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DIGITAL CULTURAL HERITAGE AS A RESOURCE FOR EDUCATION, INNOVATION AND SUSTAINABLE DEVELOPMENT

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ABSTRACT

Digitalisation provides significantly more opportunities to preserve, access and share cultural heritage, yet digital access does not by itself create educational, innovative or sustainable value. This article examines the conditions under which digital cultural heritage becomes an active resource for learning, creative use and sustainable development. The study is a conceptual analysis of literature on digital cultural heritage, education and sustainable development, combined with a reevaluation of selected findings from the author's 2016 qualitative research on intercultural communication competence. That earlier work is not treated as empirical evidence about digital heritage; rather, it extends the conceptual lens of knowledge, motivation, skills, openness and experiential learning to contemporary digital heritage practices. The article argues that digital cultural heritage becomes valuable through a process that moves from preservation and access towards contextualisation, engagement, learning, skills development and creative reuse. Examples from Europeana concerning digital heritage education and immersive cultural experiences demonstrate both the opportunities and the limitations of technology-supported learning. The case of Uzbek audiovisual heritage, focusing on the photographic and cinematographic legacy of Khudaibergan Devanov, shows how historically significant archival materials can serve as tools for education, intercultural understanding, research and creative engagement. The article concludes that sustainable value does not come from digitisation itself, but from the interaction of digital infrastructure, cultural context, educational practice, institutional capacity and human creativity.

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Introduction

For years societies preserved and transmitted the memory and meaning through material and documentary objects, audiovisual records, practices, knowledge and other forms which represent cultural heritage. Digital solutions have widened the horizon of opportunities for preserving and accessing such heritage, whereas the digitisation should not be understood merely as the production of digital copies. Digital cultural heritage can be further considered as a resource for education, research, creativity, innovation and social development.

The article addresses as a central problem the distinction between access and meaningful value. Meaning a digitised photograph, film or manuscript is not automatically educational simply by being available online. It is necessary for a user to have context, motivation and opportunities to interpret and

engage with the cultural materials. UNESCO's Recommendation on documentary heritage acknowledges documentary materials including digital forms as resources for knowledge creation, intercultural education, scientific and technological progress and development, and appeals for new forms and tools for education and research (UNESCO, 2015).

The paper is built conceptually on the earlier qualitative research on intercultural communication competence conducted by the author in 2016. Even though that research studied international volunteers rather than digital cultural heritage, its findings on the relationship among knowledge, motivation, skills, openness and practical experience lie in direct relevance to this exploration. The study displayed that if participants actively sought information about cultural difference, interpreted it through own experience and applied into practice, the possessed information became more meaningful. These findings serve as a useful conceptual basis to question how digital cultural materials can correspondingly move from information towards learning and action.

Hence the article addresses three following questions:

1. What educational opportunities are created when cultural heritage becomes digitally accessible?
2. How can digital heritage support learning, creative use and innovation?
3. What are the conditions and challenges that define whether digital heritage contributes to sustainable cultural and educational value?

The article consolidates a conceptual literature review and a case-based study of Uzbekistan's audiovisual heritage with a focus on Khudaibergan Devanov. Whereas the 2016 research provides a conceptual resource and is not considered as empirical evidence about digital heritage.

The central argument is that digitalisation created vast possibilities, but its value comes from contextualisation, engagement, learning and reuse. Digital cultural heritage realizes its potential not merely as digitised content, but as an enabling resource for knowledge, creativity and participation.

2. Digital Cultural Heritage as a Meaning-Making and Knowledge Resource

2.1 Culture, Shared Meanings and Cultural Heritage

Communities interpret their past and present through symbols, values, memories and knowledge which altogether represent cultural heritage. This corresponds with the understanding of culture developed in the earlier research of the author. Trenholm and Jensen (2008) describe communication as a symbolic, interpretative, transactional and contextual process through which people create shared meanings, while culture can be understood as a learned system of shared perceptions, beliefs, values and norms.

