

Storytelling as a Creative Activity in the Classroom

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ABSTRACT

In our ongoing research, we argue that storytelling activities can be used as creative tasks to stimulate creativity in children, one of the so-called 21st century skills. In this paper, we lay the foundations for our project on digitally supported storytelling, by gathering the viewpoints on storytelling and creativity expressed by local primary school teachers and reviewing methods reported in the literature. We report the main characteristics and features to consider in creative storytelling activities, and present our current work on a distributed storytelling interface for supporting children's creative skills development that meets the practical requirements found in the literature and expressed by the teachers.

Author Keywords

Creativity; Storytelling; Teachers' views, 21st century skills; Technology.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous; H.5.2. User-centered design.

INTRODUCTION

Social skills and creativity have been identified as key competencies for new learners in the 21st century knowledge society [3]. Among all different activities that we could consider to stimulate and foster the development of social skills and creativity, storytelling seems to be particularly suitable, given its inherently social and creative nature [11]. It has been used before to support and research aspects of linguistic, cognitive, and affective development in childhood, as well as other skills such as memory and writing skills [28][29]. Furthermore, it provides opportunities for social interaction, which is paramount for the development of children as they grow up [5], and involves necessary interpersonal skills such as communication and empathy [13].

In our project, we focus on storytelling in the context of children's creative activities, and explore how technology-

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supported (interactive) storytelling techniques can be implemented to support and enable the creative process. However, as a first step in the development process, we explored the current practice of primary school teachers on storytelling and creativity as well as their perspective on storytelling as a creative activity for the 21st century school. In this paper we contribute (1) an overview on storytelling, with a special focus on school settings, (2) insights from local teachers' perspective on creativity and storytelling, and (3) a presentation of the ongoing development of a robotic character to be used in storytelling activities.

BACKGROUND ON STORYTELLING

Technological perspective

Garzotto surveyed interactive storytelling systems for children, showing that there is a variety of approaches and enabling technologies [9]. However, among all the possible spectrum, we are especially interested in tangible and collaborative systems which would keep children in the physical world while in contact and in cooperation with peers. According to Vygotsky [32] children create meaning in close interaction with other individuals and the environment around them. Vygotsky argues that spoken and written language as symbol systems are important for cognitive development. Recent work by Gupta [10] illustrates that children often use their own symbol systems, like drawings, in storytelling activities. Use of tangible objects can assist children in the process of telling a story. In this sense, remarkable related work ranges from tabletop technology to tangible objects used as input means. In the first group, the work in [2] uses emergent narrative techniques to allow children to interact with intelligent agents to develop a story using tangible toy figures, whereas works such as [8] or [1] support the creation of digital artefacts to be used in stories by using touch, tangible cameras or tagged pucks on the tabletop. In the second group, typical approaches use tangible manipulatives [31], action figures [25] or RFID tagged objects and toys [14] as main input to trigger interactive storytelling in a display. When using physical robots as base technology, they have been mostly used as characters. For example, in [33] a small robot that can record movements can be customized with cardboard drawings to create physical characters. Sugimoto explored the use of a turtle toy controlled by means of handheld projectors [30]. In [21], the navigation of a small robot is controlled by children using tangible cards on a digital tabletop, whereas

with a similar approach the work in [27] uses programmed behaviours sequenced in a computer and linked to tangible cards to be physically rendered in a dinosaur robot. More recently, MyKeepon robots have been used to render stories physically, limiting children's interaction to choose a few actions in a pre-scripted story [20]. Furthermore, there have been some good samples in which the robot is used as a storyteller, such as [19] which used a Nao robot with pre-recorded behaviour, or the robot as a supportive activity companion as in [34].

In summary, all these developments for storytelling represent important efforts to develop novel systems and approaches considering tangible and robotic technology. However, in most cases the context of use is more related to informal contexts, in which teachers or instruction practice are not explicitly mentioned or involved. As pointed out by Garzotto in the research challenges identified in her work, there is a need to understand the requirements of the interactive storytelling technology in formal contexts.

