

A Comparative Analysis of Tools for Presenting Cultural-historic Resources in Education

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Abstract – Development of effective tools for cultural-heritage education is becoming more and more important in the times we live in. Interactive user activities and visual elements are necessary for better understanding of and immersion in the cultural heritage world.

Objectives of our research include the applicability and criteria covered by tools for presenting cultural heritage content.

The study is based on an empirical approach, divided in three stages. In the first phase we chose the instruments to be evaluated. The second phase identifies the criteria for evaluating these tools. In the third phase we perform an analysis of how these criteria are met and finally present the results.

Our analysis showed that the reviewed instruments do not support all of the necessary specific functionalities and requirements.

We think it is necessary to raise awareness among the respective scientific communities and developers of such tools that being able to access and use them smoothly is important for preserving our cultural heritage and educating children in this subject.

Keywords – storytelling, serious games, gamification, digital library, virtual museum.

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1. Introduction

Learning through digital cultural-historic resources can be viewed as a process, focused not only on knowledge, but also on recognizing the importance of the common and national cultural heritage. This process is generally used in educational scenarios, in which tutors offer content in the form of pre-created learning resources, included in traditional learning programs, methods and teaching strategies. In the present day, learners have many opportunities for learning in context, by using different desktop and mobile technologies. Those can be integrated in cultural heritage education, and thus help younger audiences grow consciousness about the values of cultural heritage of humankind and its importance for the future. This paper includes a review of different approaches based on digital storytelling as a means for presenting digital cultural-historic resources for educational purposes, serious games, digital libraries, and virtual museums as technological solutions for children education. For the purpose of this research, we describe several specific requirements and functionalities tools for children education need to support. We also present a comparative analysis of these approaches and show to what extent each of them meets these requirements.

2. Tools for Presenting Cultural-historic Resources in Education

2.1. Digital Storytelling

Learning through Digital storytelling is used for presenting social, cultural, and other activities through improvisation, theatrical and other techniques. Each nation has its own stories and narratives, which are shared as a means for entertainment, education, preservation of the culture and setting moral values. Storytelling is a popular tool for presenting information in many areas, including but not limited to digital cultural heritage, serious games, and education [11]. It combines visual

communication (slideshow of images, film, or animation) with sound [10].

The use of digital cultural-historic resources in storytelling activities requires specific tools for structuring, processing, editing, enhancing, and publishing. These instruments provide a set of functionalities, designed to support the management and presentation of rich multimedia content, such as text, images, sound, and video. During our analysis, we reviewed several software components for implementing storytelling and presenting digital cultural-historic artefacts for educational purposes, among which are ShadowStory [4] and Narralive Storyboard Editor [5].

Most of the investigated systems rely on the interpretation of existing artefacts, to develop the major elements of the story – characters, plot, resolution, and culmination. Despite the large number of libraries of add-ons and templates, the reviewed tools still have limited capabilities:

- They do not support a variety of formats, such as hyperlinks and three-dimensional objects;
- They cannot be reused and updated multiple times;
- They are not adaptive;
- They are not publicly accessible, as most of them are developed as part of a scientific research project;
- They cannot be used for enhancing children’s knowledge, as they are not designed for this audience;
- They do not include any knowledge assessment functionalities.

2.2. *Serious Games and Gamification*

Serious games and gamification of learning can be used in e-Learning as methods for increasing the motivation, engagement and focus of young learners, by utilizing game elements in educational environments. That offers a modern and innovative approach for including cultural-historic heritage in education, which can offer a significant growth of students’ interest and better academic results.

As an instrument for supplementing cultural heritage learning, serious games have an incredible potential due to the ability to offer a free choice of the place of learning, flexible management of time, choice of learning duration and pace, autonomous education in the context of gaming, self-controlled education, problem solving, systematic thinking and desire for cooperation [1]. To that moment, there is no unified classification of serious games, but the following major categories have been identified - Game-based learning, Gamification of learning, Organizational-dynamic games, Simulation games and Edutainment [7]. We have reviewed the

following categories of serious games for the purpose of our analysis – interactive virtual museums (Olympic Pottery Puzzle) [3], prototypes and demonstrations (Roma Nova) [9], games for acquiring cultural-heritage knowledge (VECTOR) [2] and games for gaining specific historical knowledge and social skills (The Thracians) [8].

