

Children and Digital Storytelling

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ABSTRACT

How children use technology and what benefits digital storytelling can bring to education and social development are subjects which interest researchers worldwide. This paper will first consider how best to design technology for child, rather than adult, users. Then it will consider how interactive tools can be used in education before more specifically focusing on the benefits of storytelling. How to teach children to become storytellers will also be considered. The research reviewed in this paper shows that storytelling can increase children's technical skill. Children creating digital stories are also likely to collaborate and explore boundaries. Storytelling improves the interactions between peers and increases general social skills. Through telling original stories, children can learn to symbolically represent meaning and conceptualize abstract concepts. By telling stories collaboratively, children can increase their communication abilities and form more inclusive social groups. Storytelling is also a proven way to communicate material across a wide array of subject areas.

General Terms

Your general terms must be any of the following 16 designated terms: Design, Human Factors, Theory

Keywords

Digital storytelling, children, interactive media, child computer interaction

1. INTRODUCTION

One of the most interesting aspects about the research on children using digital media to create stories is its global nature. The potential benefits of digital storytelling to education as well as social development interest researchers worldwide. Aside from research done in the United States, this paper will also consider research from Australia, Switzerland, Italy, China, Kuwait, and several other countries. Widjajanto, Lund and Shelhowe (2008) define digital storytelling as: "the art of telling stories with a mixture of digital graphics, text, recorded audio narration, video and music to present information on a specific topic" (p. 465).

To understand the context of digital storytelling, first this paper will report on research surrounding best design practices for digital applications for children, and how these applications can be used as educational tools. After providing this background, there will be a review of research which analyzes how children use digital media to create original stories, the benefits of this behavior, and how children can be taught to tell stories.

2. DESIGNING TECHNOLOGY FOR CHILDREN

Designing technology for children requires a different approach than designing technology for adults. Children have their own expectations of technology, and it is often important to consider educational technology in a classroom context.

2.1 Children are not Adults

Children and adults have different expectations when it comes to the technology they use. Unfortunately, many researchers design and test technology as if they are dealing with an adult audience. Horton and Read (2012) explain that simply having been a child does not sufficiently equip a researcher with a useable understanding of how children will use or react to a given technology (p. 252). They suggest that a better method would be to involve children in the design process, getting their feedback even at the earliest stages of prototyping. Researchers Kauppinen, Luojus, Tuomisto, and Ahlgren. (2013) put this theory into practice by designing gesture based tools because young children are not able to work with text-based interfaces. Wyeth, Diercke, and Viller (2006) are also interested in designing for children and suggest that researchers study existing toys and games to discover why they appeal to children, and then apply those concepts to educational toys and games.

2.2 Children's Expectations of Technology

Children have high expectations for the technology they use. While studying a piece of software intended to help children learn sign language, Korte, Potter, and Nielson (2014) learned: children "expect seamless, intuitive behaviour from technology in part based on their existing experience with game platforms, mobile technology, and other computer games" (p. 105). The researchers were encouraged by how adaptive the students were, and found them unafraid to work with new and unknown technology.

2.3 Designing for the classroom

When considering implementing digital media in the classroom, cost is an important factor. Australian researchers Bodén, Dekker, Viller, and Matthews (2013) considered this when they studied an ARG (Alternate Reality Game) called *Save the Wild* which sought to educate children about sustainability. Students created origami shapes with specially marked paper. The computer then scanned these marks, and the students were told a story about the animals or objects they made. The researchers emphasized the importance of developing educational technology strategies that do not require significant expensive additions to the classroom. They explained the goal of educational technology development: "Careful attention to the existing infrastructure in classrooms can lead to the introduction of new technology that is not invasive but supports and enhances existing classroom and learning activities" (p. 234). The researchers also felt it was important to give the children a physical part of the experience to keep as they believe that will make the learning experience last beyond the gameplay. In their study, this souvenir was the origami animal each child created.

While cost is a primary concern, cultural differences also need to be taken into consideration, particularly when designing for an international audience. Researchers working on a mobile storytelling application for a village in Africa quickly learned that their perception of storytelling was different than that of the people for whom they were building the application (Bidwell, Reitmaier, Marsden, & Hansen, 2010). For example, they learned

that Western culture is very image based, but this was not the case in tribal communities with a strong oral tradition. It is always important to consider the end user when designing a digital storytelling application.