One of the findings of the 2016 study was also an important qualification that cultural knowledge does not provide a universal explanation for individual behaviour. Samovar et al. (2013) stressed the uniqueness of the individuals and the dangers of generalisation. Hence cultural knowledge can contribute to interpretation, but should not replace the focus on individual circumstances and context.

This differentiation is crucial in context of digital heritage: where a digital representation of cultural life does not have one fixed meaning which can be simply transmitted to the user. Here the meaning is created in a consolidation of historical and cultural context of this object, the information accompanying it, the knowledge perceived and the perspective of the person interpreting it.

2.2 From Digitisation to Meaningful Access

Digitisation can considerably increase accessibility of the documentary heritage, especially materials that are geographically dispersed, fragile or difficult to consult physically. Having mentioned that the access itself does not fully explore the potential of the object, UNESCO's 2015 Recommendation further expands preservation to long-term accessibility and encourages Member States to develop educational and research tools around documentary heritage (UNESCO, 2015).

The contemporary digital heritage environment is outgrowing isolated online repositories and moving towards interoperable data infrastructures. The emphasis is also made by the Common European

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Data Space for Cultural Heritage: Strategy 2025–2030 which identifies high-quality data, interoperability, multilingual discovery, wider access, reuse and emerging technologies such as artificial intelligence, 3D and extended reality as priorities. The funding gaps, institutional capacity and data silos are being recognized as continuing challenges (European Commission & Europeana Foundation, 2025).

Hence we observe an important paradigm shift from digitisation as preservation to digital heritage as meaningful access. Accessibility opens doors to learning but interpretation and engagement define if that possibility gets an educational value.

3. Digital Cultural Heritage as an Educational Resource

3.1 From Access to Learning

Digital collections enable access for learners to archival records that may otherwise have been unavailable due to geographical, institutional or physical limitations. For example, Europeana facilitates access to cultural heritage collections from institutions across Europe and supports educators in blending these materials into teaching and learning.

Nonetheless, the access to information should not be considered equivalent to learning. The separation is consistent with the author's 2016 research, where knowledge, motivation and skills were recognized as interdependent dimensions of intercultural competence. Spitzberg and Cupach's (1984) competence model equally highlights knowledge, motivation and skills as interconnected components of effective intercultural interaction.

This principle can be applied prudently to digital heritage. Meaning the cultural information can become educationally meaningful when the learners can interpret it, connect it with existing knowledge and apply it through activity which can be seen in the example of O'Neill et al. (2024). Their study described the usage of digital cultural heritage assets from the Digital Repository of Ireland in software engineering education. The students actually worked with heritage materials and metadata standards, letting the cultural heritage resources to illustrate the technical concepts in an authentic learning environment. The research shows that digital heritage can function simultaneously as cultural content and a practical learning environment.

The ramification is that the educational value of digital heritage is less related to the quantity of the material available rather to how effectively it is incorporated into learning activities.

3.2 Knowledge, Motivation and Experience

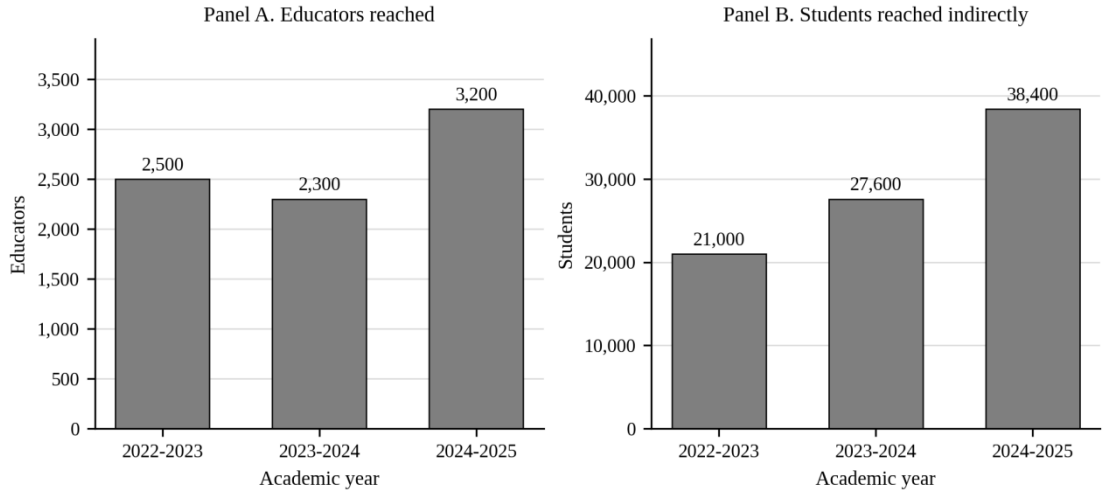
The 2016 study further suggested that formal knowledge became more meaningful when it was connected with practical experience. This observation can be applied to digital heritage education, where learners move between viewing, investigating, interpreting and producing.

