Analysis of Educational Digital Storytelling Environments: The Use of the "Dimension Star" Model

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Abstract. The focus of this paper is on the analysis of Educational Digital Storytelling Environments (EDSE) using the reference model «Dimension Star» [7]. More specifically, two EDSE were analyzed with the use of this model: (a) Toontastic [6] and (b) Kodu [9] which have been widely used in the educational process. The analysis of these environments showed that the diagrammatic analysis using the above model provides opportunities for easy and quick comparison of essential dimensions of the digital storytelling environments, which is particularly useful for researchers and educators. Finally, the completeness of the model «Dimension Star», as a tool for evaluating digital storytelling software in education, is investigated and possible extensions are suggested.

Keywords: digital storytelling, evaluation, education, "Dimension Star".

1 Introduction

Education through storytelling has been tested successfully in almost all the history of mankind unlike formal education at universities and schools which is a relatively recent institution. It seems that knowledge in any form (religion, technology, agriculture, hygiene etc.), is stored better in our brain if it takes the form of narration. According to narrative psychology, there are two modes of thinking: paradigmatic thinking (logico-deductive and classificatory discourse) and narrative thinking. Neurological findings seem to support this distinction, since narrative thinking (also called episodic memory) seems to lie in the hippocampus, while paradigmatic thinking lies in the cortex [4]. According to Papadimitriou (2003) narrative is an important epistemic modality. Epistemic modality refers to the way a speaker / writer communicates his doubts, certainties and predictions.

In recent years, however, multimedia and digital technology gave a new dimension to storytelling, the digital storytelling. Digital storytelling is therefore a modern expression of the ancient art of storytelling and derives its strength from the harmony between image, music, narration and voice, thereby giving bright color to characters, situations, experiences and ideas [2]. The advent of digital storytelling in educational environments is based on theories by which learning is a result of knowledge building and not just a knowledge transfer. Building on theories of constructivism, [5] digital storytelling is a great channel to apply these theories in

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practice. According to Ohler (2006) digital storytelling allows students to have active participation and not just be passive consumers in a society steeped in digital products. Creating digital stories is an educational process which strengthens the bonds between children in class, and at the same time between students and their teacher [1].

A number of requirements have been reported which may serve as criteria for digital story software evaluation [3] [8]. In this paper, we will study and evaluate with the "Dimension Star" model two representatives of EDSE: (a) Toontastic [6] and (b) Kodu [9]. This is the contribution of this work. In the next section the evaluation model mentioned above is described which is then used to analyze the aforementioned digital storytelling environments. Finally, the results of the analysis are discussed and appropriate conclusions are drawn.

2 "Dimension Star": An Evaluation Model for Digital Storytelling

All applications of digital storytelling have certain common characteristics. More specifically, the content of a digital story is either *default* or it is allowed to the user to *create his own (Concreteness).* Digital stories typically follow a conceptual *structure.* The structure shows whether the resulting narratives relate to the literary definitions of a story. The degree of conceptual structure has consequences in the *cohesion* and *continuity* of the story which show us the causal and temporal relationship between the elements of the story. It also affects the *cognitive effort* required to create a story. The presentation of a digital history varies depending on the degree of virtuality and spatiality. S*patiality* indicates whether the objects in space and space itself play a role in the evolution of the story. *Virtuality* refers to the extent to which the activity of storytelling takes place in a virtual world. Moreover, there is an interest in the degree of *collaboration* between users, the degree of *control* that users have in the evolution of events and the degree of *interactivity* that is allowed by the software. Finally, *immersion* shows the extent to which the user is drawn into the story.

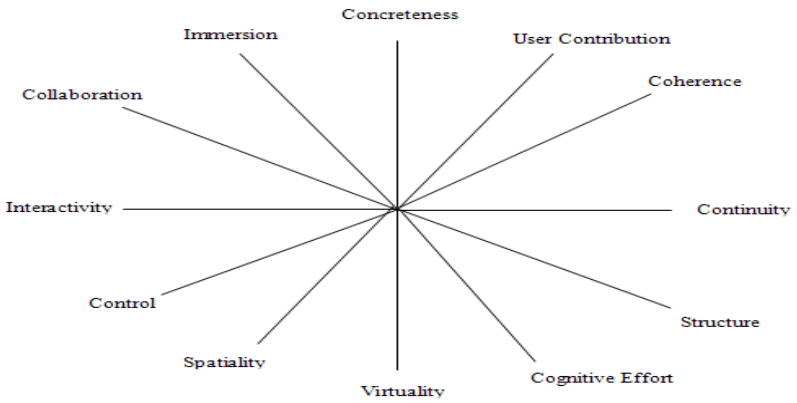

Fig. 1. A diagrammatic representation of the "Dimension Star" model

The «Dimension Star» [7], includes all the aforementioned features that may or may not have a DSE (Fig. 1). The length of each peak is proportional to the features of each digital story. In fact, each feature is evaluated using a 4-grade scale (low, medium, high, very high) and the result is reflected on the length of the appropriate peak of the «Dimension Star». The "Dimension Star" is therefore a reference model for the analysis of DSE.

