Introduction of Digital Storytelling in Preschool Education: a Case Study from Croatia

Nives Mikelic Preradovic

nives.mikelic@gmail.com

University of Zagreb

Gordana Lesin

g.lesin.zg@gmail.com

University of Zagreb

Damir Boras

dboras@ffzg.hr

University of Zagreb

Abstract

Our case study from Croatia showed the benefits of digital storytelling in a preschool as a basis for the formal ICT education. The statistical analysis revealed significant differences between children aged 6 – 7 who learned mathematics by traditional storytelling compared to those learning through digital storytelling. The experimental group that used digital storytelling showed significant improvement in their abilities to solve computational and mathematical problems, which suggests that this method was age-appropriate and versatile. Also, the observations of educators from both the experimental and the control group showed that children were more motivated by digital storytelling, succeeding to complete all stories with an incredible amount of engagement and enthusiasm. These findings indicate that interactive multimedia storytelling, compared to the traditional one, can be used as an effective tool for improving child's mathematical and computer literacy skills in the preschool context in which ICT is being introduced for the first time.

Key words

Digital Storytelling in Mathematics, Preschool Education, ICT-supported Learning, Formal Education

I. Introduction

Digital storytelling (DST) commonly refers to the process of developing a multimodal narrative (that includes pictures, video, sound effects, music or text), using digital tools. Although digital stories were primarily intended for self-expression (Hartley & McWilliam, 2009; King, 2008; Meadows, 2003b), their role in teaching and learning is becoming inevitable (Robin, 2008; Sadik, 2008).

The recent research shows that DST can facilitate both the storytelling and the integration of information and communication technology (ICT) in education, bringing many benefits for both teachers and students at all educational levels (Coutinho, 2010; Foley, 2013; Gyabak & Godina, 2011; Heo, 2009; Hung, Hwang, & Huang, 2012; Kearney, 2011; Mantei & Kervin, 2010; Verdugo & Belmonte, 2007; Yang & Wu, 2012).

Although the introduction of ICT in kindergartens is regarded as an out-of-date subject in many developed countries (and is a well-covered topic for over fifteen years), some Eastern European countries (like Croatia that recently joined EU, or other non-EU countries) are still struggling with the introduction of ICT into compulsory education, including preschools. Consequently, no existing research has examined the value of either ICT or DST in a preschool setting in Croatia.

Additionally, fears of preschool educators towards the use of ICT are currently a major topic of research (Hoffman, Park, & Lin, 2015; Kerckaert, Vanderlinde, & van Braak, 2015; Konca, Ozel, & Zelyrut, 2016; Liu, 2015; Masoumi, 2015; Nikolopoulou & Gialamas, 2015; Nolan & McBride, 2013; Turgut, Tunga, & Kişla, 2016). Unfortunately, as some authors point out (Jenkins, 2008, p. 15), "the focus is still on what media are doing to children, when the emphasis should be placed on what children are doing with media".

Therefore, the aim of this paper is to address the necessity of introducing ICT through digital storytelling in preschool education as a basis for the life in a digital age.

II. ICT integration in early childhood education: a literature review

The goal of preschool education is to support the child's development at all levels. During their early childhood, children explore their ability to create using different media and through creative movement. ICT-supported language learning programs (both first and second language programs), ICT-supported mathematics and the computer literacy learning program all represent the important aspect of education in a growing computerized world. On the other hand, knowledge gained in the kindergarten enables child's further education and understanding of the school material.

It is important to enable them to acquire basic skills through preschool programs that foster easier and better application of acquired skills in their everyday life. Digital technologies provide one more channel for them to demonstrate their creativity and learning (Mikelić Preradović, Unić, & Boras, 2014).

Eleven years ago, Council of Europe (2005) has emphasized the importance to “give special encouragement to training for children in media literacy, enabling them to benefit from the positive aspects of the new communication services and avoid exposure to harmful content” in the draft of the *Resolution on human rights and regulation of the media and new communication services in the Information Society*.

Since then, a growing number of researchers that explored the role of ICT in early childhood education (Marsh, 2010; Wohlwend, 2009; Yelland, 2010) are supporting the introduction of ICT into curriculum, emphasizing that young children are able to engage in digital practices in creative and innovative ways (Burnett, 2010).