The described games use digital cultural-heritage resources and virtual reconstructions to educate the users, but many of them have never been released to the general public. They have been used only for academic research, which has prevented children from being able to access various historic and topics.

2.3. *Digital Libraries*

Digital libraries can contain millions of historic archives and are extremely suitable for sharing cultural-heritage objects for research, education, and entertainment. An example of a popular digital library is Europeana, which provides access to various types of artefacts like books, music, and other pieces of art. It includes a component – Historiana, which is a tool for stimulating and assisting teachers with the creation, adaptation and use of digital cultural resources in e-Learning scenarios, which can foster critical thinking.

All of the reviewed digital libraries support functionalities for creating and modifying learning materials, but they do not use gamification methods and models, which can increase learners’ satisfaction and engagement, and inspire them to continue learning. These tools also do not support any means for assessing the viewers knowledge.

2.4. *Virtual Museums*

Virtual museums offer the ability to explore cultural-historic resources by providing remote access to a digital copy, which allows more detailed examinations of fragile artefacts in a personalized manner. They can incorporate many different artefacts and serve various purposes to a wide variety of audiences. The term “virtual museum” represents an information system for storing conceptually unified ranges of electronic collections of objects, described by metadata. The metadata usually contains object and museum-related characteristics and eases the research, education, and exploration activities in a virtual space. These types of systems are split in several categories – virtual reality (VR) exhibitions, augmented reality (AR) museums, mixed reality (MR) virtual museums and haptic museums.

The reviewed solutions have the following major drawbacks:

- They cannot be modified for the purpose of different learning scenarios;

- They are not adaptive to student's needs;
- They do not support continuous knowledge gain, as they are not built for that purpose in mind;
- They offer no knowledge assessment functionalities.

3. Requirements and Functionalities

The rapid development of methods and technologies for teaching requires high adaptability of the tools for context-specific use of digital cultural resources for learning purposes. That is necessary to meet the emerging requirements and educational needs of the children audience. The different software solutions need to improve the interaction of the pupils with the content, and present that content in a more accessible and understandable way. The following list contains the specific requirements that environments, used in children education, need to support.

Cloud Architecture – when the software is installed in the cloud, there is little need for manual archiving and copying content. That allows users to access the content regardless of their physical location or type of device they use, and safely store various data (learning resources, assessments, results, and others).

Adaptive Learning technologies facilitate the adaptation of learning goals and materials towards individual requirements of the students. That includes the creation of dynamic educational content, based on a preliminary assessment of the students via knowledge tests, and concentrated on the educational gaps of each individual student, as well as presenting student-created content.

Microlearning is an educational approach that involves the delivery of small, very specific parts of content to students. This gives learners control over what and when they are going to study. The creation of separate learning modules, available for use on demand, and integrating them in e-Learning systems, gives students the ability to create their own curriculum, based on individual and specific requirements.

Social Skills – the inclusion of more synchronous tools for communication and collaboration, such as real-time videoconferencing and virtual boards, increases the use of online learning as means for promoting social activities.

Game-based Learning, which explores gamification in the context of education, is a process of designing and including game elements to enhance the existing educational process. Gamification includes many different elements, borrowed from game design theories, which can help increasing children's results and offer alternative forms of interaction.

Multiple Application, Modification and Reuse of learning resources improves the effectiveness and sustainability of education and allows instructors to share their own resources with other teachers as well as students from all over the world.

Interactivity of Learning stimulates student engagement and with the use of the right technologies, it can make the learning process highly attractive [6]. Carefully designed and structured activities make learning easier and encourage students to grasp new concepts and develop practical skills.

Feedback and Assessment Functionalities are used to enhance individuals' skills and productivity by identifying personal areas of improvement.

Accessibility means that each user, regardless of their specific needs, would be able to use the system, including visually and sonically impaired students.

