PEDAGOGICAL GUIDELINES FOR THE DEVELOPMENT OF EDUCATIONAL DIGITAL STORYTELLING ENVIRONMENTS BASED ON A PEDAGOGICAL EVALUATION STAR

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Abstract

This paper focus on the construction of general pedagogical guidelines for the design of Educational Digital Storytelling Environments (EDSE) based on a specific evaluation model, named the DS 'Pedagogical Evaluation Star'. DS 'Pedagogical Evaluation Star' is based on modern social and constructivist views of learning and is consisted of sixteen pedagogical dimensions, namely: collaborative learning, creativity and innovation, multiple representations, motivation, cultural sensitivity, gender equality, cognitive effort, feedback, learner control, flexibility, learner activity, valuation of previous knowledge, sharply-focused goal orientation, experiential value, knowledge organization and metacognition. The proposed guidelines may help the researchers and the designers to take into account the appropriate pedagogical principles in the design of EDSE.

Keywords: educational digital storytelling, pedagogical design, pedagogical evaluation.

1 INTRODUCTION

In every culture, stories have been shared as a means of entertainment, education, cultural preservation and to instill moral values [1]. Stories have been used to record important events, celebrate the feats of heroes and heroines, transmit the spirit and facts of a major occurrence, and point out patterns of human experience and behavior [2]. People tell stories in an attempt to come to terms with the world and harmonize their lives with reality [3].The Iliad and the Odyssey by Homer are examples of how powerful storytelling is. Critical thinking skills, vocabulary, and language patterns are enhanced through use of stories. Thus, storytelling is a cornerstone of the teaching profession [2].

Storytelling exists as far as time allows us to remember, while digital storytelling is its modern successor. In fact storytelling and the rapid development of media technology have influenced each other, thus creating a new type of storytelling, digital storytelling. Digital storytelling is combining the art of telling stories with a mixture of digital graphics, text, recorded audio, narration, video and music. Although storytelling is not new, the idea of digital storytelling is new [4]. McDrury & Alterio [5] note that students find stories appealing if they connect with their own experience. Hibbing and Rankin-Erikson [6] as well as Boster, Meyer, Toberto, & Inge [7] have shown that the use of multimedia in teaching helps students retain new information as well as aids in the comprehension of difficult material. Digital storytelling was introduced as a technique to encourage and embed student reflection on the activities in which they were engaged, recognizing that reflection can be enhanced as a collaborative process [5]. Digital storytelling is making its first steps, especially in education and much remains to be done so that the DS becomes a vital part in every day educational practices. This is very important since storytelling is the original form of teaching [8]. In fact, digital storytelling can provide educators with a powerful tool to use in their classrooms.

To this end, a number of models have been proposed for the technical and pedagogical evaluation of educational digital storytelling environments [9][10][11]. However, these models are no fully inspired by modern social and constructivist pedagogical ideas but mainly emphasised technical aspects. Recently, an evaluation model named ‘pedagogical evaluation star’ [12] has been proposed for the evaluation of EDSE which is rooted on social and constructivist views of learning. In this paper, we will focus on the said ‘pedagogical evaluation star’ [12] and we will present some general pedagogical guidelines for the design of EDSE arising from it. Here, it is worth noting that, although there have been proposed various digital storytelling environments, there is an absence of a clear pedagogical framework –in terms of guidelines- that can help in the design of educational digital storytelling applications by software designers and developers.

In the next section of this paper, there will be an overview of the theoretical background of the proposed pedagogical guidelines for the design of EDSE, in close reference to the aforementioned 'Pedagogical Evaluation Star'. Then, the general pedagogical guidelines for the design of educational digital storytelling environments arising from this evaluation star will be presented. Finally, the paper ends with a summary as well as our future research plans.

2 BACKGROUND

Modern social and constructivist learning approaches [13][14][15][16] are the backbone of the sixteen pedagogical dimensions that form the "DS Pedagogical Evaluation Star" (fig. 1).