Marco, Cerezo, and Baldassarri (2013) built off that lesson by designing for end users who were a diverse group of children with varying needs. Their research deliberately included both neurotypical children and children with various neurologic conditions. The researchers feel that there is a dearth of good research on how educational technology can help special needs children. Marco, et al. are also seeking to solve a limitation of the multi-touch interface, namely that younger children are not precise enough in their movements to interact easily with such technology. They also noted that children of various learning capabilities need different levels of educator involvement. Even so, children from both groups were able to successfully complete the task.

These research studies highlight the importance of designing technology specifically for children. Children can express their own unique expectations more clearly than adults can guess or assume them. It could be especially useful to involve children in the design process when developing educational tools.

3. INTERACTIVE MEDIA IN EDUCATION

Interactive Media (and particularly digital storytelling) have proven to be very effective in teaching students material in a variety of subject areas from science and math to art and cultural history.

3.1 Science and Math

Naturally, there has been a great deal of interest in the scientific community around how interactive media could enhance education. This research has occurred in a variety of subject areas. For instance, chemistry can be a challenge to teach because there are many layers of content to represent. Some aspects of chemistry are observable, but there are also subatomic components which cannot be directly seen or easily represented. To address this problem, Ducao, Milne, and Koen (2013) built an interactive application to represent various chemistry lessons. Their application presents the information graphically and narratively which they found solved the problem of the complexity inherent in certain chemistry concepts.

McCarthy, Li., Tiu, and Atienza (2013) showed that math is yet another area where interactive media and digital storytelling could support learning. They studied the PBS Mathematics Transmedia Suite as a possible solution to the knowledge gap between preschoolers from low income homes and those from high income homes. They focused their attention on the math tools, particularly three suites themed around popular children's stories. Researchers found that participants performed better on the standardized test after working with the transmedia suite.

3.2 Art, Culture, and Literature

Science and math are not the only subjects where digital storytelling can be used as a learning tool. The ShadowStory project was inspired by traditional Chinese shadow puppetry (Lu, et al., 2011). The project sought to connect children with this dying but beautiful artform. Actually making shadow puppets and putting on a performance takes a lot of skill and time. The researchers sought to make an easier digital version which could act as a gateway for children into the art form. The final tool

allowed children to create stories on their tablets and later project them onto a larger screen for the performance, controlling the "puppets" with handheld sensors. The researchers studied the tool for a week at an elementary school. They saw increased in creativity, collaboration, and awareness of traditional culture. This project was similar to another application created by Widjajanto, Lund, and Schelhowe (2008) called Wayang Authoring, which was based on Indonesian puppetry. The researchers in both studies hope that they have introduced children to a traditional art form in a simple way, so that when they are older and better prepared they can interact with it in its original, complex, and beautiful form.

Some researchers have even found that digital storytelling can be a useful tool in getting children excited about traditional media, such as physical books. Department of Hidden Stories is a mobile game meant to be played in libraries across England. What was particularly interesting about this study was the goal of the researchers to use their mobile-based game to encourage children to interact with books as well as tell stories. To create their stories, children were prompted to seek existing books from the library and incorporate them into new stories which they drew on paper before photographing. The app also allows children to scan the ISBN barcodes on books to find stories made by other children using the same books. The researchers strongly feel that "rather than designing tools that are a focal point of play, we argue that we should design tools that act as conduits and mediators for play" (Wood et. al., 2014, p. 1893). They wanted the experience to be about what the child could create, not what the tool could do. In this study, researchers were pleased to observe children actually interacting with the books in the library instead of just going there to use the computers.

These studies are examples of how digital storytelling can help children learn about science, math, art, culture, and literature. Further research will likely show many additional areas in which storytelling could be a valuable educational tool. One of the aspects that many of these studies have in common is that the researchers put the children into the position of storyteller, rather than just listener.

4. Children as Creators

Providing children the tools to create stories of their own as Wood et al. suggest has several benefits. Rubio, Inkpen, Ly, Kaminsky and Plutte (2013) explain, "No longer mediated by adults, children who create their media acquire a new form of engagement that fosters open communication and establishes relationships" (p. 600). By making up their own stories, children can learn valuable social and technical skills. Giannakos & Jaccheri (2013) discovered that using technology as part of the creative process had many benefits. The children who spent time working with the technology acquired a greater understanding of technology. Furthermore, the experience they had was of greater intensity, and the children were more likely to work together and share ideas. They also found that when creating with technology, the children were more inclined to test their limits and explore boundaries.

4.1 Social and Cognitive Development

Al-Mousawi and Alsumait (2012) also found that telling stories improved the interactions of students and increased general social skills. These researchers used a storytelling tool to assess and strengthen the communication skills of four and five year old children in Kuwait. The researchers were interested in both social and mental development. They designed a storytelling tool for the

iPad, using six children as design consultants and testers. The application provided the children with backgrounds, objects, and sounds to create scenes of their own. The children were asked to tell these stories in small groups. The researchers saw an improvement in the interactions of students and increased general social skills.

