expanded significantly, going beyond the classic object-centred view and incorporating intangible heritage. It is in this domain that scientific knowledge and ethical legacy are inscribed, central elements for understanding the historical and cultural relevance of the figure of Amato Lusitano.

This convergence between memory and humanities is based on the conceptualisation of Heritage Education proposed by Fontal [15], which focuses on the notion of connection. In this approach, the focus shifts from the object (the cultural asset) to the complex relationship established between it and the subject (the public). In this relational perspective, Heritage Education operates through heritage preservation, a concept understood as a sequence of processes that begins with knowing and understanding, progresses to respecting, valuing and raising awareness, and culminates in the processes of caring for, enjoying and transmitting. It is through this sequence, which forms the basis for the construction of the data collection instrument, that the act of heritage preservation is consolidated, transforming what the author refers to as “potential heritage” into “effective heritage” for the community [15].

In this sense, digital environments cease to be mere channels of dissemination and become “texts, contexts and extensions” of the heritage itself [15].

In the process of heritage preservation, Information Technology and Digital Humanities play a strategic role [1,16,17], allowing historical legacy to be transformed into interactive and multisensory knowledge experiences. From this perspective, the documentary *Amato Lusitano: Science and Humanism* is understood here as a mediator in the heritage process, aiming to transform historical knowledge into effective heritage by attributing identity values on the part of the public.

Thus, Amato Lusitano’s legacy is not limited to the printed editions of his works, but is manifested in the methodology, critical spirit, and humanistic ethics that emanate from them [18,19]. This broader perspective allows us to frame Amato as a scientific and humanistic figure whose influence extends beyond his own time. By focusing on these intangible dimensions, the documentary takes on the role of a mediating device that seeks to convert this ethical legacy—often invisible—into an object of identification and appreciation for contemporary audiences.

The digital age, however, highlights a paradox: while information overload can marginalise local content, digital tools offer unprecedented potential for democratising and recontextualising heritage. It is precisely at this intersection between technology, memory, and public participation that this study is situated, guided by the principles of Public Digital Humanities. This field promotes the use of digital methods not only for academic research but also for creating products and experiences that actively engage the public, stimulating knowledge and civic debate [20,21].

The documentary is the primary vehicle for this practice, functioning as a “digital boundary object” in the sense proposed by Star and Griesemer [22]. This concept describes objects capable of articulating different communities of practice, in this case, researchers, educators, and audiences, allowing for the negotiation of meanings and the co-construction of knowledge. Thus, the documentary operates simultaneously as an educational medium and an instrument of heritage mediation, translating complex academic research into accessible and emotionally resonant language. This translation process is a curatorial act that generates a new “digital aura”, distinct from Benjamin’s aura of the physical object [23], but legitimised by the rigour of the research and the authority of the testimonies.

1.3. Documentary as Discourse: From Creative Treatment to Historical-Biographical Documentary

Documentary cinema, since John Grierson's seminal definition (cited in [24] as 'the creative treatment of actuality'), has been recognised as a field for constructing discourses. The choice of this format is based on an understanding of its potential as an instrument of cultural and educational mediation. Far from being a transparent window onto reality, documentaries have a 'point of view', an organising perspective that selects, structures and interprets fragments of the historical world to construct a persuasive argument about it [25]. The ethical responsibility of the documentary filmmaker is immense, as this point of view shapes the viewer's perception [25] and influences the way knowledge is transmitted.

In the vast documentary universe, *Amato Lusitano: Science and Humanism* falls into the subgenre of historical-biographical and scientific dissemination documentaries. This format follows well-established conventions, popularised by filmmakers such as Ken Burns [26] or in high-impact series such as Carl Sagan's *Cosmos* [27], which have proven particularly effective in translating complex topics for broad audiences. Among its main features are interviews with experts, omniscient narration, and archival material used to illustrate and contextualise the period. In the case of *Amato Lusitano: Science and Humanism*, the approach is deliberately hybrid, blending different modes of representation to achieve pedagogical and aesthetic goals. This fusion of genres dialogues with Nichols' typologies of documentary modes [28], also finding resonance in the reflections of contemporary Portuguese theorists such as Manuela Penafria. Penafria's perspective [29] on the porous boundaries between reality and fictional construction in documentary cinema frames the choice for a rigorous narrative that does not abandon an aesthetic and poetic dimension capable of generating emotional and educational impact.