This transition towards active reuse can be seen in Europeana's education activities. During the 2023–2024 academic year, more than 2,300 formal and non-formal educators interacted with Europeana resources, which resulted indirectly in reaching more than 27,600 students. The programme emphasized the reuse of digital cultural heritage, learning scenarios and connections between physical and digital environments (Europeana Foundation, 2024). As Figure 1 shows, the reported reach of these activities has grown across three consecutive academic years, with the number of students indirectly reached rising from more than 21,000 in 2022–2023 to more than 38,400 in 2024–2025 (Europeana Foundation, 2023, 2024, 2025). These figures describe participation rather than measured learning gains, yet they indicate that educational reuse of digital heritage is becoming a structural rather than an occasional practice.

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Figure 1

Educators and Students Reached Through Europeana Education Activities, 2022–2023 to 2024–2025



Note. Panel A shows the number of formal and non-formal educators who took part in education activities organised by the Europeana Initiative and European Schoolnet. Panel B shows the number of students reached indirectly through those educators. Figures are reported minimum values ("more than") and are therefore conservative. Data compiled by the author from Europeana Foundation (2023, 2024, 2025).

However it should be mentioned that technology itself should not be considered as a guarantee of better learning. Sun and Ch'ng (2024) compared the results of screening of traditional 2D documentaries in relation to immersive 360° ones where both presented Miao cultural heritage. The results stated that the immersive format increased perceived appeal and engagement without producing superior objective knowledge retention.

The data demonstrates that technological immersion and learning outcomes are related but not identical.

Thus, for digital cultural heritage to be effective, it requires alignment among technology, content, learner experience and pedagogical purpose.

3.3 Openness and Engagement With Cultural Difference

The author's earlier research also distinguished important conditions for learning across cultural differences such as openness, curiosity and willingness to engage. Even though digital cultural heritage can extend outreach of learners to histories and cultural expressions beyond their direct milieu, it does not necessarily ensure the intercultural understanding.

The importance of active engagement can be seen in the recent studies of Zhang et al. (2025) who study VR-based digital cultural heritage education. They identified curiosity, enjoyment, perceived control and immersion as important dimensions of continued engagement. Their findings suggest that interactive environments can encourage users to explore cultural heritage more actively in comparison to passively receiving information.

Comparably, Guo (2025) explored a blending of digital games and synchronous online courses in heritage education of Chinese porcelain. The findings demonstrated that combining experiential digital activities with structured instruction could improve the learning outcomes and motivation of participants. The order of activities played an important role as the exploration could generate questions which afterward were addressed through systematic teaching.

These studies illustrate a wider interpretation of openness emphasizing that digital heritage does not automatically produce openness to cultural difference. On the contrary, it can create conditions for curiosity, exploration and interpretation, where the learner's active engagement is central.

4. From Learning to Innovation and Sustainable Development

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4.1 From Knowledge and Skills to Creative and Innovative Reuse

While previous sections establish the progression from access towards learning, this section discusses what can happen after learning. The author's 2016 research suggested that knowledge, motivation and practical skills could influence subsequent educational and professional activity. Applying this to digital cultural heritage provides a conceptual bridge from learning to creative reuse.