Early research on the impact of ICT on children's learning and development already indicated positive effects on the cognitive and social development (Haugland & Shade, 1994). Early research also demonstrated that, when compared with traditional activities (such as assembling puzzles with other children or building blocks on the floor), ICT caused different types of interactions, more social interaction and higher levels of language and cooperative-play activity (Clements, Nastasi, & Swaminathan, 1993). Children prefer working with their peers over working alone and, while on computer, they engage in more turn taking and high levels of spoken communication and cooperation.

Furthermore, results of the large study conducted by UNESCO's Institute for Information Technologies in Education (UNESCO, 2010) showed that the use of ICT in early education curriculum (more precisely, in learning mathematical concepts) enhances logical and abstract thinking, development of mathematical reasoning and conduction of experiments as well as the problem solving skills.

Also, a number of researchers have noted the potential of ICT to facilitate children's cognitive, social, and language development (Clements & Sarama, 2003a; McCarrick & Li, 2007). Furthermore, enhancement in problem solving, child's concentration and motivation were found as evidence of engagement with ICT (O'Hara, 2008 as cited in Garvis, 2016). Children playing computer games were motivated to learn in new and different ways (Yelland, 2002), while history computer games showed potential for the development of self-reflection and cultural analysis, since they encouraged children to draw on facts they learned in class and their own experiences (Jenkins, 2008).

Research also shows that appropriate use of ICT allows children to develop skills such as language development and literacy (Morrow, 2009).

Another study that explored web searching of young children in kindergarten (Spink, Danby, Mallan & Butler, 2010) showed that even children of this young age were able to formulate advanced search queries with keywords, browse the Web, make relevance judgments, perform successive searches and information multitasking.

Critics of ICT-supported education, such as Cordes and Miller (2000), have expressed concern that the ICT use might inhibit language, emotional, moral and social development and lead to social isolation. They also list risks to physical health, intellectual development, concentration and creativity. There is a fear among educators that, compared to the outdoor play, which is socially, culturally and developmentally beneficial for children, ICT might not be able to bring such a benefit (Frost, 2010).

Wolfe and Flewitt (2010, p. 391) confirm this fear in their study of ICT integration in early childhood education in UK, reporting that "educators feared that children's lives were being made toxic through increasing use of new technologies, inactivity and inability to critically evaluate competing sources of information". Also, researchers report about adult's concerns that ICT enables children to (accidentally or deliberately) access inappropriate content online and risk their personal safety engaging in online activities (Miller, 2005).

Due to these fears, educators' personal resistance to computer use (or computer anxiety) and several safety hazards linked with the use of ICT in early childhood that were cited in the literature, ICT still remains a marginal priority for many early childhood practitioners (Nolan and McBride, 2013).

Despite the critics of ICT-supported education, there is a growing understanding that, when used appropriately, ICT has the potential to increase child's learning experience (Clements, 2002). There is also increased recognition that computer-based instruction can be effectively integrated into early childhood education curriculum (Plowman & Stephen, 2005), motivating the development of reading fluency and other development opportunities (Clements & Sarama, 2003b).

But, the introduction of ICT in early childhood and preschool education needs to be based on a careful selection of activities through which children will be able to adopt the targeted content.
On the basis of their work on a guided enquiry, Plowman, Stephen and McPake (2010, p. 93) defined three main areas of learning that ICT can be used for: "extending knowledge of the world, acquiring operational skills, and developing dispositions to learn".

Regarding the results of the introduction of ICT in early childhood education, the positive impacts have been documented in many publications. Computer-animated stories are found useful and relevant for the language development (Verhallen, Bus & DeJong, 2006), while the process of writing photograph captions in the digital photography project resulted in significant progress in expressive vocabulary development (Labbo, Love & Ryan, 2007). With the help of ICT, reluctant and untidy little writers are encouraged to engage in writing activities using word-processing tools (Beck & Fetherston, 2003). Furthermore, a study by Weiss, Kramarski and Talis (2006) brings findings on ICT-supported mathematics education in kindergarten, where children who used ICT demonstrated greater achievement than those who learned mathematics with traditional tools. Also, the study that investigated the impact of ICT on the psychomotor skills and school readiness, reported that children who used ICT outperformed the other group on the school readiness test (Li, Atkins & Stanton, 2006).