The expository mode forms the backbone of the documentary *Amato Lusitano: Science and Humanism*, evident in the narration and logical structure of the interviews with experts, ensuring clarity in the communication of content. This is complemented by the poetic mode—visible in the contemplative cinematography of historical sites, which seeks to evoke the *genius loci*—and by the observational mode, present in the documentary's opening sequence with students at the Amato Lusitano Educational Garden, created as a centre for non-formal education and a specific example of the tangible cultural heritage related to Amato Lusitano. By adopting these conventions but dispensing with dramatised recreations, the aim was to construct a rigorous and sober narrative that respected the complexity of the historical figure and whose emotional involvement emerged from the intrinsic power of his biography and legacy, rather than resorting to external devices.

1.4. Meaningful Learning and Critical Experience in Digital Heritage Education

The pedagogical framework of the project is based on Ausubel's theory of meaningful learning [30], which holds that learning is most effective when new information is anchored in relevant pre-existing concepts. The documentary was designed to facilitate this process by offering multiple "subsumes" or conceptual anchors: its narrative of exile dialogues with historical knowledge about migration; its medical ethics draws on contemporary debates in bioethics; and its scientific methodology exemplifies the principles of the empirical method.

This approach presupposes the subject's active participation in the construction of meaning, which, in the adopted concept of Heritage Education, transcends the traditional view of passive reception. Although watching a documentary does not translate into a practical physical activity, it is configured here as a process of active symbolic appropriation. Based on Fontal's sequence of heritage preservation [15], the viewer is encouraged

to follow a cognitive and emotional journey: from the acquisition of factual knowledge to deep understanding and, ultimately, the attribution of value to cultural heritage.

In the context of Digital Humanities and Digital Heritage Education, this link between mediated experience and active learning is particularly relevant [31,32]. In the field of heritage, evaluating the user experience is crucial. Monitoring bonding and knowledge acquisition is a critical tool for proposing relevant recommendations for the design of digital experiences for cultural, educational, and recreational purposes [1]. Digital media—and, in this case, the documentary—function as spaces for co-learning and co-creation of meaning, allowing the public to participate in the symbolic reconstruction of scientific and humanistic heritage. The story of Amato Lusitano exemplifies this potential: his trajectory as a scientific genius and victim of religious persecution is converted into a digital narrative object that stimulates empathy and critical thinking. Thus, the documentary does not present heritage as a fixed or uncontested legacy, but as a field for vital and interpretative dialogue [33,34]. The aim is to educate citizens capable of questioning and reinterpreting the past while considering the ethical and social challenges of the present.

2. Materials and Methods

2.1. Documentary and the Action Research Process

The production of the documentary *Amato Lusitano: Science and Humanism* [35] followed an action research methodology [36], in which the process of artistic creation constitutes an act of research, and the final product is designed to stimulate social and educational engagement [37,38]. Action research can be understood as a cyclical process that integrates the phases of planning, action, observation, and reflection, simultaneously aiming to transform practices and produce situated knowledge [36,39,40]. Based on collaborative and participatory principles, this approach aligns with contemporary paradigms of communication and cultural heritage enhancement, understood as dynamic processes of social construction [33], in which creative practice serves as a means of public engagement and the co-production of meaning. The documentary was thus conceived as a form of heritage/cultural and scientific mediation, aimed at promoting critical reflection on the historical legacy of Amato Lusitano and strengthening the dialogue between academia and society.

In this context, three of the authors served as directors, while the others took on coordinating roles in the design and production of the documentary analysed. This position of “practising researcher” requires extra attention to mitigate potential biases, but also offers a privileged internal perspective on the creative process, which can enrich the interpretation of the documentary’s public reception.

The investigative design was thus implemented in four interdependent phases, described in Table 1.

Table 1. Stages of the documentary development process.

Stages of the Action Research Process	Brief Description
Pre-production and research (Planning)	Bibliographic and archival review; definition of narrative axes; selection of experts; iconographic research; logistical planning.
Production and direction (Action)	Interviews with experts; filming at historical sites; collection of visual and audio materials.
Post-production (Observation and creative analysis)	Editing, graphic design, animation, sound treatment, and colour correction.
Public validation (Observation and reflection)	Premiere of the work; collection and analysis of data relating to public perceptions of the documentary.

