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Assessment of the Usefulness of Authentic Learning Using 3D Reconstructions with Virtual Characters

Livia ȘTEFAN^{1*}, Dragoș GHEORGHIU²

Abstract

The present paper proposes a sustainable method for discovering, teaching and learning history using the authentic learning paradigm by means of a set of 3D historical reconstructions populated with virtual characters, whose purpose is to improve the authenticity of the reconstructions and to offer complex information on the historical contexts. The paper provides the details of two case studies of 3D reconstructions conducted in Vălenii de Munte and in Albești, Dobrogea. To understand the functionalities of such a complex living system, real characters (actors dressed in epoch costumes), as well as real objects from ethnographic museums have been scanned in 3D and introduced in the virtual environment in Unity3D. The perception of usefulness is an essential indicator of the quality and efficiency of the digital learning environments and consequently of their subsequent acceptance by teachers and students. The research purpose of the paper was to conduct a process of assessment of the contribution of the virtual characters and objects to the realization of the authentic learning environment, and to present the research findings. The assessment of the usefulness of learning in virtual environments using 3D reconstructions and virtual characters by means of the learning outcomes is discussed to illustrate the research conclusions.

Keywords: *authentic learning; anthropomorphism; virtual characters; assessment; usefulness perception.*

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1. Introduction

Understanding and explaining the Past is a pedagogical challenge. Museums usually display objects and sometimes human characters. Objects however, are generally favoured over people.

The experiments conducted by the authors in virtual environments [1], [2] have demonstrated the importance of using the human element within historical reconstructions.

The current paper proposes a sustainable method for discovering, teaching and learning history using the authentic learning paradigm by means of a set of 3D historical reconstructions populated with virtual characters, whose purpose is to improve the authenticity of the reconstructions and to offer complex information on the historical contexts. The research outlines the details of two case studies of 3D reconstructions: a) an 18th century manor house in Valenii de Munte, situated in the hill region of the southern Carpathians [3], and b) a Hellenistic site in Albesti, Dobrogea [4].

The perception of usefulness is an essential indicator of the quality and efficiency of the digital learning environments and consequently of their subsequent acceptance by teachers and students. The research purpose of the paper was to conduct a process of assessment of the contribution of the virtual characters and objects to the realization of the authentic learning environment, and to present the research findings. Different assessment methods of the usefulness of learning in virtual environments using 3D reconstructions and virtual characters by means of the learning outcomes are discussed to illustrate the research conclusions.

2. Anthropomorphism

Anthropomorphism is a fundamental of the human cognition, producing mental models that we are familiar with [5]. “Anthropomorphic forms are non-living objects that reflect human-like qualities” [6: 1], and blur the difference between self and other [7].

The use of anthropomorphism as a mental model to render information more familiar to the user and increase his degree of identification with the virtual characters has an important pedagogical advantage as it provides:

- a better understanding of the use of objects (based on the explanation of the gestures observed, and

- a richer picture of the cultural context studied.

3. Authentic Learning

Authentic learning refers to a variety of modern educational and instructional techniques, which “connect [...] what students are taught in school to real-world issues, problems, and applications” [8]. These instructional techniques are based on the idea that students are “more likely to be interested in what they are learning, more motivated to learn new concepts and skills, and better prepared to succeed”.

Authentic learning is also an active learning, i.e. allows students to “explore, discuss, and meaningfully construct concepts and relationships in contexts that involve real-world problems and projects that are relevant to the learner [9: 2].

Authentic learning “engages all the senses allowing students to create a meaningful, useful, shared outcome [...] real life tasks, or simulated tasks that provide the learner with opportunities to connect directly with the real world.” [10].

Another related concept is „authentic student achievement” which refers to “intellectual accomplishments that are worthwhile, significant and meaningful” [11]. This instructional approach also impacts the learning assessment, which “calls for the elimination of grades and standardized testing [...] becomes part of the learning process so that students play a larger role in judging their own progress” [12].

Examples of authentic learning using virtual learning environments are:

- Simulations, reconstructions;
- Role-playing (such as MMORPG - games);
- In-context/situated learning.

With the authentic learning paradigm it is possible to discover, teach and learn history by inserting virtual characters into 3D historical reconstructions. The virtual characters can improve the degree of authenticity of the reconstructions, and offer complex information on the historical contexts.

4. The Pedagogical Method

To become instruments of study and interpretation of the Past, the 3D historical reconstructions have to be designed in a manner that provides information complementary to pure architectural reconstructions, such as

daily activities or technologies specific to the studied places and epochs (Figure 1 a, b).



Figure 1 a, b

To understand the functionalities of such a complex living system, real characters (actors dressed in epoch costumes), as well as real objects from ethnographic museums have been scanned in 3D and introduced in the virtual environment created using the gaming engine Unity3D [13].

We have selected several representative characters: a merchant, a maid from the mansion, and a blacksmith (Figure 2 a,b,c).