3 Evaluation of Digital Storytelling Environments Using the "Dimension Star" Model

With the help of the evaluation model of digital stories "Dimension Star" an attempt has been made to evaluate two DSE, namely: (a) ToonTastic [7] that provides opportunities to create various stories on a variety of subjects and (b) Kodu [9] which supports the creation of various stories about a particular subject. Based on this evaluation analysis, the strengths and weaknesses of each DSE is highlighted (Fig. 2) while the completeness of the "Dimension Star" in the context of EDSE is also investigated.

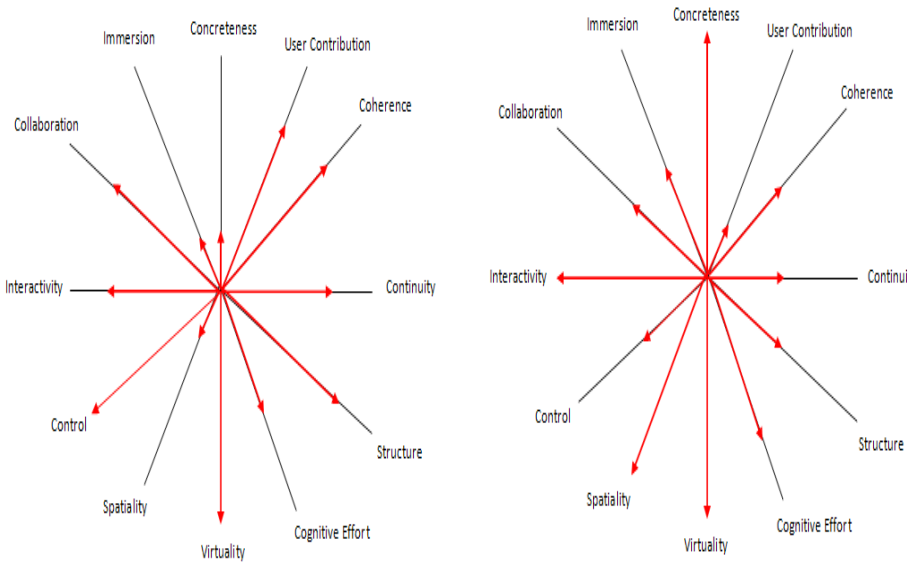

Fig. 2. "Dimension Star" for software Toontastic and Kodu respectively

3.1 ToonTastic

ToonTastic [7] (Fig. 3), is a collaborative digital animation creator that bridges the gap between game and more formal methods of storytelling. It is a constructive tool designed to help children capture and share their stories with other children around

the world. It is designed to appeal to a broad group of users. As a drawing tool it is simple enough for six years old children and very interesting to entertain adults. However, ages that it is primarily addressed are between eight and twelve. The aim of this software -that underlines its theoretical background- is to provide children with opportunities to outline their internal representations and convert them to external, with visual and physical representation, so that children are able to debug and rebuild their mental models.