The documentary presents a narrative structure that combines chronology and theme. This choice reflected the pedagogical objective of relating Amato Lusitano's scientific thinking to the ethical and humanistic values that underpin his life and work. The expository mode forms the backbone of the film, centred on narration and interviews with experts. At the same time, the poetic and contemplative elements—namely, filming in historical locations and sound design—aim to create an immersive, emotionally engaging experience that reinforces meaningful learning. Thus, the documentary sought to balance informative rigour with sensory and emotional impact to promote understanding and appreciation of Amato Lusitano's scientific and humanistic heritage.

Pre-production and research began with an immersion in the life and work of Amato Lusitano, through the analysis of biographical works and critiques by national and foreign authors, as well as contact with historical archives. This research allowed us to consolidate the factual basis and define the narrative axes, culminating in the decision to structure the film around the duality of 'Science' and 'Humanism.' From there, a main chronological structure was developed, complemented by thematic 'capsules' for in-depth analysis. Specialists in the history of medicine, philology, Jewish culture, pharmacology, and botany from Portugal and Spain were carefully selected, with whom preliminary videoconference conversations were held to assess the relevance of their contributions. This stage was complemented by extensive iconographic research and the preparation of a detailed production and logistics plan, including filming permits and travel planning.

The production and implementation phase corresponded to the filming of the documentary. Interviews with experts, conducted using a semi-structured script, formed the core of the content. Filming took place in locations of historical and symbolic relevance, such as the streets of the old town of Castelo Branco, the Historical Library of the University of Salamanca, and the classroom of Friar Luis de León. In the context of action research, these spaces were understood not only as settings but as material testimonies to history, capable of lending symbolic density to the narrative. This approach, combined with two Full HD cameras and careful lighting, aimed to create not only an informative record but also an academic and cinematic atmosphere.

Post-production consolidated the film into its final form. The editing followed a 'counterpoint' logic between interviews, archive footage, and shots of historical sites, seeking to maintain the narrative rhythm and viewer engagement. A first cut of 90 min was reduced to 60 min. The graphic design and animations illustrated Amato Lusitano's journey and medical concepts, the sound was treated as an autonomous narrative layer, and the colourimetry gave visual unity to the whole.

Finally, the public validation phase enabled an empirical assessment of the documentary's reception and critical reflection on the creative process and the work's social and educational value. This stage completed the first cycle of action research, gathering empirical evidence to guide possible reformulations of the work or new strategies for social and educational intervention, in line with the iterative and transformative nature of the methodological approach [36,40].

2.2. Objectives of Study

The overall objective of the study is to analyse the audience's perceptions of the documentary *Amato Lusitano: Science and Humanism* and to verify its association with the sociodemographic profile (academic and generational).

More specifically, the study aims to:

O1: To evaluate participants' perceptions of the communicative and educational effectiveness of the documentary *Amato Lusitano: Science and Humanism*.

O2: To analyse whether there are differences in perceptions of the communicative and educational effectiveness of the documentary depending on academic status and age group.

O3: To analyse the relationship between prior knowledge about the life and work of Amato Lusitano and the perception of novelty attributed to the documentary.

O4: To identify the technical, narrative and communicative elements of the documentary perceived by participants as strengths and opportunities for improvement.

To address objectives O2 and O3, the following research hypotheses were formulated:

H1. *There are differences in perceptions of the communicative and educational effectiveness of the documentary depending on the academic profile and age of the participants.*

H2. *Prior knowledge about the life and work of Amato Lusitano is associated with the perception of novelty of the documentary.*

2.3. Participants

The sample for this study consisted of 55 audience members who attended the first public screening of the documentary *Amato Lusitano: Science and Humanism*, held in an academic context as part of a Scientific and Cultural Conference dedicated to the figure of Amato Lusitano. The event, which was free and open to the public, took place in April 2025 in the auditorium of the School of Education at the Polytechnic Institute of Castelo Branco. The conference had a diverse audience, including students from teacher training and Communication Design and Audiovisual Production courses, teachers, researchers, and the general public, as well as almost all the experts interviewed in the documentary.

Participants were selected through convenience sampling (non-probabilistic sampling) in the context of an event held in an academic setting. It is therefore assumed that the sample size and the specificity of the audience constitute limitations to the generalisation of the results. However, this group offers a highly valuable diagnosis for the present cycle of action research, allowing the reception of the work to be validated in relation to different academic and age profiles.

Participation was voluntary and anonymous, and informed consent was obtained in accordance with the General Data Protection Regulation. Thus, of the 57 respondents to the questionnaire, two did not authorise the processing of their data for research purposes and were therefore excluded from the analysis.