Design, suitable for the target age group – UX (user experience) design is the process of raising the level of user satisfaction for a given product, through improving the usability, accessibility, and attractiveness, provided when interacting with the product. The main goal of applying UX design in e-Learning systems is to ease the navigation through the process and allow kids to concentrate entirely on the content. It includes creating useful educational environments, which have their interface and other components tailored for stimulating the learning process.

4. Comparative Analysis

To study the applicability of technical solutions and the influence of cultural heritage on children, we produced a comparative analysis of the tools and methods for context-specific use of digital cultural resources in education, reviewed in the previous sections. The key goals of this analysis include:

- To separate the systems in focus by whether they are public or private;
- To analyze the availability and accessibility of these environments and determine to what extent they are suitable for context-specific use of cultural historic resources for education;
- To determine the interoperability and social capabilities of the platforms;
- To determine how suitable they are for children.

The indicators used in this research (see Table 1) and described above correspond to the overall criteria for evaluating the systems – user interaction, user experience, key elements of the educational process – goals, resources, assessment, and others.

Table 1. Indicators for analyzing online systems for context-specific use of digital cultural resources for education

	Story-telling	Serious Game	Digital Library	Virtual Museum
Reuse and modification	✓	-	-	-
Adaptive content	✓	-	-	-
Cloud functionality	✓	✓	✓	✓
Resource creation	✓	-	-	-
Resource Organization	-	-	-	-
Microlearning	-	-	✓	-
Interactivity	✓	✓	✓	✓
Teacher-student interaction	✓	-	-	-
Social capability	-	-	-	-
Clean goals	✓	✓	-	-
Feedback	-	✓	-	-
Assessment	-	-	-	-
Accessibility	-	-	-	-
Publicity	-	-	✓	✓
Multilanguage support	-	-	-	-
Multiple content formats	-	-	✓	✓
Storytelling	✓	-	-	-
Entertainment	✓	✓	-	-
Gameplay	✓	✓	-	-
Suitable for children	✓	✓	-	-
Academic freedom	✓	-	-	-

5. Results and Arguments

Our study is based on an empirical approach, divided in three stages. In the first phase we chose the instruments to be evaluated. They were selected on the basis of our previous research – Storytelling, Serious Game, Digital Library and Virtual Museum. In the second phase we identified the criteria for evaluating these tools. In this part we present the result of the analysis of how these criteria, described in Table 1, are met.

The analysis showed that the reviewed systems for context-specific use of digital cultural resources for education do not cover all necessary indicators and do not support all of the specific requirements and functionalities, needed for this context. They all

support cloud architecture and deployment, and interactivity. None of these platforms support resource organization, microlearning, assessment of knowledge, accessibility, and multi-language support. As part of this analysis we present the following arguments, statements and concerns about the current state of these tools.

The lack of criteria like reuse and modification, as well as adaptive content, lead to problems with enriching and updating the learning content, which in turn leads to limitations of teaching abilities. The absence of resource creation and organization functionalities, and microlearning, results in reducing the overall effectiveness of the software. The ability to manage resources guarantees that the right resources will be available at the right time for the right purpose. The fact that the resources we analyzed do not natively support student feedback and knowledge assessment is a problem directly affecting the educational process and learning outcome. User feedback is also very important as learners could use it to ask additional questions they are interested in. Assessment is a key component of education and children’s development, and students need to be aware not only of their grades in major subjects, but also be evaluated for skills which will help them in the rapidly developing and everchanging world. Public availability and accessibility of software extends their reach to a wider audience, which is of vital importance to cultural heritage education. Gamification and different forms of entertainment would stimulate children’s engagement in educational material, enable competition and increase their motivation for learning.

6. Conclusion

This paper presented empirical proof that existing software tools, used in cultural heritage education have limited capabilities for educators, as well as students. We propose that future development of such instruments should consider the arguments outlined in the previous section. The addition of even a few of the described functionalities, like microlearning and assessment, would give numerous opportunities for improving the teaching and learning processes. Finally, we want to reiterate over the accessibility and public availability of such tools, as the majority of them has never been released to the general public and have been used only for academic research purposes that generally prevents students’ access to cultural-historic resources, which is a required element for their interaction with and development of a national identity and patriotism.

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