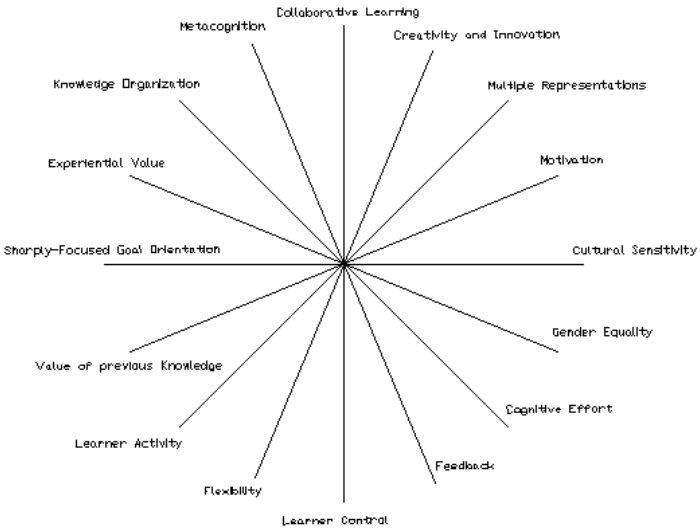

Figure 1: DS Pedagogical Evaluation Star

Collaborative learning refers to the degree that an EDSE leads to collaborative creation of digital stories. Collaborative learning is based on long-held assumptions about teaching and learning. There is a shift in the roles in a classroom: both teachers and students take on more complex roles and responsibilities [17]. Problem solving and inquiry approaches stressing cognitive skills and the ideas of Vygotsky [15], Piaget [13], Kohlberg [18] and Bruner [14] are linked to transaction. This perspective views teaching as a "conversation" in which teachers and students learn together through a process of negotiation with the curriculum to develop a shared view of the world.

Creativity and innovation refer to the extent that an EDSE helps students to create something new that has some kind of value. Guilford [19] stated that "a creative act is an instance of learning and that a comprehensive learning theory must take into account both insight and creative activity". Individual assignments based on problem solving and problem finding stimulate creativity and innovation [20][21][22].

Moreover, *multiple representations* refer to whether text, pictures, video, voice, graphs, diagrams etc are used by an EDSE so as to reinforce the messages designed to be conceived by the learners. A lot of advantages can be gained from their use by a number of studies which have shown [23][24]. In fact, multiple representations can contain complementary information or support complementary cognitive processes and one representation can be used to constrain possible (mis) interpretations from the use of another. Learners can be also encouraged by the use of multiple representation to develop multiple perspectives of the concepts in question at the same time enhancing their knowledge about these concepts [25].

Motivation refers to the degree that intrinsic and extrinsic motivation is provided by the EDSE at hand to motivate students. Broussard and Garrison [26] broadly define motivation as "the attribute that moves us to do or not to do something". There are two main types of motivation: intrinsic and extrinsic. Intrinsic motivation is motivation that is animated by personal enjoyment, interest, or pleasure, while extrinsic motivation refers to doing an activity for to attain some separable outcome [27].

In addition, *cultural* sensitivity refers to the extent an EDSE adapt to the cultural diversity of the students. Cultural sensitivity is a very important pedagogical factor [28] that should be taken into consideration in the design of an EDSE. Recently, both theorists and practitioners in online education are paying increasing attention to the cultural dimension in the design process by emphasizing the need to provide culturally sensitive learning environments [29][30][31].

G*ender equality* refers to the extent to which an EDSE is designed in a way that promotes gender equality. Equity does not imply treating all learners the same because many factors could disadvantage students in having a chance to achieve equitable outcomes. Responses may include "equal treatment or treatment that is different but which is considered equivalent in terms of rights, benefits, obligations and opportunities" [32]. What have to be done is to train educational software designers, curriculum developers, textbook writers, administrators, managers, and teachers in gender awareness prior to developing both; new digital tools and curricula.

Cognitive effort refers to the mental work necessary to put together a story out of the clues presented to the use. A key factor to the pedagogical success of a computer based tutoring system is the cognitive effort required for the students to get acquainted with it [33].