However, in order for ICT to become an effective educational tool that would improve child's cognitive skills, strong interpersonal ties between children and educators represent a necessity (Nir-Gal & Klein, 2004). Also, educators who decide to use ICT in early childhood education curriculum need to ensure that ICT "supports the development of positive dispositions towards learning" (Siraj-Blatchford & Siraj-Blatchford, 2006, p. 5) and that ICT is used in a developmentally appropriate manner (Fischer & Gillespie, 2003). Educators can provide guidance to young children that interact with ICT in several ways (Plowman & Stephen, 2005, p. 152): "explaining how to use software, demonstrating how to use a tool, suggesting alternative actions, moving children to an appropriate level of difficulty, offering remedial help when errors occur or sharing pleasure in features such as animation".

Finally, Espinosa, Laffey, Whittaker and Sheng (2006) suggest that enabling access to ICT for young children does not imply the benefit and improvement of child's skills, pointing out that educators need to moderate the use of ICT for young children.

III. Research Methodology

Although traditional storytelling has been used in kindergartens in Croatia for many years, the use of ICT and digital storytelling represents a novel approach to teaching and learning.

The purpose of this study was to find out the impact of using digital storytelling (DST) on children's achievement in a preschool mathematics curriculum as well as on their computer literacy skills. The additional goal was to compare the motivation, interaction and engagement of children aged 6 to 7 in DST activities (that included children's short video narrative, animation and digital images) and storyteling activities that used only raw materials (paper, glue and printed picture cards).
The pre- and post-test surveys were developed by kindergarten educators and members of the professional kindergarten team.

At the start of their preschool year in Croatia, children are not required to possess reading or writing skills. Therefore, as a pre-test of the computer and mathematical literacy of each child, educators had to fill in two non-standardized tests in the form of an interview.

Regarding the computer literacy, educators estimated child’s independence in the following activities: turning computer on/off, mouse use, finding numbers and letters on the keyboard, typing letters on the keyboard, typing words, finding files on the desktop or using “search” option, using drop-down menus, using toolbars, using drawing tools, using CD/DVD ROM unit, creating and opening new folders and saving files on the computer.

The total score for each child is a simple linear combination of the results of the individual particles, with the theoretical range from 0 to 48 points. A higher total score indicates a higher level of computer literacy of the child. The internal consistency of the scale was also measured by the Cronbach's alpha coefficient (α = 0.95), which indicates a very high reliability of the measuring instrument.

As a pre-test of the mathematical literacy of each child in the experimental group - Jingle Bells and the control group - Bunnies, a non-standardized test in the form of an interview was used with questions from the geometry (geometrical shapes and bodies), counting and number patterns (numbers 1 to 20), spatial sense (relations between objects), as well as addition and subtraction of one or two elements to a set of objects. The sample question (Figure 1) was: "Imagine you have 6 baloons, but 2 balloons got popped. How many balloons do you have now?"

The total score for each child is a simple linear combination of all scores, with the theoretical range from 0 to 20 points. A higher total score indicates a higher level of mathematical literacy. The Cronbach's alpha coefficient was $\alpha = 0.70$.

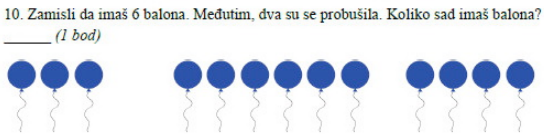

Figure 1. How many balloons are left?
Source: Non-standardized test developed by educators and members of the professional team of the kindergarten Milan Sachs in Zagreb, Croatia

Analysis revealed no statistically significant difference in the mathematical literacy and computer literacy between the experimental and the control group in the pre-test.

Three times a week during one school year, children in both groups were learning mathematics though DST or traditional storytelling (as part of planned educational activities for the day).
The independent variable was the teaching method, while the dependent variable was the children's acquisition of mathematics.

