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Research Article

The Effect of Digital Storytelling on Primary School Students

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Abstract – In this study children's attitude toward interactive storytelling, as an educational tool was examined. It encompasses the design process of digital storytelling and evaluates its effectiveness through the participation of third and fourth grade students. Twenty two participants were involved in the evaluation process. Children's attitude was assessed investigating their happiness, enjoyment as well as intention to use interactive storytelling in the future. Data collection methods included observation, interviews, and surveys, specifically designed to accurately capture children's responses regarding interactive digital stories. The data collected through these methods were analyzed and discussed. The majority of participants expressed high satisfaction levels, reporting happiness and enjoyment while engaging in interactive storytelling activities. They found it more interesting and enjoyable than traditional books, highlighting their willingness and intent to continue using digital storytelling as part of their future learning experiences.

Keywords: digital storytelling, education, augmented reality (AR), 3D animation.

Introduction

Digital storytelling is a contemporary method of storytelling that utilizes digital technology and multimedia elements to convey narratives. It allows storytellers to leverage the power of technology to enhance their narratives, captivate audiences, and evoke emotional connections. By integrating different media elements, videos, audio, and interactive components, digital storytelling offers a multi-dimensional experience that stimulates multiple senses and provoke active engagement (Porter, 2006).With digital storytelling, individuals can express their ideas, experiences, and perspectives in a dynamic and immersive manner. Moreover, digital storytelling has the potential to reach a wider audience as stories can be easily shared through various online platforms and social media channels.

Stories have been a part of human culture for centuries, serving as a way to pass down traditions, beliefs, and lessons from one generation to the next. They have the power to entertain, educate, and most importantly, evoke strong emotions in the listener. In today's world, with ongoing technological advancements, the storytelling has taken a new form. Artists and educators started to combine personal narratives with digital tools and software, creating digital stories.

The use of digital storytelling

Digital storytelling can be used in a wide range of contexts and for various purposes. Individuals utilize digital storytelling to share personal stories, experiences, and perspectives, using social media, blogs, or dedicated platforms to foster dialogue and build connections (Bakhtiary & Behzadi, 2023). Journalists and documentary filmmakers also employ digital storytelling methods to present news and information in a captivating and immersive manner (Soler-Adillon & Sora-Domenjó, 2018). In the tourism industry, digital storytelling is harnessed to promote destinations and attractions, while non-profit organizations use it to communicate their mission and impact, evoking empathy and inspiring support (Solomon, Adu-Debrah, & Braimah, 2022). Additionally, the healthcare sector

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employs digital storytelling for health promotion, patient education, and raising awareness about health-related matters (Moreau, Eady, Sikora & Horsley, 2018).

Digital storytelling also has a significant impact in education. The incorporation of content with storytelling enriches learning and enables the acquisition of new knowledge in an interesting and enjoyable way, which positively affects the overall satisfaction of the audience (Robin, 2015).

The advantages of digital storytelling in education

Digital storytelling has a beneficial impact on students' learning by motivating them to effectively organize and communicate their ideas and knowledge in a personal and significant manner (Barrett, 2006). Participating in digital storytelling encourages students and foster them to think innovatively by exploring imaginative approaches to presenting their stories (Sadik, 2008). This involves integrating diverse multimedia elements and employing creative techniques to enhance the overall storytelling experience. Digital storytelling offers a canvas for unlimited creativity. Storytellers can leverage a wide array of digital tools, software, and editing techniques to bring their visions to life. They can experiment with various media elements, to craft visually stunning and emotionally resonant narratives. Incorporating multimedia elements and interactive features in digital storytelling enhances information retention as students are more inclined to remember and recall content that is presented using a various multimedia element (Ohler, 2013). Hull and Katz (2006) suggest that digital storytelling supports the growth of multimodal literacy skills by providing students with opportunities to engage with diverse modes of communication. Digital storytelling can be used to enhance learning experiences, engage students, promote critical thinking and creativity, and foster development of higher-order cognitive skills (Kajder, 2010). Students can create digital stories to demonstrate their understanding of a topic, present research findings or express their perspectives on a particular subject. They can work together in planning, creating, and sharing digital stories. Thus, digital storytelling can foster collaboration and teamwork, providing a platform for expressing creativity and actively engage in learning, in a meaningful way (Robin, 2006, Yang 2012). (Harjono & Wiryotinoyo 2020) contended that digital storytelling had a beneficial impact on writing proficiency because it provided learners with advantages during the creation process. Through the utilization of software and web resources, learners could brainstorm, organize, and refine their ideas and thoughts, thereby enhancing their writing achievement. In the field of education, technology serves as more than just a passing trend; it acts as a catalyst for change, driving advancements aimed at fulfilling the learning objectives tailored for the demands of the 21st century (Hannaway & Steyn, 2017).