In addition to social development, storytelling can also be very beneficial to cognitive development. In another study children were asked to create stories by drawing and programming robots to react to their drawings (Ryokai, Lee & Breitbart, 2009). The robots used were Pleo dinosaurs. Once an experimenter showed the participants how to program the robot using the graphical user interface, the children were able to use the technology effectively. The participants used the technology in innovative ways that the experimenters had not anticipated. For instance, the software allowed the children to make voice recordings as Pleo, and some of the participants used the tool to add sound effects to their stories instead. The researchers also felt that storytelling assisted cognitive development: "Storytelling also offers opportunities for children to practice symbolic manipulations, hold multiple abstract concepts in their heads, and create meaning between these ideas" (p.19). They also noted that as storytellers, the children were able to explore a variety of possible outcomes to various events and discuss those theoretical situations with each other.

Many of the examples of interesting work on digital storytelling tools for children are small research studies, but research is also happening on a much larger scale. This research has found that digital storytelling can even be beneficial in a full classroom setting. Blas, Paolini, and Sabiescu (2010) examined digital storytelling as part of a curriculum in a school in Italy. They were interested in how storytelling can become a collective endeavor and how digital storytelling can be integrated into a curriculum. The classrooms they studied were participants in a giant competition called PoliCultura. This competition challenges whole classrooms to create stories together. The students were provided with a story editing program to create their stories which allowed them to string together images (often scanned drawings) and audio files. Thousands of children participate annually. A questionnaire sent to teachers helped the researchers evaluate the effectiveness of PoliCultura. They found that the project increased understanding of the material, content organization skills, retention, interest in a subject matter, engagement, technical abilities, communication abilities, and teamwork capacities. The researchers also found that students who were previously marginalized found a way through the storytelling to become included in a more cohesive class.

Telling original stories is incredibly beneficial to children in a number of ways. Using technology to tell stories increases children's technical skill, and increases the intensity of the storytelling experience. Children creating digital stories are also likely to collaborate and explore boundaries (Giannakos & Jaccheri, 2013). Storytelling improves the interactions between peers and increases general social skills (Al-Mousawi & Alsumait, 2012). Through telling original stories, children can learn to symbolically represent meaning and conceptualize abstract concepts (Ryokai, Lee & Breitbart, 2009). By telling stories collaboratively, children can increase their communication abilities and form more inclusive social groups (Blas, Paolini & Sabiescu 2010).

5. Storytelling Together

Many of the beneficial effects shown in the previous studies occurred because students were telling stories together. Research shows that storytelling is often most beneficial when children are telling stories together. As Al-Mousawi and Alsumait (2012) found in their research, storytelling can have several positive impacts on social development. Many other researchers have found similar results indicating that collaborative storytelling can be beneficial to children such as the researchers who developed ShadowStory (Lu et al, 2011). Wyeth, Diercke, and Viller (2006) found that social interaction was one of the most important aspects a digital experience for children should offer.

Göttel (2011) explains that storytelling is inherently interactive. At a minimum, the storyteller is interacting with the person to whom the story is told. Sometimes there are multiple storytellers working together to tell a story, as with classrooms working together for the PoliCultura project. Collaboration was one of the most important aspects of that endeavor: "keeping the class united, working for a common goal and a common achievement, is very important and at the heart of the most durable educational benefits" (Blas, Paolini & Sabiescu, 2010, p. 18). In certain situations, however, it can be difficult to bring children together in the same time and place. For instance, a child in the hospital for a chronic illness could be very socially isolated.

One of the earliest digital storytelling tools for children was designed in response to this problem. StoryMat was designed to help children tell their own stories and collaborate (Ryokai & Cassel, 1999). The setup seems quite simple to the children who approach it: a mat and some toys. However, the mat and toys are supported by some interesting technology. As children play with items on the StoryMat and tell their own stories, their voices are recorded as well as their movements. When the next child plays, they can play back the previous story, listening to the audio and watching a graphic of the movement. The tool relies on graphics and audio recordings, so even children who are not old enough to read can play. Ryokai and Cassel explain the importance of the tool: "Listening to and sharing their stories and ideas with others are activities through which children make sense of their world, and practice their language skills" (p. 272). StoryMat allows children who might not initially have this opportunity take advantage of the many benefits of storytelling.