The sample included 37 students (67.3%) and 18 non-students (32.7%). As shown in Table 2, most participants were in the 18–24 age group (65.5%), followed by the 55+ age group (27.3%).

Table 2. Distribution of participants by academic status and age group.

Academic Status	18–24 Years	25–39 Years	40–54 Years	55 or Older	Total
Students	36	1	0	0	37 (67.3%)
Non-Students	0	0	3	15	18 (32.7%)

From the age and academic distribution of the sample, two distinct generational and academic groups emerge. One consists of 37 university students under 40, and the other consists of 18 non-students aged 40 or over. This provides a relevant interpretative basis for comparative analysis, allowing us to verify whether age and academic factors influence perceptions of the documentary.

2.4. Tool

To meet the study's objective, a questionnaire was developed to focus on the audience's perceptions of the documentary and the aspects they valued most or felt could be improved. The questionnaire, developed by the authors, underwent preliminary evaluation by two experts, focusing on the clarity of the items and the appropriateness of the response scale, as fundamental aspects for aligning the instrument with the study objectives. The suggestions presented were incorporated, resulting in the final version of the instrument.

The questionnaire was administered immediately after the public screening of the documentary, in either paper or digital format (via a QR code in Office Forms).

In its final version, the instrument was organised into four parts, summarised in Table 3.

Table 3. Questionnaire structure.

Part	Description/Content	Specific Objective
(A) Sociodemographic characterization	Includes the variables: age and academic status (student vs. non-student).	To analyse the relationship between participants' characteristics and the perceptions expressed.
(B) Perception items	Items evaluated on a 4-point <i>Likert</i> scale (1 = totally disagree; 4 = totally agree).	Analyse the degree of agreement of the participants with different aspects of the documentary, in order to capture general perceptions
(C) Multiple-response items	Identification of up to three aspects considered most positive and to be improved (narrative, content, clarity, duration, quality, and accessibility).	Identify the most valued aspects and those susceptible to improvement.
(D) Consent	Confirms the consent to use the data for research purposes.	Ensure ethical compliance of the study.

Part B of the questionnaire included eleven items formulated as statements, with which participants were asked to indicate their degree of agreement on a four-point Likert scale (1 = strongly disagree; 4 = strongly agree). The use of this scale was intended to avoid neutral responses and encourage participants to take more definite positions.

To ensure the validity of the instrument's content, the eleven items in Part B were designed in direct conjunction with the heritage processes presented in the theoretical framework [15]. These items focused on aspects such as clarity, relevance, informational value, educational potential, and cultural contribution of the documentary, allowing for the operationalisation of the transition between factual knowledge and heritage appreciation. Table 4 explains this correspondence, identifying the processes associated with each item in the questionnaire.

Table 4. Items in part B of the questionnaire.

Code	Item	Heritage Processes
I1	The documentary clearly presents the historical context in which Amato Lusitano lived.	Knowing and understanding
I2	The documentary provides a better understanding of the importance of Amato Lusitano's work.	
I9	The documentary provides an insight into the life of Amato Lusitano	
I3	The documentary adds nothing new to what I already knew about Amato Lusitano.	To know
I4	Before watching the documentary, I was familiar with aspects of Amato Lusitano's life and work.	

I7	The documentary clearly presents Amato Lusitano's contributions to medicine in his time.	To understand
I11	The documentary has comprehensive and enlightening content	
I6	The documentary promotes recognition of Amato Lusitano's importance in the history of science.	Value and care for
I8	The documentary contributes to the appreciation of local historical and cultural heritage.	
I5	The documentary can be used in schools to spark interest in Amato Lusitano.	Raise awareness and communicate
I10	The documentary can help make Amato Lusitano's life and work accessible to younger generations.	

2.5. Procedures Followed in Data Analysis

In the data analysis, descriptive techniques and non-parametric statistical tests appropriate to the ordinal nature of the data were applied. Data treatment was performed using the Statistical Package for the Social Sciences (IBM SPSS Statistics, version 28.01), adopting a significance level of 5%.

To ensure the validity and internal consistency of the data obtained from the eleven items of section B of the questionnaire, psychometric sensitivity was assessed, an exploratory factor analysis was conducted, and Cronbach's alpha coefficient was calculated [41,42].