The value of digital cultural heritage can be extended beyond viewing. It can become something users create with, for example, it can be incorporated into research, digital storytelling, educational platforms, documentary production, games, design, virtual exhibitions and immersive experiences.

According to the European Commission and Europeana Foundation's 2025–2030 strategy, the access and reuse are at the center of digital heritage development, whereas new applications, AI, 3D and extended reality are identified as opportunities for innovation and value creation (European Commission & Europeana Foundation, 2025).

A practical example can be seen in the EU's Twin it! 3D for Europe's Culture initiative, whose 2026 phase focuses on reuse intentions and encourages creators, developers and cultural professionals to explore new applications of 3D heritage in education, research, design, gaming and immersive experiences (European Commission, 2026).

The correlation can be therefore represented in the following order:

knowledge → skills → capability to act → creative use → innovation

In this context the innovation is not considered as technology for its own sake, rather it surfaces when cultural resources, digital infrastructures, human skills and applications interact.

4.2 Digital Cultural Heritage and Sustainable Development

UNESCO's Culture 2030 Indicators recognize internationally the relationship between culture and sustainable development. The framework measures contribution of culture to sustainable development through four dimensions: knowledge and skills, inclusion and participation, prosperity and livelihood, environment and resilience (UNESCO, 2019).

Digital heritage can contribute to development of these dimensions through several roadmaps: for education — by expanding access to cultural resources, for inclusion — by reducing some geographical barriers, for prosperity — by enabling reuse in research, creative industries, tourism and digital services. This cannot happen automatically but with evidence, participation and institutional capacity highlighted in UNESCO's framework. At the same time the EU's cultural data strategy recognizes funding, skills, institutional prioritisation and data silos as continuing barriers (European Commission & Europeana Foundation, 2025; UNESCO, 2019).

Hence the relationship can be framed as in the following order:

access → contextualisation → engagement → learning → skills → participation and reuse → cultural, social and economic value

This expands the digital cultural heritage to a scale of being an enabling resource rather than a direct technological solution to sustainable development.

Table 1 summarises the frameworks and empirical studies reviewed in Sections 2 to 4, setting out for each source the enabling condition it identifies and the limitation it reports. The table makes visible a pattern that runs through the literature: every source that documents an opportunity also documents a condition on which that opportunity depends.

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Table 1

Enabling Conditions and Reported Limitations Across the Reviewed Frameworks and Studies

Source	Focus	Enabling condition identified	Reported limitation
UNESCO (2015)	Preservation of and access to documentary heritage	Long-term accessibility, standardisation, interoperability and dedicated educational and research tools	Access alone does not generate use; rights and cooperation remain unresolved
UNESCO (2019)	Culture in the 2030 Agenda	Four measurable dimensions: knowledge and skills; inclusion and participation; prosperity and livelihoods; environment and resilience	Requires evidence, participation and institutional capacity
European Commission & Europeana Foundation (2025)	European data space for cultural heritage, 2025–2030	High-quality data, interoperability, multilingual discovery, reuse, AI, 3D and extended reality	Funding gaps, limited institutional capacity, persistent data silos
European Commission (2026)	Twin it! 3D for Europe's culture	Reuse of 3D heritage in education, research, design, gaming and immersive experiences	Reuse depends on creator capacity and clarity of rights
Europeana Foundation (2023, 2024, 2025)	Educator training and classroom reuse	Teacher training, learning scenarios and links between physical and digital environments	Reach data measure participation, not learning outcomes
O'Neill et al. (2024)	Heritage assets in software engineering education	Authentic materials and metadata standards function as a technical learning environment	Value depends on deliberate curricular integration
Sun & Ch'ng (2024)	2D versus immersive 360° documentary	Immersion increases perceived engagement	No superior objective knowledge retention
Guo (2025)	Digital games combined with synchronous courses (ARCS model)	Exploration before structured instruction improves motivation and outcomes	Effects depend on the sequencing and design of activities
Zhang et al. (2025)	Engagement in VR heritage education	Curiosity, enjoyment, perceived control and immersion sustain engagement	Engagement is not equivalent to learning; measures are self-reported
Rashidova (2016)	Intercultural communication competence of volunteers	Knowledge, motivation, skills, openness and experience operate as interdependent conditions	Different population; transferred conceptually, not as empirical evidence

Note. Table compiled by the author from the sources cited. “Enabling condition” refers to the factor each source identifies as necessary for digital cultural heritage to generate educational or developmental value; “reported limitation” refers to the constraint the same source records. ARCS = attention, relevance, confidence, satisfaction; VR = virtual reality.