The purpose of this study is to examine the children’s attitude toward interactive storytelling, by assessing their happiness, enjoyment and intention to use it. These variables were selected for the research because they have been identified in the literature as having hight importance in determining general attitude (Bourgonjon, Valcke, Soetaert, & Schellens, 2010; Giannakos, 2013). Also, enjoyment and happiness are related to intrinsic motivation, which is a prerequisite for children engagement in learning (Blumenfeld, Kempler, & Krajcik, 2006; Deci & Ryan, 2008; Saeed & Zyngier, 2012). For this reason, we developed a digital story, which targets children from primary school (third and fourth grade). The process of creating digital story enriched with augmented reality (AR) elements is briefly explained, as well as the evaluation process with the children, as an end user. The study was conducted with a mixed-method approach. The results of the evaluation are also presented and elaborated.

Methods

This study used a mixed research approach that allows combining quantitative and qualitative data. The quantitative data was collected using a questionnaire consisting of questions related to enjoyment, happiness and intention to use. The paper-based survey was based on the work of Giannakos (2013). The quantitative data was supported by qualitative data from a light conversations/interviews with children and teachers, as well as from teachers’ observations.

The experiment took place at primary school "Strasho Pindzur" in Karbinci, with a full authorization from school's principal, teachers and parents. The evaluation included 22 participants-individuals from third and fourth grades, with a gender distribution of 10 males and 12 females. During the experiment, the teachers were present in the classroom, but they have no influence on the children.
The interactive digital story was created using Blippbuilder platform (developed by the Blippar company, known for its expertise in augmented reality-AR). This platform provides a user-friendly interface for creating interactive digital stories without requiring extensive coding skills. The AR creation tool allows users to overlay digital content like images, videos, animations, and interactive features onto physical items [Timovski et al. 2020; Nikola et al. 2022]. Additionally, software applications such as Sketchfab or Autodesk Maya were employed for creating complex 3D models, enhancing the visual richness of the storytelling experience.

The process began with the selection of a theme suitable for primary school children, resulting in the creation of "The Enchanted Kingdom" (Figure 1). This narrative was carefully crafted to include fantasy elements and mythological creatures, aiming to evoke a sense of wonder and excitement among the target audience, as well as to stimulate their imagination. The text of the story was designed to be concise and clear, considering that the primary mode of experiencing the narrative was through augmented reality elements.

Figure 1. Book cover and book template

Blippbuilder's 3D environment provided a dynamic workspace where elements could be positioned according to three axes: X, Y, and Z (Figure 2). This environment allows for strategic placement of elements, such as the front cover or book template, to enhance the overall visual experience of an-augmented reality story. Elements were rotated and positioned to create the illusion of depth and immersion when viewed through the application.
The interactive digital story was presented using a book template, with text on one side and corresponding 3D animated objects on the other. This layout ensured that each 3D animation aligned with the text, facilitating comprehension and enhancing reader engagement. Navigation through the story was facilitated using intuitive left and right arrows, providing a user-friendly interface for children.

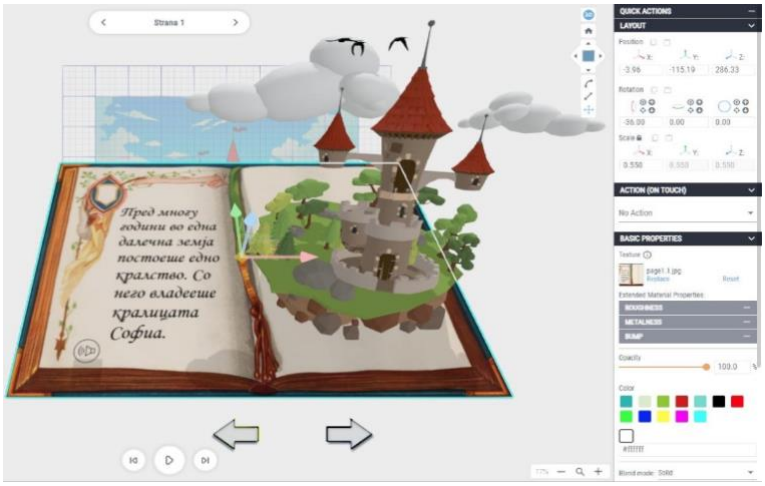

Figure 2. Positioning the elements in Blippbuilder platform

Intricate 3D models were created using software applications such as Sketchfab or Autodesk Maya. These models were carefully chosen to complement the narrative visually and through animation. They were positioned within the story to create an illusion of depth, enhancing immersion in the augmented reality environment. Animation clips and audio elements were also integrated to enrich the storytelling experience further.