5.1 Learning Together

Mazzone, Xu, and Read (2007) found in their research that co-discovery, or exploring technology together, often involves peer tutoring, or children teaching technology to each other which requires one child to be able to explain their understanding of the technology to another child. They also found that it has the added benefit for researchers that children are more likely to verbalize their thoughts than when simply asked to think aloud. Asking children to work together with a digital storytelling tool is useful to both the children and the researchers.

Children do not just use technology with each other. Parents are often an important part of the educational and creative process. Horton and Read (2012) explain that it is important to include both parents and children in the process of designing educational technology because they have two separate perceptions on what technology is available to children and how it can best be used. Furthermore, the interaction between parents and children as they use technology together is valuable in and of itself. Budd (2007) laments, "few systems acknowledge the importance of the

interaction between children and parents in the context of use in the narrative learning process” (p. 97). Budd and his team developed PageCraft, a storytelling tool that integrates objects and technology. Children can carry the system around in a little case that resembles an adult’s briefcase. With the components in the case, the child can create a story with a parent or grandparent. The child could also choose to create a story independently and then share that story with an adult. Mäkelä, Giller, Tscheligi, and Sefelin (2000) found that stories are a way families like to communicate when given the option. These researchers created an application to allow easy photo sharing, and although it was not their intent, the child participants often chose to use the application to create and share short stories with each other and their parents.

6. Teaching Storytelling

There are various schools of thought on how to teach children to tell original stories. Burke and Kafai (2010) examined how learning to write computer code can help children become creative storytellers. They explain that tools such as Storytelling Alice or Scratch use digital storytelling to explain programming concepts to children, but little research has been done on how writing code affects children’s ability to write stories. To test their theory, the researchers worked with an after-school club at a public middle school in Philadelphia. The eleven members of the club developed original stories using Scratch over a six-week period. Self-report measures showed that the children’s programming knowledge and storytelling ability increased. They explained that through these exercises, the students learned “the importance of sequence, structure, and clarity of expression—three aspects characteristic of effective coding and good storytelling alike” (p. 348).

Rubegni, Colombo, and Landoni (2013) examine not only how students creating their own digital storytelling projects can be beneficial to learning in a primary school, but also use their findings and observations to develop several design recommendations. They argue for a holistic perspective on how mobile devices can be integrated into the classroom by considering everything from child-computer interaction to the needs of teachers. Researchers found that a digital storytelling assignment added depth to the teaching experience, increased students’ understanding of the material, and encouraged creativity. Based on their findings, the researchers presented four design requirements for a digital storytelling application, “definition of story structure and plot, media creation and editing, sharing with the class, publication of the story” (p. 5). They feel that these four features will provide children with a solid foundation from which to build their own original content. The researchers argue that providing this foundation and some structure will actually enhance greater creativity.

Chu and Quek (2014) asked if providing children with tools such as pre-created story elements helped or interfered with creative story telling. The researchers were hoping to discover if providing context limits children or if it gives them a springboard to jump off of when imagining. Their research included children eight to eleven years old, and they studied how the use of images in a storytelling platform affected the children’s creativity. Some students participating in the study were given just a plain background to work with while others were provided with images. In the study, children played with a tangible object which was converted to a digital format on the screen. They found that the background helped children get started and provided a focal point

for their creation. These children were more focused and engaged in the storytelling process. Those without the background, however, tended to use a more traditional narrative structure and created more elaborate stories.

To teach children to tell stories, innovative new methods should be tried, such as Burke and Kafai (2010)’s programming project. These non-traditional strategies could offer benefits different from the current system. Designing tools for children should involve a thorough consideration of the needs of all the participants, including children, parents, and teachers (Rubegni et al., 2013). It can often be beneficial for children to be provided with some structure that helps them direct their creativity (Rubegni et al. 2013)(Chu & Quek 2014).

7. Conclusion

Storytelling can have many educational benefits, particularly when children are telling their own stories together. Through telling stories, children can interact more deeply and meaningfully with the subject matter. They can also develop important mental, technical, and social skills. There are many interesting tools which help children consume and create stories, and when more tools are designed it is vital that they keep the needs of children in mind. Future research should consider what other subject areas can be enhanced with digital storytelling. Furthermore, research should focus on designing digital storytelling tools which are cost-effective and can easily be integrated into a classroom setting.

From an educator’s perspective, these tools and strategies have already proven to be beneficial. As costs permits, they should be integrated into the classroom. If cost does not permit, then administrators should seriously reconsider how they are allocating resources. With a method this valuable, they may find they cannot afford not to include digital storytelling in the curriculum.

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