Regarding the analysis of psychometric sensitivity, the means of the 11 items ranged from 2.25 to 3.78, with medians predominantly equal to 4, which suggests a general trend towards positive evaluations. The asymmetry values ranged from −1.952 to 0.249, and those for kurtosis ranged from −1.389 to 3.178. All items presented values within the limits defined in the literature [42,43], indicating good psychometric sensitivity and the absence of severe distortions in the distributions of responses. Thus, it was considered appropriate to perform an exploratory factor analysis and assess the internal consistency of the 11-item set.

The exploratory factor analysis showed a very satisfactory adequacy of the data ($KMO = 0.822$; significant Bartlett's sphericity test, $\chi^2(55) = 250.815$; $p < 0.001$), showing a two-factor structure with eigenvalues of 4.99 and 1.38, which explained 57.9% of the total variance [43,44].

The first factor, comprising nine items (1, 2, 5, 6, 7, 8, 9, 10, and 11), showed high internal consistency ($\alpha = 0.89$) [45]. This factor reflects the perception of the documentary as a clear, informative, and pedagogically relevant resource that can enhance the historical and scientific legacy of Amato Lusitano and stimulate educational and cultural interest. Based on this structure, the factor was operationalised as a new composite variable, called "Communicative and educational effectiveness of the documentary". This variable, calculated from the arithmetic mean of the nine items mentioned, represents the central construct of the empirical validation of the documentary.

The second factor grouped two items: prior knowledge (item 4) and the perception of the documentary's content as novel (item 3, recoded). These items showed a weak negative correlation ($r \approx -0.27$) and low internal consistency ($\alpha = 0.44$), so they were analysed individually.

In summary, the results confirm the structural validity and internal reliability of the data collection instrument, demonstrating that most items consistently assess the communicative and educational effectiveness of the documentary, a central variable in subsequent analyses.

3. Results

3.1. Perceptions of the Communicative and Educational Effectiveness of the Work

In terms of the communicative and educational effectiveness of the documentary (Table 5), the results reveal a high average ($\bar{x} = 3.64$) and low variability ($s = 0.39$). The high internal consistency of the items comprising the factor ($\alpha = 0.89$) reinforces the construct's reliability and the consistency of the responses, allowing us to affirm that the participants made a very positive assessment of the documentary's communicative, informative, and educational value.

Table 5. Descriptive statistics of the communicative and educational effectiveness construct.

Construct	Items	<i>n</i>	Min	Max	$\bar{x}$	<i>s</i>	α (Cronbach)
Communicative and educational effectiveness of the documentary	1, 2, 5, 6, 7, 8, 9, 10, and 11	55	3	4	3.64	0.39	0.887

To assess the influence of sociodemographic characteristics on perceptions of the documentary's communicative and educational effectiveness, the Mann–Whitney U test was used, which is appropriate for ordinal data.

The results revealed statistically significant differences between students (<40 years old) and non-students (≥ 40 years old) ($U = 186.00$; $Z = -2.70$; $p = 0.007$). Non-students showed higher levels of agreement (MR = 36.17) than students (MR = 24.03).

(These results suggest there is an association between the generational and academic profile of the audience and their perception of the communicative and educational effectiveness of the work. Non-students showed greater appreciation of the documentary, which may be related to a more mature engagement with the content, in contrast to university students, who are younger). These results suggest that the generational and academic profiles of the audience significantly influence their perceptions of the work's communicative and educational effectiveness. Non-students showed greater appreciation for the documentary, suggesting a more mature engagement with its content, in contrast to younger university students. Thus, the results support the acceptance of Hypothesis H1.

3.2. Perceptions About the Novelty of the Work

As shown in Table 6, the participants indicated little prior knowledge about the life and work of Amato Lusitano ($\bar{x} = 2.25$; $s = 1.142$), while the perception of novelty was relatively high ($\bar{x} = 3.19$; $s = 1.199$).

Table 6. Descriptive statistics of the constructs: prior knowledge and perception of novelty.

Constructs	Min	Max	$\bar{x}$	<i>s</i>	<i>r</i>	<i>p</i>
Previous knowledge about the life and work of Amato Lusitano (Item 4)	1	4	2.25	1.142	−0.28	0.039
Perception of novelty about the life and work of Amato Lusitano (Item 3 recoded)	1	4	3.19	1.199		

The analysis of the existence of an association between the participants' profile and previous knowledge about the life and work of Amato Lusitano (I4) revealed a statistically significant association ($\chi^2(3) = 15.51$, $p = 0.001$). Given that 37.5% of the cells had expected counts < 5, Fisher's exact test (Monte Carlo) was also performed, confirming the association's significance ($p < 0.01$).