5. Uzbekistan: Digital Film Heritage as a Case

Uzbekistan presents a useful case for exploring this argument as its audiovisual heritage contains historical evidence that can be recontextualised for contemporary education and cultural engagement. This section does not aim to provide a history of Uzbek cinema; instead it focuses on the educational and developmental potential of selected film and photographic heritage.

5.1 Historical Film Heritage

Cinema and photography took root in Central Asia at the end of the nineteenth and beginning of the twentieth centuries. Consequently Uzbekistan developed a substantial audiovisual heritage encompassing feature films, documentary materials, newsreels and photographic collections.

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The research carried out by Karimova (2010, 2019) emphasizes that Uzbek cinema should not be understood only as an artistic field but also considered in relation to broader technological, social and cultural transformations, which makes the audiovisual heritage especially valuable as a source of historical evidence.

However in this article we will focus not on the development of cinema itself but what surviving audiovisual materials can do in the present days. Applying the earlier discussed correlations, we may suggest that after preservation, digitisation and contextualisation, historical films and photographs can become primary sources for teaching history, culture, visual analysis and research.

5.2 Khudaibergan Devanov as an Educational and Cultural Case

Khudaibergan Devanov (1879–1937) is a pioneering Uzbek photographer and cinematographer, whose photographs and films document Khorezm during a period of substantial political, social and cultural transformation and can serve as a particularly relevant example for this exploration.

The importance of his documentary legacy was internationally recognized through its inscription on the Memory of the World Asia-Pacific Regional Register in 2024. The collection is represented by photographs and photographic glass negatives documenting Khorezm through several historical periods and showcases visual evidence of social life, political transformation, architecture, economic activity and cultural practices (Memory of the World Committee for Asia and the Pacific, 2024).

From an educational dimension, the significance of this collection lies in its potential as a primary-source learning environment, where learners can investigate visual evidence, make comparisons of historical and contemporary environments, explore the representations of cultural life and construct their own interpretations. Hence the materials can support historical inquiry, visual literacy and cultural understanding.

In addition to that, the case can showcase the relationship between digital heritage and engagement with cultural difference. Learners, who are unfamiliar with Khorezm, can encounter another historical and cultural environment through original visual sources. Such encounters can move beyond factual learning towards interpretation and reflection if accompanied by contextual information and critical questions.

The international exhibition Uzbekistan: A Beautiful World, which was presented at UNESCO Headquarters in Paris in April 2025, showcased how Devanov's heritage can be recontextualised for international audiences and was considered as a representation of Uzbekistan's history and cultural memory through Devanov's photographic legacy (UNESCO, 2025).

Hence the case can be synthesized as:

preservation → recognition → access → contextualisation → engagement → learning → interpretation and reuse

5.3 Opportunities and Challenges

The Devanov case offers several educational opportunities, where learners can work with the heritage rather than merely consume it. For example, digitised photographs and films can be used as primary sources in university and school teaching, visual analysis, digital storytelling, research assignments, online exhibitions and comparative studies.

Uzbekistan's audiovisual heritage can be connected with the innovation pathway developed in Section 4 by creative use through documentaries, digital exhibitions, historical mapping, interactive platforms and immersive experiences.

Meanwhile the digitisation alone is insufficient as long-term value requires reliable preservation infrastructure, metadata, contextual information, rights management and institutional capacity. UNESCO's Recommendation specifically points out the access, standardisation, interoperability, copyright considerations and cooperation in the preservation and use of documentary heritage (UNESCO, 2015).