Whereas the preschoolers in the experimental group created a digital story, the children in the control group created a story using picture cards. The narrative in both groups was the same. The main subjects of the stories were geometrical shapes and bodies, numbers, spatial relations, addition and subtraction operations, which resulted in four digital and four non-digital stories at the end of the year.

Both kindergarten educators and preschoolers actively participated in the creation and the production of stories. In the experimental group, they acted as storywriters, collecting the online available materials (images, music and animations), sequencing the elements, creating the short narrative videos (with children as narrators) and composing the final storyboard in Prezi. The university teacher experienced with DST assisted educators in the experimental group during the digital story production and design of the prezi using the Seven Elements of Digital Storytelling (Robin, 2006). He provided them with the guidance through all stages of the authoring process.

In the first stage, educators have chosen 4 stories that are worth to tell. These stories were the same in both the experimental and the control group. For example, they have created the storyboard for learning geometrical shapes and bodies based on the picture book for children about shapes. (In that book, mouse Sivko likes to sit on the top of the round cheese, while penguin Zimko prefers sitting on an ice cube. Bear Brundo could eat triangle pizza every day, while dog Fido likes to play with paper kites in the shape of a rhombus. Owl Zoe loves the crescent moon, while cat Franc adores stars.)

In the second stage, educators have drafted the initial four scenarios, while the third stage consisted of the development of storyboards. In the experimental (Jinglebells) group, all elements of the structure were collected by educators and preschoolers using ICT: images retrieved from the web and digital text that will be placed on Prezi canvas. In the control group, educators and preschoolers were using raw materials (picture cards cut with scissors and colored with crayons) to create the same storyboards, without ICT resources.

In both groups, as part of the fourth stage, educators discussed the scenarios with kindergarteners to ensure that they all understand the concepts, the flow of the narrative, the use of the appropriate words and that they stay focused on the story.

In the next stage, educators and children in the Jinglebells group have set the path in Prezi to present and connect the elements (images, text and frames) and to be able to pan, zoom, and rotate while moving through the prezi in an order that they planned in the previous steps, creating a narrative that will carry them through the prezi. After that, educators recorded the voice of the narrators (children in the group who were willing to participate) and added children's voices in prezis. Finally, they added the transitions: canvas rotation and fade-in animations to make their stories more appealing. In the same time, educators and children in the control group (Bunnies) used picture cards that they colored themselves and cut-out texts that they glued together to create a narrative in the form of a picture book. Children were encoraged to tell the stories out loud as they flipped through the pages of the picture books they have created.

Finally, children in both groups were engaged in discussions, collaboration and critical thinking at all stages of the project.

The observations of educators from both groups showed that children were more motivated by DST, succeeding to complete all four stories with an incredible amount of engagement and enthusiasm. On the other hand, children in the control group were more restless, sometimes even unready to contribute and were asking if they could do something else.

The post-test surveys used at the end of the school year were similar to pre-test surveys, with some additional facts about the narratives. The sample question (Figure 2) was: "Below or above: which fish is below the line?"

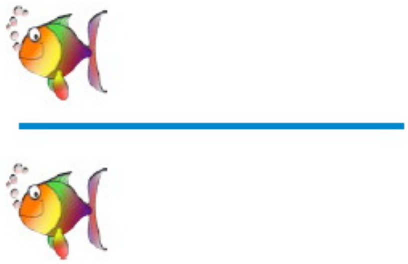

Figure 2. Below or above: which fish is below the line?
Source: Non-standardized test developed by educators and members of the professional team of the kindergarten Milan Sachs in Zagreb, Croatia

a. Participants

The experiment was conducted in Milan Sachs public kindergarten in Croatia with the experimental group Jingle Bells (N = 29) and the control group Bunnies (N = 26). These groups were randomly assigned their roles in the experiment which lasted for a whole school year. Children were aged 6-7 years. ICT resources used in the experimental group were: digital camera, cell phone / smart phone, computer, tablet and different computer (text, video and image editing) software.
Since educators worked with small children who cannot withstand the long-term testing, they decided not to give the computer literacy test and mathematical literacy tests to children in the same day. Consequently, not all children were present in both tests, which yielded a difference in the number of participants (N) in each test.

c. Results

Computer Literacy – Differences between the experimental group (Jingle Bells) and the control groups (Bunnies)

At the end of the school year, t-test was conducted to determine whether there is a statistically significant difference in computer literacy of children who learned through DST and children who were taught using traditional storytelling.