Feedback refers to the extent extrinsic and intrinsic feedback is provided by an EDSE. The necessity of feedback in a computer system is emphasized by psychologists, pedagogists, and usability engineers [34]. The main role of feedback is to inform and to motivate the user to increase his or her effort and attention. There are two types of feedback in education, intrinsic and extrinsic. Intrinsic feedback can enforce learners to develop core cognitive skills such as hypothesis formation and testing. Regarding extrinsic feedback, there are also two types and both considered beneficial – negative feedback prompts improvements, while positive feedback increases motivation.

What is more, *learner control* refers to the degree to which the user is able to modify or influence the flow and outcome of the story. The four fundamental categories of learner control in an educational environment are: pace control, sequence control, content control and advisory control [35][36][37]. Cognitive researchers have claimed that learner control is an important aspect of effective learning [38][39].

Flexibility refers to the extent to which the EDSE at hand takes into account learners individual preferences and background. Flexible learning takes into account learners individual preferences and background. The more adaptable an environment is, the easier it is to fit the student's individual needs [40].

Learner activity refers to the degree an EDSE enables both; learners to take an active role in their learning and teachers to change their role from a traditional didactic one to that of a facilitator. According to Ohler [41] the teacher should help students to manage their skills and talents by helping them to "tell a story that is strengthened rather than weakened by the media they use, form a learning community so they can share their ideas and talents, meet the educational goals of the project, and leverage their imagination and creativity". The emphasis is on the activity of the student rather than on that of the teacher.

Valuation of previous knowledge refers to the extent an EDSE takes into account learner's previous knowledge. Constructivism encourages teachers to recognize the value of prior knowledge and experiences that each child brings with them into the classroom, and help them build on their understandings of the world by providing appropriate learning experience plans. The importance of previous material and the cumulative nature of knowledge have to become clear to the learner [42].

Furthermore, *sharply-focused goal orientation* refers to the extent that the learning goals are clearly defined to the learner. The goals should be clearly defined [43], but they have to originate, as much as possible, with the learners themselves according to constructivist learning theory [44].

Experiential value refers to the degree learning results can be changed from reflection on direct experiences. Wenger [45] suggest that individuals learn as they participate within a community by interacting with its history, assumptions and cultural values, rules, and patterns of relationship.

Knowledge organization refers to the extent an EDSE can promote children's conceptual development. In fact, knowledge organization in the field of computer based education can be used to effectively facilitate learning, usually in the form of concept maps. Concept map is a graphical tool for organizing and representing knowledge. It can help teachers to assess children's conceptual development and understanding, identify non scientifically consistent ideas, and facilitate learning by building new knowledge on old knowledge [46].

Finally, *metacognition* refers to the extent an EDSE could enhance learners' metacognitive skills. Guilford [47] asserted that "the student be taught about the nature of his own intellectual resources, so that he may gain more control over them". According to Azervedo [48], scaffolding students' self-regulated learning and metacognition during learning in a computer-based learning environment can motivate students to learn from challenging tasks.

The aforementioned basic and essential dimensions that can pedagogically characterize an EDSE can lead to the creation of general pedagogical guidelines for the development of Educational Digital Storytelling Environments which are presented in the next section of this paper.

3 PEDAGOGICAL GUIDELINES FOR THE DEVELOPMENT OF EDUCATIONAL DIGITAL STORYTELLING ENVIRONMENTS

Pedagogical Guideline 1: It is very important for an EDSE to promote *collaborative learning*. Many learners can be involved in the creation of a digital story (DS) so an EDSE would be recommended to be created in a way that promotes collaborative learning. Software that utilizes network programming can help students in different places create stories collaboratively simultaneously, encouraging synchronous and asynchronous communication. Moreover, collaborative software may need collaborative hardware. For example, if we want to let many students paint at the same time, a multi-pen interactive display could be created that lets users interact with different pens simultaneously.

Pedagogical Guideline 2: An EDSE should promote *creativity and innovation*. EDSE should enable learners to create original digital stories as digital storytelling is one of the best ways to promote creativity and innovation. According to the UK national curriculum standard education should give learners the opportunity to become creative, innovative, enterprising and capable of leadership to equip them for their future lives as workers and citizens. EDSE should help students to free their imagination, giving them the appropriate tools to create novel digital stories. In this direction is the availability of various tools which can be used in combination so that to produce diverse digital stories.