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Contextualisation is particularly important hence learners should be encouraged to ask who created an image, when and why it was produced, whose perspective it represents and how it may be interpreted today; historical images should not be treated as self-explanatory evidence.

The case consequently presents a wider argument of the article: there is an opportunity for Uzbekistan not simply to digitize more heritage but to establish conditions under which digitized heritage can become educationally meaningful, creatively reusable and socially valuable.

6. Discussion: From Digital Access to Sustainable Cultural and Educational Value

The analysis illustrates that the evaluation of the digital cultural heritage should not be limited primarily to the amount of digitised material or the number of online users since its wider value emerges through a chain of relationships:

preservation → access → contextualisation → engagement → learning → skills → reuse → innovation → sustainable cultural value

The first finding of significant importance is that access is necessary but insufficient. As an example, UNESCO's documentary-heritage framework connects preservation with accessibility and education, while contemporary European policy increasingly emphasizes reuse and interoperability.

The second important finding is that learning functions as a critical intermediary. Sections 3 and 4 discussed the examples where digital heritage becomes educationally valuable when learners actively investigate, interpret and apply cultural material. The study of O'Neill et al. (2024) shows how authentic heritage can support technical learning, whereas Sun and Ch'ng (2024) advise that technological immersion does not automatically improve the knowledge retention.

The third finding is presented by engagement with cultural difference and its contribution to broader forms of learning. While the digital heritage can expose learners to unfamiliar cultural milieu, their curiosity, autonomy and experiential engagement can encourage deeper exploration. Guo's (2025) insights demonstrate the potential of blending experiential digital activities with structured learning and the author's earlier research provides a conceptual basis for understanding knowledge, motivation and skills as interconnected rather than independent.

The fourth finding suggests that innovation depends on reuse. The new European cultural-data strategy explicitly connects access and reuse with innovation and value creation (European Commission & Europeana Foundation, 2025). Whereas the Uzbekistan case showcases that this principle is not limited to European collections: Devanov's heritage can similarly become a resource for teaching, research, digital storytelling and creative production.

Finally, institutional and social conditions are required for sustainable value, as the right-hand column of Table 1 makes visible across every source reviewed. Meaning that unequal digital access, insufficient skills, fragmented collections, weak metadata, rights restrictions and limited funding can prevent digital heritage from reaching its educational and innovative potential. Hence the cooperation among cultural institutions, educators, researchers, technologists and creative practitioners is required for sustainable digital heritage management.

This article remains primarily conceptual and illustrative concurrent with the proposed pathways which should not be interpreted as a proven causal model. The participation figures presented in Figure 1 likewise describe reach rather than learning outcomes. Future empirical research should examine how different types of digital heritage influence learning outcomes, intercultural understanding, creative skills and long-term participation.

7. Conclusion

This article has argued that digital cultural heritage can become a resource for education, innovation and sustainable development if the access is connected with meaningful engagement, learning and reuse. Therefore the digitisation should not be considered as a final goal, as its value depends on contextualisation, educational practice, user capabilities, institutional infrastructure and opportunities for responsible use.

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The analysis suggests a pathway from preservation to access, access to engagement and learning, and learning to creative reuse and sustainable cultural educational value. This paradigm brings together digital preservation with education, intercultural learning, skills development and innovation instead of treating them as separate fields.

A practical model is represented by the Uzbekistan case of Khudaibergan Devanov which emphasizes that his photographic and cinematographic legacy is valuable not only because it preserves the evidence of the past rather it can support historical inquiry, cultural education, intercultural engagement, research and creative production once preserved, recognized, digitized and contextualised.

Therefore the central implication is a shift from treating the digital cultural heritage as digitized content towards understanding it as an enabling environment for learning, participation and innovation. Only in this case the sustainable value can emerge when cultural resources and digital technologies are blended with human interpretation, skills and creativity.

Future research should empirically test the proposed pathway across different heritage collections and educational contexts including Uzbekistan and investigate how digital heritage affects measurable learning outcomes, intercultural competence, creative skills and sustained cultural participation.

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