Practice at schools

There has been a broad interest in using digital storytelling in instruction to develop many different skills, such as problem solving competence, creativity, creative thinking, critical thinking, emotional intelligence, oral language competence, social skills, and memory among others [28]. In this section, we provide a summarization of literature on storytelling at school, in which the focus is not necessarily on the use of advanced technology but more on the storytelling practice.

Baumer et al. study the effects of *playworld educational practice* on the development of narrative competence in 5 to 7 year old children [4]. Students engaged in joint adult-child dramatization of the text, general discussions, drawing activities, and free play activities that resulted in pretend play. The findings show that children who participated in this practice showed significant improvements in narrative length, coherence, and comprehension compared to children who just listened to the story read by the adult, and engaged in group discussion and individual writing and drawing activities. This is in line with more recent studies which report the link between play and creativity skills [12].

In the *Storytelling and Story-Acting* (STSA) practice [24], any child who wishes can dictate a story to the teacher, who writes down the story for the child. At a later stage the teacher reads the story to the entire class, while the child/author and other children act out the story. The teacher takes on the role of a coach that helps students develop the story and the associated play. Nicolopoulou et al. remark that there have been few systematic attempts to assess its effects on young children's learning and development [22].

Campbell [7] investigates how digital storytelling can enhance ability to create higher quality writing in junior elementary school classes (ages 10-12). The results of

embedding storytelling activities in teachers' instruction illustrate that teachers and students moved beyond the fun and attractiveness of technology, and learned to use the digital tools to create more sophisticated stories with the time, producing better scripts and longer and more sophisticated digital stories.

Sarica and Usluel [28] also reported positive effects of digital storytelling using picture and video editing software. Their experimental group engaged in a five-stage digital story creation activity similar to [23], which considers the planning of the story, pre-production activities, the production process, post-production, and the delivery stage. The control group created posters using the same content material. The experimental group outperformed the control group in terms of writing skills.

Preparation was emphasized by Kirsch [15], who examined whether children, aged 10-11, learned vocabulary through storytelling. She narrated or read stories, at the beginning or at the end of a unit of work, depending on the learning objectives. After each storytelling event, the children were encouraged to retell the story and to mention any new words or sentences they remembered. The children engaged in the storytelling activities, and recalled and retained lexical items over a period of time. Kirsch pointed out that stories can work well but teachers need to plan how to use them, make language accessible through the use of voices, pictures or signs. Kocaman-Karoglu [17] found that the use of digital storytelling by the teacher helped 6-years-old students remember and comprehend the subject's content over traditional approaches in classroom instruction.

In summary, storytelling requires considering several activities during the learning sessions. They can include some reading by the teacher, but also an active participation of the students and play. Discussions are also considered, as well as additional activities such as writing and drawing in relation to the topic of the story. However, various authors also admitted that embedding storytelling activities in the classroom is time-consuming and not easy. Robin [26] emphasizes the power of digital storytelling as a tool for the 21st century classrooms. He discusses that digital storytelling is being currently used in K-12 classrooms with an emphasis on technical skills and without paying attention to the subject matter, the teaching strategies, and needs in the classroom. For this reason, and to help us to prioritize design requirements, we are exploring how primary school teachers in our network would consider storytelling in order to have a better view on their practice.

Insights from local teachers

We focused on primary schools that would be more likely to participate in follow-up studies based on previous experiences in other research projects and to ensure that we start fitting their needs from the beginning. Five primary school teachers answered our questions. They were 3 women and 2 men with an age ranging from 23 to 31 years old (mean=28.2 y.o.) and experience ranging from 1 to 8

years (mean=4.4 years). All of them held a bachelor degree in Education. Unfortunately, we did not get senior teachers involved, which could have been useful to get more valuable insights reported and informed from experience. However, we still believe that targeting junior teachers is necessary and useful, as they are the new generation of teachers who are and will be the users interested in implementing instruction using digital resources and technology.