Pedagogical Guideline 3: EDSE should use *multiple representations* in order to help users make the most of what is being taught. A lot of external representations can be used by the digital storytelling environments such as text, voice, pictures, graphs, diagrams, tables, videos etc. so as to reinforce the learning process.

Pedagogical Guideline 4: An EDSE should provide high *intrinsic and extrinsic motivation* to students. Digital storytelling usually provides intrinsic motivation as the creation of a digital story is interesting in itself but some external rewards (e.g. grades, publishing the best digital story in the school's blog, best digital story competitions) should be provided to learners so as to be extrinsically motivated.

Pedagogical Guideline 5: An EDSE should be as *culturally sensitive* as possible. In fact, it is very difficult for an EDSE to adapt to every cultural norm, but it is possible to address to some diverse ethnic and cultural backgrounds. For example, the scenario and the heroes, that are provided by the environment to be used in the creation of the digital stories can be from different cultural backgrounds.

Pedagogical Guideline 6: EDSE should be designed in a way that promotes *gender equality*. Learners should be enabled to construct digital stories with both male and female heroes, which is not common in most current EDSE, which use almost only male characters.

Pedagogical Guideline 7: The cognitive effort needed for a student to get acquainted with an EDSE should be relevant with the targeted student age group of the environment. As a result, the complexity of the interface of the EDSE should be carefully designed.

Pedagogical Guideline 8: An EDSE should provide feedback to its users. In EDSE feedback can be provided in the creation of the story, warning students when they are not following the instructions given or when they have forgotten a part of the construction of the digital story. There must be negative feedback that prompts improvements and positive feedback that increases motivation. Intrinsic visual feedback is essential to encourage students to reflect on their stories and be self corrected

Pedagogical Guideline 9: An EDSE should be designed in a way that there is much learner control. An EDSE should allow learners decide about the time spent in each digital story that is created, the order the story material is created, the content of each story and the access to learning support.

Pedagogical Guideline 10: An EDSE should provide as much *flexibility* as possible. Of course a complete personalization is a puzzling issue, however the design of an EDSE should be designed in

this direction. For example students can collaborate with their friends of the same cognitive style and preferences or should be provided with different stories according to their learning styles (e.g. visual, kinesthetic).

Pedagogical Guideline 11: An EDSE should promote *learner activity*. The emphasis should be on the activity of the student rather than on that of the teacher. EDSE should enhance learners' activity, letting them construct their own stories, while teachers stay in the background, having a facilitative role.

Pedagogical Guideline 12: EDSE is advisable to provide *experiential learning*. An advantage of digital storytelling is the fact that it is an intuitively experiential learning process however the extent of experiential validity of an EDSE depends on the quality of the software (e.g. degree of immersion).

Pedagogical Guideline 13: *Knowledge organization* is an effective approach in designing an EDSE. Concept maps and story grammars can be an effective approach for developing learner-centered storytelling tools which can help students develop and apply their knowledge about learning concepts in question [49].

Pedagogical Guideline 14: An EDSE should promote *metacognitive skills*. Metacognitive support in a computer-based environment can increase students' learning effectiveness [50]. To this end, providing opportunities to visually externalize students' representation can advance and improve their knowledge. The formation of a reflection sheet with appropriate questions could be also useful.

4 SUMMARY AND FUTURE RESEARCH PLANS

Fourteen general pedagogical guidelines for the design of Educational Digital Storytelling Environments were issued in this paper, namely: collaborative learning, creativity and innovation, multiple representations, motivation, cultural sensitivity, gender equality, cognitive effort, feedback, learner control, flexibility, learner activity, experiential value, knowledge organization and metacognitive skills. These general guidelines can be a useful tool for software designers and developers of digital storytelling environments especially in the early stages of conception and design of EDSE. The next goal of this research effort is the design and implementation of an EDSE taking into consideration the guidelines that arise from the "Pedagogical Evaluation Star" which is the pedagogical framework in which our work is based.

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