The analysis of the adjusted residuals (Table 7) revealed patterns consistent with the two groups identified in the sample. Students (<40 years old) had a higher-than-expected frequency in the "totally in disagreement" category (adjusted residual = +2.7), suggesting

less prior knowledge of the documentary's subject. In contrast, non-students (≥ 40 years) had a higher frequency in the "partially agreeable" category (adjusted residual = +3.6), indicating greater previous familiarity with the topic.

Table 7. Association between academic/generational status and prior knowledge (Item 4).

Situation Academic/Age Group	Totally Disagree	Partially Disagree	Partially Agree	Totally Agree	Total
Students (<40 yrs)	18 (48.6%) [+2.7] ^a	9 (24.3%) [+1.1] ^a	4 (10.8%) [−3.6] ^a	6 (16.2%) [−0.5] ^a	37 (100%)
Non-students (≥ 40 yrs)	2 (11.1%) [−2.7] ^a	2 (11.1%) [−1.1] ^a	10 (55.6%) [+3.6] ^a	4 (22.2%) [+0.5] ^a	18 (100%)
Total	20 (36.4%)	11 (20.0%)	14 (25.5%)	10 (18.2%)	55 (100%)

Note: ^a Adjusted residuals.

These results suggest that academic status and age are associated with the extent of prior knowledge of the life and work of Amato Lusitano, with non-student and older participants showing greater prior exposure to the subject.

The existence of an association between the academic and generational situation and the perception of novelty of the documentary was also analyzed (Item 3 recorded), and it was found that the differences observed between the two groups are not statistically significant ($\chi^2(3) = 2.77$, $p = 0.428$).

However, a weak, statistically significant negative correlation was observed between prior knowledge and the perception of novelty, $r(54) = -0.28$, $p = 0.039$, suggesting that participants with less initial familiarity with the life and work of Amato Lusitano tended to perceive the documentary as more innovative and informative. This result reinforces the idea that the cognitive effect of the documentary was particularly relevant for participants with less prior knowledge. Given the existence of a statistically significant correlation between the variables, Hypothesis H2 is confirmed.

3.3. Elements of the Documentary Perceived as More Positive and Subject to Improvement

Regarding the most valued elements and those identified as subject to improvement in the documentary, Table 8 presents the frequency with which participants reported each option.

Table 8. Participants' perceptions of the most positive and improving aspects of the documentary.

Elements	More Positive		To Improve	
	n	%	n	%
Clarity of information	41	74.5	13	23.6
Content	41	74.5	10	18.2
Production quality	32	58.2	7	12.7
Accessibility	2	3.6	25	45.5
Duration	10	18.2	25	45.5
Narrative	29	52.7	19	34.5

Note. Absolute frequencies (n) and percentages (%). Each participant could check(tick) up to three options per category (N = 55).

From the table analysis, it stands out that the most valued elements were the clarity of information and content, both mentioned by 41 participants (74.5%). The quality of production (58.2%) and, to a lesser extent, the narrative (52.7%) also stood out. In contrast, the elements most frequently cited as needing improvement were the accessibility and

length of the documentary, mentioned by 25 participants each (45.5%), followed by the narrative (34.5%) and the clarity of information (23.6%). These results suggest an overall positive perception, accompanied by critical attention to the pace and accessibility of the content. The narrative stood out for receiving a considerable number of both positive and negative mentions, reflecting divergent perceptions among participants.

The analysis of the association between the perception of duration as an aspect to be improved and the academic/generational profile of the participants revealed no statistically significant association ($\chi^2(1) = 3.37, p = 0.066$). Despite this, there was a tendency for students (<40 years old) to more frequently indicate duration as an element to be improved (54.1%) than non-students (27.8%), suggesting possible differences in expectations regarding the pace and length of the documentary (Table 9).

Table 9. Frequency and percentage of participants who marked duration as an aspect to improve, according to their academic status.