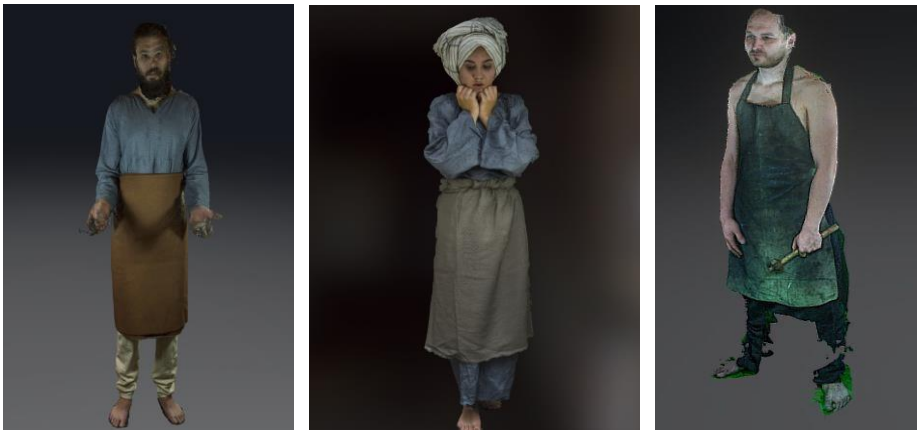


Figure 2 a,b,c

The objects with which they were connected, their gestures, and the costumes were defined based on documents of the time, for an 18th century manor house in Valenii de Munte, situated in the hill region of the southern Carpathians (Figure 3 a). In some cases historical information was copied after the iconography of the time, such as the reconstruction of the Albesti Hellenistic site in Southern Dobrogea (Figure 3 b).



Figure 3 a,b

5. Evaluation of the Usefulness of the Enhanced Virtual Learning Environment

5.1 Definitions of the PU

The perception of usefulness (PU) is an essential indicator of the quality and efficiency of the digital learning environments and consequently of their subsequent acceptance by teachers and students.

PU is “the degree to which a person believes that using a particular system would enhance his/her job performance” [14].

PU is influenced by “perceived ease of use” (PEOU).

PU influences both the attitude toward systems use and the behavioural intention to use the system [15].

The current research purpose of the paper is to evaluate the contribution of the virtual characters and objects to the realization of the authentic learning, i.e. of the perceived usefulness of the enhanced 3D reconstructions as a learning tool.

6. Evaluation of the Perceived Usefulness of the Enhanced Virtual Learning Environment

6.1 The evaluation methodology

The assessment of the PU of the virtual characters in a 3D reconstructed learning environment was achieved by performing an evaluation of the benefits of the authentic learning environment.

A “methodological mix” [16] was employed, such as interviews and focus groups, to obtain more accurate results.

The focus group was composed of children living in the cities overlapping the rebuilt archaeological sites. We were interested in the

process of learning in context, in other words not only in the rebuilt context, but also in the real, geographic one.

Each group displayed the following demographics: max. 10 children, ranging between 9 and 15 years of age.

The children from the target group were trained to understand the historical context (architectural and cultural anthropological). After experiencing architectural reconstructions populated with historical characters, the children were tested through interviews to assess their cognitive improvement.

6.2 The results

The interview method was employed and the evaluation was conducted on two levels:

- Authentic assessment of the learning outcomes - by means of questions (for students aged 9-12) and free discussions (for students aged 13-15);
- Evaluation of the intention to use this environment - by means of a survey.

For the first evaluation stage, the results are presented below.

Table 1. Questions for students aged 9-12

Question
What does it mean to be a blacksmith?
How does a blacksmith shop look like?
What tools does he use?
What is the result of his work?

Table 2. Feedback from students aged 13-15

Result
The introduction of 3D characters makes the story more dynamic than the empty spaces or just objects;
We need to understand the role of the spaces (e.g. the kitchen);
The 3D characters “bring” the history;
It is similar to an audio book;
It is very good that you have designed several historical epochs;

The 3D characters showed us how everything evolved - the houses, objects;

I was impressed by the design of the objects;

I didn't find that the characters' design was exaggerated;

I liked mainly Vălenii de Munte;

I would like to see connections among the sites.

For the second evaluation the children had to provide answer on a 3-factor *Likert* survey.

Table 3. The results of the survey

Question	Strongly agree	Not sure	Strongly disagree
Are the virtual characters improving the learning process?	70%	20%	10%
Do you perceive this environment as easy to used?	90%	10%	0%
Do you intend to use this environment for learning?	70%	30%	0%

7. Conclusions

The current paper proposes a pedagogical strategy based on the use of 3D characters to animate historical reconstructions.

Compared with the architectural reconstructions developed without the use of characters, the variant proposed in the present paper, using reconstructions populated with characters which suggested different activities specific to the site and the time, had an augmented educational value.

The results have demonstrated that anthropomorphic characters have generated a high degree of interest in children whose attention was primarily focused on human activities and relatively little on objects or architecture. The assessment of the PU showed that students were aware of the benefits of introducing virtual characters. Furthermore, most of them expressed the intention of using these environments in the future.

It is apparent that anthropomorphism functioned as educative instrument, to cite the production of the familiar mental models, or the

blurring of the difference between the self of the user and the historical characters.

This fascination of the young users with the reconstructions of the anthropomorphic figures is thus a factor that must be taken into account in the future reconstructions of the Past.

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