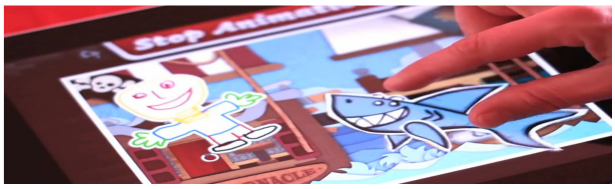

Fig. 3. Software ToonTastic

The analysis of digital storytelling software ToonTastic with the "Dimension Star" model is described as follows: As far as *User Contribution* is concerned, ToonTastic receives a high value. This is because the user can choose the types of scenes that will form the storyline. For the dimension *Concreteness* ToonTastic receives a low value because although there is supporting material (libraries backgrounds, designs, sounds), the user can create all the material needed from scratch. The dimensions of *Cohesion* and *Continuity* receive a high value, because the elements of the story have a logical and temporal flow since the software helps the user build the story with questions in each step. As far as the dimension *Structure* is concerned, ToonTastic receives a high value, due to the fact that the software helps the user with appropriate questions to create a well structured story. The dimension *Cognitive Effort* receives a medium value because considerable effort is needed to understand the functionality of the software. As far as the dimension Virtuality is concerned, ToonTastic receives a very high value since the story takes place entirely in a virtual environment, while on the dimension of *Spatiality* ToonTastic receives a low value because the motion of objects in the two dimensional space of the software does not play any special role in the evolution of each story. The dimension *Control* receives a very high value, because the user can build step by step, every piece of the story. Furthermore, the dimension *Interactivity* receives a medium value because the user can interact with the heroes of the story in the story construction, however there is no interaction during the narration. As far as the dimension *Collaboration* is concerned, ToonTastic receives a high value since five children can paint at the same time with the five digital pens that are available. Finally, the dimension *Immersion* receives a low value because even though the software is interesting, it doesn't create conditions of virtual reality.

3.2 Kodu

Kodu [9] (Fig. 4), is a visual programming language which is used for the creation of digital games. It is easy to use and includes tools for creating three-dimensional

worlds. Kodu is a multi-dimensional tool for digital storytelling with a variety of possibilities for creating digital stories. It is designed to be user friendly and accessible for children aged between 8-18 years. The creation of digital stories is made through the selection of appropriate characters and objects (e.g. character Kodu, trees, clouds, rocks etc.) that can be used in specific situations. Kodu helps children build a sound programming literacy without complicated programming concepts.

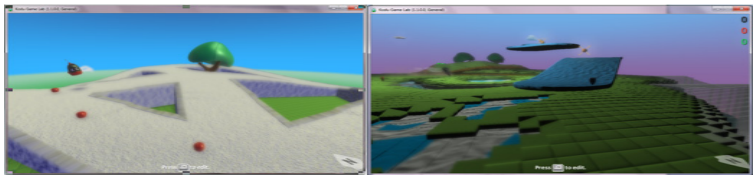

Fig. 4. Software Kodu

The analysis of DSE Kodu with the "Dimension Star" model is described as follows: The objects and characters used in Kodu are pre-defined, so the dimension *Concreteness* receives a high value. The user can change the plot of the story by using strictly the default graphics library of the software. Therefore, the dimension *User Contribution* receives a medium value. In Kodu the user can create numerous well structured scenarios which can have temporal and logical consistency, however the software has no special function to help the user in this direction. Consequently, the dimensions of *Cohesion*, *Continuity* and *Structure* receive a medium value. The dimension Cognitive Effort receives high value because users need considerable effort to familiarize themselves with the environment and create complex stories. The dimension *Virtuality* receives a very high value because the story takes place entirely in a virtual environment, while the dimension of Spatiality receives a high value because the motion of objects in the three dimensional space of Kodu plays an important role in the evolution of each story. As far as the dimension *Control* is concerned, Kodu receives a medium value, because although the user can construct the story in detail, the default characters and objects provided by the environment should be used. Furthermore, the dimension *Interactivity* receives a high value because the user can interact with the characters and the objects of story during the creation and the presentation of the digital story. Moreover, the creation of digital stories can be done in groups but the software doesn't have any special utility that promotes cooperation, so the dimension *Collaboration* receives a medium value. Finally, the dimension *Immersion* receives a medium value, because the story space becomes to a certain extent real space for the user.

4 Conclusions

The diagrammatic analysis of digital storytelling environments (DSE) with the "Dimension Star" model allows the user to identify, at first glance, the strengths and weaknesses of the DSE at hand and make comparisons based on the dimensions of the

edges of the star. Moreover, the "Dimension Star" can become a useful tool for software developers of digital stories especially in the early stages of conception and design of DSE. More specifically, by categorizing DSE using the dimensions described by the “Dimension Star”, digital storytelling software designers have the opportunity to choose from successful examples. In addition, teachers can use the results of the analysis with the “Dimension Star” so as to choose appropriate DSE which are in line with the goals they want to achieve. As far as the completeness of the Shafer model is concerned, there should be noted that although the proposed dimensions for analysis of DSE are fundamental, there is room for the introduction of extra dimensions. More specifically, new dimensions can be added with an emphasis on constructivist learning, as for example, the software's ability to use "multiple representations" during the learning process. Extending the model “Dimension Star” is an imminent goal of this research effort.

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