		N	M	Sd
Computer literacy	Jingle Bells	25	34.64	7.38
	Bunnies	20	22.35	6.63

Table 1. Descriptive results of educators‵ evaluation of children's computer literacy in experimental and control groups
Source: Compiled by author

It is evident from Table 1 that children who used DST in kindergarten ($M = 34.64$, $Sd = 7.38$) achieved higher scores in computer literacy than children who participated in the traditional storytelling ($M = 22.35$, $Sd = 6.63$). However, it was necessary to check the statistical significance of the difference obtained.

	Group			
	Experimental	**Control**	**t**	**df**
Computer literacy	34.64	22.35	5.80*	43
	(7.38)	(6.63)		

Table 2. T-test of computer literacy in experimental and control groups
- p <0.05; standard deviations are shown in parentheses below the arithmetic means

Source: Compiled by author

Table 2 shows the results of t-test, which aimed to test the degree of difference in computer literacy between the control and the experimental group. Prior to the implementation of t-test, Levene's test of homogeneity of variance was conducted ($F(1,43) = 1.04$, $p = 0.31$) which showed the homogeneous variances at the 5% level of significance.

T-test with 95% confidence interval (CI) of difference in means ($t(43) = 5.80$, $p = 0.00$) showed that the experimental group has achieved statistically significantly better results in computer literacy than the control group. The mean difference was 12.29 (95% CI, 8.02 do 16.56). Cohen's d was 1.75, indicating a large effect size, i.e., a shift of one and a half standard deviations.
It means that around 96% of participants in the experimental group achieved a higher score than the arithmetic mean of the control group, while only 40% of results of the two groups overlap. Consequently, there is around 89% chance that a randomly selected child from the experimental group achieved higher scores in the computer literacy than a randomly selected child from the control group.

Mathematical Literacy – Differences between the experimental group (Jingle Bells) and the control groups (Bunnies)

T-test was also conducted to determine whether there is a statistically significant difference in mathematical literacy of children who learned through DST and children who were taught using traditional storytelling.

Table 3 shows that children who were taught mathematical skills through DST achieved slightly higher results (M = 17.10, Sd = 3.14) in the mathematical literacy test than children who were taught in a traditional way (M = 14.90, Sd = 2.63). However, it was necessary to check the statistical significance of the difference obtained.

		N	M	Sd
Mathematical literacy	Experimental group (Jingle Bells)	20	17.10	3.14
	Control group (Bunnies)	21	14.90	2.63

Table 3. Descriptive results of educators‘ evaluation of children’s mathematical literacy in experimental and control groups
Source: Compiled by author

Table 4 shows the results of t-test, which aimed to test the degree of difference in mathematical literacy between the control and the experimental group. Prior to the implementation of t-test, Levene's test of homogeneity of variance was conducted (F (1.39) = 0.21, p = 0.65), which showed the homogeneous variances at the 5% level of significance.

T-test with 95% confidence interval (CI) of difference in means (where t (39) = 2.43, p=0.02) showed that the experimental group has achieved statistically significantly better results in mathematical literacy than the control group. The mean difference was 2.195 (95% CI, 0.37 to 4.02). Cohen’s d was 0.76, indicating a middle to high effect size.