Academic Situation	n	No Tick	Tick	$\chi^2(1)$	p
Student	37	17 (45.9%)	20 (54.1%)	3.37	0.066
Non-student	18	13 (72.2%)	5 (27.8%)	-	-
Total	55	30 (54.5%)	25 (45.5%)	-	-

In the case of accessibility, there were also no statistically significant differences between the perceptions expressed by students and non-students ($\chi^2(1) = 0.22, p = 0.637$). The proportions were similar in both groups. About 50% of non-students (≥ 40 years old) and 43% of students (younger audience) noted this aspect, indicating a consistent perception of accessibility as an area for improvement in documentaries across different academic profiles.

In summary, the results indicate a positive overall evaluation of the documentary, with varying perceptions by age and academic situation.

4. Discussion

4.1. Summary of the Main Results

The results show very positive perceptions of the documentary *Amato Lusitano: Science and Humanism* regarding its communicative and educational effectiveness, particularly in terms of information clarity, scientific rigor, and audiovisual quality. Participants with less prior knowledge of the life and work of Amato Lusitano showed a higher perception of novelty, and there were statistically significant differences by academic/generational profile, with non-students (≥ 40 years old) showing higher levels of agreement than students (<40 years old). These results suggest the potential of documentaries to promote meaningful learning [30] and to act as a resource for historical–scientific dissemination and heritage education.

Although the questionnaire enabled immediate assessment of public perceptions, interpreting these results and the differences observed between the groups requires placing them in the broader context of contemporary heritage education practices in a digital environment.

4.2. Composition of the Sample and Its Implications for the Analysis

The composition of the sample, predominantly young and university students, including students from teacher training courses and Communication Design and Audiovisual Production courses, is essential for contextualising the results. The most frequent criticisms of duration, accessibility, and narrative reflect audiovisual consumption patterns characteristic of audiences accustomed to fast communication rhythms and short

formats. Although the differences between students (<40 years old) and non-students (≥40 years old) were not statistically significant, the descriptive analysis suggests that younger participants tended to evaluate the duration of the documentary more critically. This conclusion is consistent with studies on audiovisual reception among young audiences, which highlight the importance of narrative dynamics and brevity in maintaining interest [46,47].

The results reinforce this distinction: non-students scored significantly higher on the construct 'Communicative and Educational Effectiveness' ($p = 0.007$), while. At the same time, it is more frequently noted that duration is an aspect to be improved (54.1% vs. 27.8%), suggesting generational differences in consumption patterns.

Studies comparing pre- and post-digital generations (Baby Boomers and Generation X versus Generation Y and Z) show that the latter develop cognitive and communication styles adapted to the rapid and fragmented mediation of digital technologies [48]. In this sense, students' preference for shorter formats can be understood as a consequence of exposure to media ecosystems that emphasize immediate impact, a fast pace, and high visual appeal. Thus, for effective engagement with young audiences, heritage dissemination strategies may benefit from modular, interactive, and shorter formats.

For young audiences, accustomed to the fast pace of digital platforms, the density of discourse and the 60 min duration may have diminished their perception of effectiveness, despite recognising the quality and clarity of the content. This result reinforces the importance of diversifying the format. It highlights that criticism of the duration can be understood as criticism of the pace, a central challenge in heritage mediation practices for Generation Z audiences.

4.3. Communicative Effectiveness and Mediation in Digital Heritage Education

The results confirm the documentary's high communicative and educational effectiveness, highlighting its value as a cultural measurement tool in the context of digital heritage education. The participants' perceptions regarding the clarity of information, scientific rigour, and production quality validate the documentary format as an accessible, engaging, and socially relevant means of communication, in line with the literature that highlights the role of documentaries in the democratisation of historical and scientific knowledge [49,50]. Although viewing is a receptive act, the viewer's active involvement is enhanced by the documentary's immersive nature, which can stimulate critical reflection and historical empathy.

The fact that non-students had significantly higher averages than (younger) students suggests that factors such as experience, maturity, or cultural literacy may favour a more integrated appreciation of scientific and heritage content. This trend aligns with research identifying generational and educational differences in the reception of cultural and educational products, associated with varying levels of media and heritage literacy [51,52].

The results also highlight the potential of documentaries as mediators between academic and non-academic communities, a central practice in Public Digital Humanities. This mediating role aligns with the notion of digital boundary object [20], understood as an entity that facilitates communication and the sharing of meanings between different domains of knowledge. This mediating function also reinforces the educational role of digital technologies in museum contexts, bringing cultural heritage closer to audiences and enhancing the quality of the experience [1].