To capture the teachers' view on creativity, teachers answered the questions replicated from [6], which is a more general survey on creativity in schools in Europe. Our local teachers considered that creativity is a fundamental skill to be developed in school, which can be applied to every domain of knowledge or school subject. They explain that creativity is about finding relations or connections that have not been made before or about the ability to produce something original. Their attitude towards whether ICT can be used to enhance creativity was very positive (with a score of 4.2 out of 5). The main observations are in line with what was reported in [6]. A remarkable difference is that among our participants mobile phone technology has a better consideration for learning, which we assume to be a consequence of the evolution that such devices have had over the last years (touchscreens and learning apps).

On the creative activities carried out in their classrooms, three of them mentioned activities in which both teacher and students are involved. Typically, the teacher proposes an open problem or activity and provides materials, requiring the pupils to work on the problem (usually in groups), with the teacher as a supporter/coach (i.e. without giving a solution or advice directly). One teacher also mentioned using a kind of theater lessons where improvisation is needed and participation is encouraged, but where attention and listening to other peers are also important skills to be developed. Concerning technology used to enhance creativity, two teachers said that they were not aware of using technology for this purpose, except *Kodu*, which is a programming environment used as a creative medium [18]. Another teacher mentioned that he uses tablet apps and sometimes uses software from teaching methods, but he stated not being a fan because it does not normally fit the creativity purpose.

Participants were also asked to express their agreement or disagreement on a 5-point scale with a number of statements related to issues on how storytelling is used (e.g. If I had more time, I would consider storytelling activities more often; Children are requested to do drawings/writing besides a storytelling activity; I use digital materials in storytelling activities;...). We observed that storytelling activities are not carried out very often, presumably because of the short time that teachers self-reported to have available. More traditional materials are preferred over digital for practical reasons. Typically, teachers use drawing and writing in combination with storytelling.

Overall storytelling activities are considered as a positive contribution to creativity development.

Teachers were requested to indicate how often specific activities should be used in storytelling sessions according to their opinion. Activities with higher ratings showed a large overlap with the activities described in our literature review, including dramatization, pretend play, and children and teachers reading stories. Moreover, all the respondents mentioned a kind of collaborative or group activity when asked for the structure of storytelling activities. The comments were in the direction of children working and discussing together, so that they get feedback and stimulate each other. Also receiving feedback from the teacher was mentioned, but as a secondary and more final source. Finally, the teachers gave their opinion on which skills children would need to be developed further. They talked about oral language skills and kinesthetic skills, confidence to speak up and express themselves verbally, imagination, creativity, being a good listener, patience, and paying attention. Thus, this suggests that the technology to be considered should be flexible, allowing teachers to designate different roles to children (e.g. active contributor or storyteller, audience or listener, assets creator...) and arranging activities in small working groups.

DISCUSSION AND PROPOSED SOLUTION

The related work and the practice informed by local teachers reveal that there are some desirable requirements as well as issues that may impede the spread of storytelling activities in practice, despite evidence that digital storytelling may have a positive effect on learning. It is suggested that storytelling activities may consist of stages, which typically include a kind of preparation or preproduction, production and/or performance, and discussion. However, not all of the stages are necessary as existing materials can be reused, especially when teachers declared that the available time is limited. In order to facilitate discussion and children learning from each other, joining them together to carry out some collaborative work is recommended based on the teachers' opinion, giving children an active role in the creation of stories.

In general terms, these elements and stages can confer a structure as follows: The teacher proposes a general topic to work with. Children prepare the materials and customize the props and characters needed. Children enact the story, which is important to get benefits in terms of pretend play as reported in the literature [4], while coaching will ensure producing higher quality storytelling. Finally, discussion on the story and alternative endings or variations. In that structure, secondary creative/constructive tasks such as drawing, writing, and designing can be considered depending on the children's level and learning goals. However, we must be aware of the limited time that teachers declared to have available to prepare the activity, and that it is the main obstacle for them to include such activities more often. This means that a system should not

strictly require to have all the stages, should be easily customizable and should allow the reuse of assets, so that the effort can be acceptable over time.