	Group			
	Experimental	**Control**	**t**	**df**
Mathematical literacy	17.10	14.90	2.43^{*}	39
	(3.14)	(2.63)		

*p <0.05; standard deviations are shown in parentheses below the arithmetic means
Table 4. T-test of mathematical literacy in experimental and control groups
Source: Compiled by author

IV. Conclusion

The statistical analysis conducted at the end of the school year confirmed our hypothesis that digital storytelling in early childhood education contributes to the development of both mathematical and computer literacy skills.
We have obtained statistically significant differences in the performance of children who were taught in a traditional manner and those who participated in DST.
At the end of the school year, the experimental group that used DST showed significant improvement in their abilities to solve computational and mathematical problems, which suggests that this method was age-appropriate and versatile.
Additionally, the observations of educators from both groups showed that children were more motivated by DST, succeeding to complete all four stories with an incredible amount of engagement and enthusiasm. These observations are in line with findings of some other researchers who claim that the enhancement of children's concentration, collaboration and motivation are distinguishable advantages of DST over traditional storytelling (Robin, 2008; Sadik, 2008).

The basic limitation of this study was the small number of participants, restricting the ability to generalize our results.

In conclusion, it would be advisable to repeat the study in other early childhood education settings, to provide a larger sample size that would allow further generalizations. It would also be interesting to examine the contribution of digital storytelling to other areas of early childhood development and to the skill development of school-aged children.
In this case study, digital storytelling proved to be a better methodological resource for teaching preschool children. Our findings indicate that interactive multimedia storytelling, compared to the traditional one, can be used as an effective tool for improving child's mathematical and computer literacy skills in the preschool context in which ICT is being introduced for the first time, which is in line with results of some studies mentioned in this paper (Garvis, 2016; Weiss, Kramarski & Talis, 2006).

The results also indicate the need for the introduction of ICT in the system of early education in the form of systematic learning support for the youngest children, with the aim of furthering their success in various areas of development.

References

Beck, N., & Fetherston, T. (2003). The effects of incorporating a word processor into a year three writing program. *Information technology in childhood education annual, 1,* 139-161.

Burnett, C. (2010). Technology and literacy in early childhood educational settings: a review of research. *Journal of early childhood literacy, 10(3),* 247-270. doi: 10.1177/1468798410372154

Clements, D.H., B.K. Nastasi, & Swaminathan, S. (1993). Young children and computers: Crossroads and directions from research. *Young Children, 48(2),* 56-64.

Clements, D. H. (2002). Computers in early childhood mathematics*. Contemporary Issues in Early Childhood Education, 3*, 160–181.

Clements, D.H., & Sarama, J. (2003a). Strip mining for gold: Research and policy in educational technology - a response to "Fool's gold". *Educational Technology Review, 11(1),* 7-69.

Clements, D., & Sarama, J. (2003b). Young children and technology: What does the research say? *Young Children, 58(6),* 34-40.

Cordes, C., & Miller, E. (2000). *Fool's gold: A critical look at computers in childhood*. College Park, MD: Alliance for childhood.

Coutinho, C. (2010). Storytelling as a strategy for integrating technologies into the curriculum: An empirical study with post-graduate teachers. In C. Maddux, D. Gibson & B. Dodge (Eds.), *Research Highlights in Technology and Teacher Education 2010* (pp. 87-97). Chesapeake, VA: SITE.

Espinosa, L.M., Laffey, J.M., Whittaker, T., & Sheng, Y. (2006). Technology in the Home and the Achievement of Young Children: Findings from the Early Childhood Longitudinal Study. *Early Education and Development, 17(3),* 421-441. doi: 10.1207/s15566935eed1703_5

Fischer, M., & Gillespie, C. W. (2003). Computers and Young Children's Development. *Young Children, 58(4),* 85-91.

Foley, L. M. (2013). *Digital storytelling in primary-grade classrooms* (Unpublished PhD. Dissertation). USA: University of Arizona State.

Frost, J. L. (2010). *A history of children's play and play environments*. New York, NY: Routledge.

Garvis, S. (2016). Digital technology and young children's narratives. In S. Garvis & N. Lemon (Eds.), *Understanding Digital Technologies and Young Children: An international perspective*. (pp. 28-37). Abingdon, Oxfordshire: Routledge (Taylor & Francis Group).

Gyabak, K., & Godina, H. (2011). Digital storytelling in Bhutan: A qualitative examination of new media tools used to bridge the digital divide in a rural community school. *Computers & Education, 57*(4), 2236-2243.

Hartley, J., & McWilliam, K. (2009). Computational power meets human contact. In J. Hartley & K. McWilliam (Eds.), *Story Circle: Digital storytelling around the world* (pp. 3-15). Chichester, UK: Wiley-Blackwell.