Access to the interactive digital story was granted through a QR code obtained during the publishing process. This QR code could be scanned using mobile devices equipped with AR-compatible application, allowing users to activate and experience the augmented reality narrative.

Data collection tools

Data collection tools included observation, interviews, and surveys, specifically designed to capture children's responses to the interactive digital story. These tools were validated through expert review and piloting with a small group of children. Data collection took place during interactive storytelling sessions in primary school classrooms.

To gauge the participants' attitudes, we developed a survey based on the work of Giannakos (2013), which included questions related to enjoyment, intention to use, and happiness. The survey was meticulously crafted in collaboration with experts from diverse fields including education, technology, and child psychology. Their opinion was taken into account throughout the questionnaire development process to validate and refine the survey items.

Happiness is a positive and pleasant emotion, which is well known by the children. It is robust and comprehensive feeling, characterized by durability and inner self-satisfaction. To assess happiness, the children were provided with a visual-analogue scale that ranged from "very happy" (5) to "very unhappy" (1), and they expressed their feelings using pictorial representations (Figure 3). Using this type of scale is appropriate for children of this age and helps them give an appropriate response to their feeling.

Figure 3. Emoticons used in visual analogue scale for measuring happiness

On the other hand, enjoyment is a positive affective state, that occurs when a person engages in an activity that he likes. It is a momentary (temporary) feeling, which lasts less than happiness. In our study a 3-point Likert scale was used to assess enjoyment, as well as intention to use. This format provides participants with a simplified and straightforward way to convey their feelings and intentions

regarding their experience with the digital storytelling platform. This scale allowed participants to express their personal feelings about how much they enjoyed engaging with the digital storytelling content and their likelihood of using it in the future.

In order to maintain the validity and reliability of the data, the researcher took several precautions during the study, considering the potential impact of environmental factors on children's emotional states. The environment where the activity took place was carefully designed to create a sense of confidence and comfort for the children involved. The teachers were also present in the classroom, but provided only technical assistance, when needed, and did not actively participate in the evaluation nor did they have any influence on the children.

Each child was individually involved in the digital storytelling application, thus allowing for an independent experience and response. Data collection was conducted at the end of the activity through a question-and-answer session. The researcher read each question to the children, and their answers were recorded in the questionnaire. If a child had difficulty understanding a question, it was repeated to ensure clarity and accurate response. Throughout the process, the researcher encouraged open communication and a free exchange of ideas to gain a deeper understanding of the children's perspectives and experiences.

Data analyses

Both quantitative and qualitative data were collected for this study. Descriptive statistics were used to describe the means (M) and standard deviations (SD). To help the interpretation of the results, the qualitative data were also used. Since, the participants were 8 and 9 years old children, with whom it is difficult to conduct structured interviews, in the qualitative phase light conversations and unstructured interviews were conducted.

Results

Happiness

During the learning process, students express various emotions, that positively or negatively affect students' motivation. According to Kay (2008) happiness, as a most well-known positive emotion, is in direct relationship with computer knowledge acquisition. That is why we choose happiness as valuable factor in our research.

The children's happiness level was evaluated using a single question, and a 5-point Likert scale, where 1 represents "Very unhappy" and 5 represents "Very happy." Most of the participants reported feeling very happy (SD=0.46, M=4.72). Specifically, 73% reported being "Very happy" and the remaining 27% reported being "Happy". Notably, none of the students expressed being "Unhappy" (Figure 4).

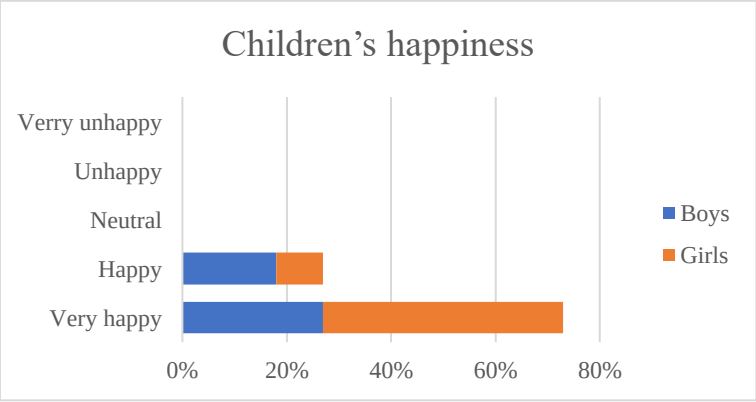

Figure 4. Results for happiness level

Enjoyment

Enjoyment can be described as a degree to which the act of engaging with technology is seen as pleasurable in and of itself, regardless of any expected performance outcomes. Studies have indicated that the level of enjoyment significantly influences the acceptance of technology by users (Venkatesh et al. 2002; Yi et al. 2003). Moreover, contributions to entertainment theory (Vorderer et al. 2004) suggest that media users actively 'work' on their enjoyment experience. Additionally, enjoyment was found to have a significant influence on intention to use (Hsu & Lin, 2008).