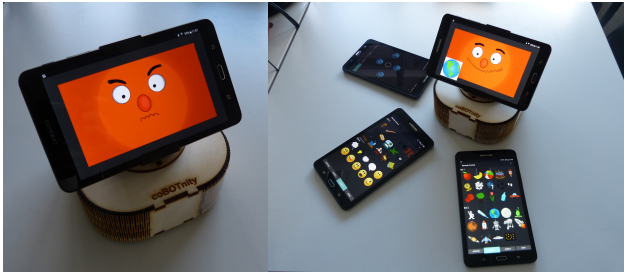


Figure 1. Surfacebot and control tablets

Regarding technological approaches, tangible approaches have the potential to provide physical affordances and interaction appropriate for children. Moreover, direct manipulation through touch input as shown in tabletop approaches has shown to be useful to both unfold the story based on user actions as well as create digital artifacts to be used in the story. On the other hand, tabletops could be a concern in terms of flexibility to move the setup and arrange several small groups in parallel. Moreover, we have seen that robot can give physical presence and embodiment to characters, but they normally require specific expensive or very specialized hardware.

Given all these observations and remarks, we focus on providing a solution based on mobile devices, tablets specifically, which can be affordable, flexible, and transparent for users. We aim to support active participation of children using mobile characters to enact and create stories collaboratively. To achieve this overall goal, we have considered a timely distributed user interface based on multiple tablets. Tablets are affordable devices available at school, which can have different functions depending on the app running, and are popular among both children and teachers. The devices, connected via a wireless router, allow several children to enact the character actions to tell the story through a control app. Moreover, in our current implementation we can flexibly arrange groups of tablets to work in different story activities, in such a way that several independent clusters of users can engage in close collaboration, fostering active participation, peer feedback, and discussion between participants on building the stories. As characters, departing from the approach in [2], in which interactive storytelling is delivered on a tabletop surface with physical but static characters, we are developing artificially intelligent agents, or *surfacebots*. These are physicalized digital characters capable of moving on the table and embodied in a tablet on top of a two-wheeled robot base (see Figure 1). The app on the tablet renders a character following the technique presented in [16], which can change its facial expression and show the objects concerning the storytelling activity. Using tablets even for the robotic character facilitates the reuse of hardware typically available at schools within a limited budget, and

moreover, the system is expandable with more apps to support additional creative tasks such as editing assets, or programming behavior with visual languages in the future.

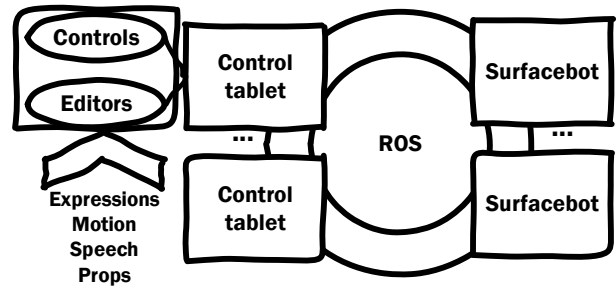


Figure 2. Components of the surfacebot architecture.

The prototype is implemented in Android and relies on ROS¹ to support the communication between tablets and the creation of clusters of devices (see Figure 2). The current implementation supports the movement of surfacebots by using the Zumo robot for Arduino². The movement control, facial expressions, and the visualization of story assets on the surfacebot screen are handled from the control tablets. These actions presented as assets on the control tablets are now predefined and preset. However, we are expanding and developing editors to allow children to create several type of assets on the tablet during or before the storytelling activity. Specifically, we have defined speech, motion and props as main editable assets. For speech, we currently rely on text-to-speech synthesis, and we are expanding it to have short speech recorded by children. For motion, we have implemented a path editor that saves trajectories introduced as a free-style dragging gesture, that can be invoked from the control as well. For props, or picture based information to be shown in the screens, we have a drawing touch editor, but we are planning to add an editor to incorporate drawings with traditional materials into the system by taking a picture with the tablet, which would be a way to accommodate additional activities besides the storytelling in the preparation stages.