Such evidence underlines the need for Public Digital Humanities to move from mere digital production to the creation of diverse content ecosystems, capable of reconciling the informational rigour of the complete work with the demands for brevity and modularity of younger audiences.

4.4. The Dissonance Between Authorial Intent and Reception by Young Audiences

The analysis reveals a notable dissonance between the author's intention and the way younger audiences received the work. Although the content was widely appreciated—highlighting the rigour of the research and its historical and scientific relevance—the formal execution was noted as needing improvement in terms of duration, accessibility, and narrative. This combination of assessments suggests that criticism focused less on the temporal extension itself and more on the discursive density of the documentary, suggesting challenges in adapting narrative rhythms to digital consumption habits [46,47].

This discrepancy did not compromise the effectiveness of the information but highlights the need to diversify formats, offering full and short versions aimed at different audiences. At the same time, it is a relevant indicator that the rigor and quality of the scientific content ensured the effectiveness of information, even in the face of a more extensive format. Thus, the relevance of developing digital heritage communication strategies based on the creation of complementary content ecosystems that combine depth and modularity, and that respond to the demands of new platforms [31] is reinforced. The adoption of this hybrid approach, suggested by the results, is a valuable orientation for future practices of heritage and educational communication.

It is also important to consider accessibility, which was identified as an aspect to be improved by about half of the participants, regardless of age or academic status. This result suggests that this perception is more related to cross-cutting factors, such as readability, technical viewing conditions, and levels of digital literacy, than to the demographic profile. This conclusion underscores that communicative accessibility is an intrinsic dimension of inclusive heritage mediation, requiring cultural institutions to shift from an information-transfer model to a more participatory communication [50].

The divergent perceptions regarding the narrative indicate that the documentary managed to balance scientific information and aesthetic dimension, but that different audience profiles react differently to the discursive density and temporal extension. This aspect underscores the challenge of narrative adaptation in historical–scientific audiovisual productions, where factual accuracy must coexist with appealing, accessible communicative strategies, capable of transforming the viewer from a passive recipient into an agent of heritage interpretation.

Overall, the documentary *Amato Lusitano: Science and Humanism* seems to have effectively fulfilled its informative and formative functions, highlighting the potential of scientific and heritage documentaries' digital cultural mediation. The action research that underpinned its production and empirical validation exemplifies a practice of integration between artistic creation and academic research, characteristic of contemporary Digital Humanities, consolidating the documentary as a privileged medium for digital heritage education in hybrid and interactive contexts.

5. Conclusions

The participants' evaluations highlight the communicative and educational impact of the documentary, particularly for the expository clarity, audiovisual quality, and scientific and humanistic relevance of the contents. Perceived novelty was especially high among participants with less prior knowledge, suggesting that the documentary served as a catalyst for meaningful learning [30].

This evidence reinforces the potential of the documentary format as a resource for digital heritage education, capable of articulating scientific communication, historical appreciation, and cultural mediation. The documentary also demonstrated the ability to translate academic knowledge into accessible narratives, acting as a mediator between different communities of practice, in line with the concept of digital boundary object [22].

The differences observed between students and non-students indicate that factors such as media literacy and academic maturity influence perceptions of communicative effectiveness. In this context, the presence of students from teacher training courses in the younger group, with a professional vocation intrinsically linked to educational content, allows us to highlight the importance of adjusting narrative and duration strategies to the expectations of diverse audiences, a central issue in contemporary approaches to digital heritage education. The inclusion of other audiences, such as cultural mediation agents or active teachers, and the application of pre- and post-test methodologies in future cycles will allow for further pedagogical and didactic validation of the resource in different formal and informal learning contexts.

Despite some limitations, namely the non-random nature of the sample and the collection of data immediately after viewing, which do not allow the evaluation of prolonged effects, the study contributes to consolidating an action-research methodology that integrates audiovisual creation and empirical validation, highlighting the value of documentary as a tool for non-formal education and public engagement with heritage.

Future research may deepen reception processes through qualitative methodologies, such as interviews or focus groups, and explore hybrid or participatory formats (short, modular or interactive versions) that allow for the evaluation of communicative effectiveness in diverse contexts. Such development could strengthen the understanding of documentary as a space for co-learning and shared construction of memory, contributing to rethinking heritage education in the digital age as an open, inclusive and collaborative field.

In this sense, the study contributes to the advancement of Digital Heritage Education practices, illustrating the potential of documentary as an effective means of cultural and educational mediation in the twenty-first century.

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