In this study, children's enjoyment during interactive storytelling was assessed using a 3-point Likert scale, where response options included "I agree"=3, "Neutral"=2, and "Disagree"=1. The results indicated that every child participating in the activity found it enjoyable and expressed a preference for this type of activity (SD=0, M=3). Furthermore, 80% of the participants described the interactive storytelling as engaging and expressed enjoyment in having this method integrated into their learning process (SD=0.26, M=2.8) (Table 1).

Intention to use

Intention to use is considered the most commonly used variable in studies examining game acceptance (Ha et al. 2007; Hsu & Lu 2004). It is usually used as a dependent variable in TAM (Technology Acceptance Model). Research indicated that usefulness and enjoyment are significant determinants of behavioural intention (Davis et al. 1992). However, in our study, intention to use was used as an independent variable. Children's intention to use interactive storytelling was determined by a 3-point Likert scale ("I agree"=3, "Neutral"=2 and "Disagree"=1). Majority of participants (90%) expressed their intent to incorporate digital storytelling into their future study routines (SD=0.29, M=2.9). Additionally, 90% of children indicated that they intend to continue using digital storytelling as part of their future learning experiences (Table 1).

Table 1. Results for enjoyment level and intention to use

Enjoyment	**I agree**	**Neutral**	**Disagree**
Studying is more interesting using the digital storytelling	18	4	/
Using the digital storytelling is fun	22	/	/
I like using the digital storytelling	22	/	/
I enjoy aspects of studying that require me to use the digital storytelling	18	4	/
Intention to Use			
I plan to use digital storytelling for studying in the future	20	2	/
I intent to continue using digital storytelling for educational purposes in the future	20	2	/

The data from qualitative phase supported these results. Children described the digital story as attractive and entertaining. They were happy and enjoyed while performing this activity. They also asked for the possibility of including similar activities in other lectures. Regarding the teachers, they also expressed positive experience of using digital story in classroom. They were especially impressed by the effect of the application on some students, who usually pay no attention in the class. They believe that the usage of similar applications during classes may significantly contribute to improve students' attitude during the school day.

Conclusion and discussion

In this study children's attitude toward interactive storytelling, as an educational tool was examined. The obtained results reveald a positive attitudes, which is in line with other similar studies (Clark & Dunser, 2012; McKenzie & Darnell, 2003; Giannakos, 2013). Participants expressed high level of happiness and enjoyment, which was supported by both quantitative and qualitative data.

This modern pedagogical approach is in line with contemporary technological advancements and reflects the way children interact with technology for both learning and leisure purposes. Digital storytelling offers a multi-dimensional experience that stimulates various senses and evokes positive emotions. The use of multimedia elements captures children's attention through multiple sensory channels, thereby enhancing the learning experience in an enjoyable and meaningful manner. The various animations, 3D graphics, and sounds, used in developed digital story, were perceived as magical, creating an engaging and entertaining atmosphere. Clearly, this increased the children's enjoyment and provoked happiness. On the other hand, positive emotions influence children's desire to continue using such applications in the future.

Children's happiness can affect motivation during the learning process, as learning is not only cognitive but also an emotional experience. If educational technologies transfer positive emotions to children, they can lead to positive learning experiences. This suggests that educators should provide a learning environment where enjoyment is supported and fostered in order to facilitate successful learning performance.

During the experiment, some minor issues were identified, such as navigation difficulties and technical glitches. Based on these findings, appropriate corrections and improvements were made to enhance the overall user experience of the application.

Although our study provides evidence for the childrens' attitudes regarding digital interactive storytelling, there are also some limitations. The biggest limitation is the small sample size. In future we hope to conduct a more extensive study with more participants. Also, a self report method (questionaire) was used to measue the selected variables (happiness, enjoyment and intention to use), which can be subject to some report biases. To avoid this, future research may include measuring emotions through face expressions, hart rate or EEG, and to correlate the results with the results of our study. In addition, the relationship between enjoyment and happiness, on learning performance can be explore.

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