Our immediate future work is focused on implementing the aforementioned editors, to empower children and teachers to easily create their own reusable material so that they are not limited to use the preset assets and actions. Future work plans include to evaluate the use of the prototype in terms of usability, creativity support and as a facility to reuse materials. Specifically, we want to carry out experiments evaluating collaboration in groups and how storytelling activities can be combined with other creative tasks. Finally, a more ambitious but interesting future work we aim to pursue is to introduce some autonomous intelligent behavior for the surfacebot to foster and enhance user participation during the storytelling.

¹ Robot Operating System, <http://www.ros.org/>

² Pololu Zumo robot, <https://www.pololu.com/product/2510>

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REFERENCES

1. Alexandra Alves, Roseli Lopes, Patrik Matos, Luiz Velho, Djalma Silva. Reactoon: Storytelling in a Tangible Environment," 2010 Third IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning, Kaohsiung, 2010, pp. 161-165.
2. Thijs Alofs, Mariët Theune, Ivo Swartjes. 2015. A tabletop interactive storytelling system: designing for social interaction. *International journal of arts and technology*, 8(3), 188-211.
3. Katerina Ananiadou, Magdalen Claro. 2009. 21st Century Skills and Competences for New Millennium Learners in OECD Countries. OECD Education Working Papers, No. 41, OECD Publishing.
4. Sonja Baumer, Beth Ferholt, Robert Lecusay. 2005. Promoting narrative competence through adult-child joint pretense: Lessons from the Scandinavian educational practice of playworld. *Cognitive Development*, 20(4), October-December 2005, 576-590.
5. Laura E. Berk. 2009. *Child Development (8th edition ed.)*. Pearson International Edition.
6. Romina Cachia, Anusca Ferrari. 2010. Creativity in schools: A survey of teachers in Europe. *Tech. rep., Institute for Prospective and Technological Studies*, Joint Research Centre
7. Terry A. Campbell. 2012. Digital Storytelling in an Elementary Classroom: Going Beyond Entertainment. *Procedia - Social and Behavioral Sciences*, 69, 385-393.
8. Xiang Cao, Siân E. Lindley, John Helmes, and Abigail Sellen. 2010. Telling the whole story: anticipation, inspiration and reputation in a field deployment of TellTable. In Proceedings of the 2010 ACM conference on Computer supported cooperative work (CSCW '10). ACM, New York, NY, USA, 251-260.
9. Franca Garzotto. (2014). Interactive storytelling for children: a survey. *International Journal of Arts and Technology*, 7(1), 5-16.
10. Amita Gupta. 2009. Vygotskian perspectives on using dramatic play to enhance children's development and balance creativity with structure in the early childhood classroom. *Early Child Development and Care*, 179(8), 1041-1054.
11. Tony Hall. 2012. Digital Renaissance: the Creative Potential of Narrative Technology in education. *Creative Education*, 3(1): 96-100.
12. Jessica D. Hoffmann, Sandra W. Russ. 2016. Fostering pretend play skills and creativity in elementary school girls: A group play intervention. *Psychology of Aesthetics, Creativity, and the Arts*, 10(1), 114-125.
13. Sharon A. Lynch, Cynthia G. Simpson. 2010. Social Skills: Laying the Foundation for Success. *Dimensions of Early Childhood*, 38(2) 3-12.
14. Nuri Kara, Cansu Cigdem Aydin, Kursat Cagiltay. 2014. Design and development of a smart storytelling toy. *Interactive Learning Environments*, 22(3), 288-297.
15. Claudine Kirsch. 2016. Using storytelling to teach vocabulary in language lessons: does it work? *The Language Learning Journal*, 44(1), 33-51.
16. Randy Klaassen, Jordi Hendrix, Dennis Reidsma, Riëks op den Akker, Betsy van Dijk, Harm op den Akker. 2013. Elckerlyc goes mobile - Enabling natural interaction in mobile user interfaces, *International journal on advances in telecommunications*, 6(1-2), 45-56.
17. Aslıhan Kocaman-Karoglu. 2015. Telling stories digitally: an experiment with preschool children. *Educational Media International*, 52(4), 340-352.
18. Kodu Research Project webpage. Retrieved March 10, 2017 from <https://www.microsoft.com/en-us/research/project/kodu/>
19. Marina Fridin. 2014. Storytelling by a kindergarten social assistive robot: A tool for constructive learning in preschool education. *Computers & Education*, 70, 53-64.
20. Iolanda Leite, Marissa McCoy, Monika Lohani, Daniel Ullman, Nicole Salomons, Charlene Stokes, Susan Rivers, and Brian Scassellati. 2015. Emotional Storytelling in the Classroom: Individual versus Group Interaction between Children and Robots. In Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction (HRI '15). ACM, New York, NY, USA, 75-82.
21. Anna Helen Leversund, Aleksander Krzywinski, Weiqin Chen. 2014. Children's Collaborative Storytelling on a Tangible Multitouch Tabletop. In: Streitz N., Markopoulos P. (eds) Distributed, Ambient, and Pervasive Interactions. DAPI 2014. Lecture Notes in Computer Science, vol 8530. Springer, Cham.
22. Ageliki Nicolopoulou, Kai Schnabel Cortina, Hande Ilgaz, Carolyn Brockmeyer Cates, Aline B. de Sá. 2015. Using a narrative- and play-based activity to promote low-income preschoolers' oral language, emergent literacy, and social competence. *Early Childhood Research Quarterly*, 31, 2nd Quarter 2015, 147-162.

23. Jason Ohler. 2008. *Digital Storytelling in the Classroom: New Media Pathways to Literacy, Learning, and Creativity*. SAGE Publications.
24. Vivian G. Paley. 2009. *The Boy Who Would Be a Helicopter*. Harvard University Press.
25. Pedro Ribeiro, Ido Iurgel, Manuel Ferreira. 2011. Voodoo: A System That Allows Children to Create Animated Stories with Action Figures as Interface. In: Si M., Thue D., André E., Lester J.C., Tanenbaum J., Zammito V. (eds) *Interactive Storytelling*. ICIDS 2011. Lecture Notes in Computer Science, vol 7069. Springer, Berlin, Heidelberg.
26. Bernard R. Robin. 2008. Digital Storytelling: A Powerful Technology Tool for the 21st Century Classroom. *Theory Into Practice*, 47(3), 220-228.
27. Kimiko Ryokai, Michael Jongseon Lee, and Jonathan Micah Breitbart. 2009. Children's storytelling and programming with robotic characters. In *Proceedings of the seventh ACM conference on Creativity and cognition (C&C '09)*. ACM, New York, NY, USA, 19-28.
28. Hatice Çıralı Sarıca, Yasemin Koçak Usluel. 2016. The effect of digital storytelling on visual memory and writing skills. *Computers & Education*, 94, March 2016, 298-309.
29. Kathryne M. Speaker, Deborah Taylor, Ruth Kamen. 2004. Storytelling: Enhancing language acquisition in young children. *Education*, 125(1), 3.
30. Masanori Sugimoto. 2011. A Mobile Mixed-Reality Environment for Children's Storytelling Using a Handheld Projector and a Robot. *IEEE Trans. Learn. Technol.* 4, 3 (July 2011), 249-260.
31. Cristina Sylla, Clara Coutinho, Pedro Branco. 2014. A digital manipulative for embodied "stage-narrative" creation, *Entertainment Computing*, 5(4), December 2014, 495-507.
32. Lev Vygotsky. 1978. Interaction between learning and development. *Readings on the development of children*, 23(3), 34-41.
33. Guanyun Wang, Ye Tao, Enmao Liu, Yunfan Wang, Cheng Yao, and Fangtian Ying. 2015. Constructive Play: Designing for Role Play Stories with Interactive Play Objects. In *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '15)*. ACM, New York, NY, USA, 575-580.
34. Jacqueline Kory Westlund and Cynthia Breazeal. 2015. The Interplay of Robot Language Level with Children's Language Learning during Storytelling. In *Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction Extended Abstracts (HRI'15 Extended Abstracts)*. ACM, New York, NY, USA, 65-66.