Haugland, S.W., & Shade, D.D. (1994). Software evaluation for young children. In J.L. Wright & D.D. Shade (Eds.), *Young children: Active learners in a technological age* (pp. 63–76). Washington, DC: National Association for the Education of Young Children.

Heo, M. (2009). Digital storytelling: An empirical study of the impact of digital storytelling on pre-service teachers' self-efficacy and dispositions towards educational technology. *Educational Multimedia and Hypermedia, 18* (4), 405-428.

Hoffman, E. S., Park, E., & Lin, M. G. (2015). Beyond Professional Development: A Case Study of Implementing iPads in Early Childhood Education. In D. Slykhuis & G. Marks (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2015* (pp. 2008-2015). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Hung, C. M., Hwang, G. J., & Huang, I. (2012). A project-based digital storytelling approach for improving students' learning motivation, problem-solving competence and learning achievement. *Educational Technology & Society, 15* (4), 368-379.

Jenkins, H. (2008). Media literacy – Who needs it? In T. Willoughby & E. Wood (Eds.), *Children's Learning in a Digital World.* (pp. 15-39). Malden, MA: Blackwell.

Kearney, M. (2011). A learning design for student-generated digital storytelling. *Learning, Media and Technology, 36* (2), 169-188.

Kerckaert, S., Vanderlinde, R., & van Braak, J. (2015). The role of ICT in early childhood education: Scale development and research on ICT use and influencing factors. *European Early Childhood Education Research Journal, 23(2),* 183-199. doi: 10.1080/1350293X.2015.1016804

King, L. (2008). Digital storytelling: stories create a storm. *The Journal for the School Information Professional, 12(4),* 4-6.

Konca, A. S., Ozel, E., & Zelyurt, H. (2016). Attitudes of preschool teachers towards using information and communication technologies (ICT). *International Journal of Research in Education and Science (IJRES), 2(1)*, 10-15.

Labbo, L., Love, M., & Ryan,T. (2007). A vocabulary flood: Making words "sticky" with computer-response activities*. Reading teacher 60(6)*, 582-588. doi: 10.1598/RT.60.6.10

Li, X., Atkins, M. S., & Stanton, B. (2006). Effects of Home and School Computer Use on School Readiness and Cognitive Development Among Head Start Children: A Randomized Controlled Pilot trial*. Merrill-Palmer Quarterly, 52(2)*, 239-263. doi: 10.1353/mpq.2006.0010

Liu, X., & Pange, J. (2015). Early Childhood Teachers' Access to and Use of ICT in Teaching: The Case of Mainland China. In *Proceedings of Global Learn 2015* (pp. 590-596). Berlin, Germany: Association for the Advancement of Computing in Education (AACE).

Mantei, J., & Kervin, L. K. (2010). This Is Me! Empowering children to talk about their learning through digital story. In A. Kanganas (Eds.), *aWAy with Words* (pp. 1-15). Adelaide, South Australia: ALEA/AATE.

Marsh, J. (2010). Young children's play in online virtual worlds. *Journal of Early Childhood Research, 8(1),* 23–29. doi: 10.1177/1476718X09345406

Masoumi, D. (2015). Preschool Teachers' use of ICTs : Towards a typology of practice. *Contemporary Issues in Early Childhood*, *16 (1),* 5-17.

McCarrick, K., & Li, X. (2007). Buried treasure: The impact of computer use on children's social, cognitive, language development and motivation*. Association for the Advancement of Computer in Education Journal, 15(1),* 73-95.

Meadows, D. (2003b). Digital Storytelling: Research-Based Practice in New Media. *Visual Communication, 2(2),* 189-193.

Mikelić Preradović, N., Unić, D., & Boras, D. (2014). Preschool and Primary School Children as Multimedia Learners. *International journal of education and information technologies*. 8, 171-178.

Miller, E. (2005). Fighting technology for toddlers. *Education digest, 71(3),* 55-58.

Morrow, L. (2009). *Literacy development in the early years: Helping children read and write* (6th ed.). Boston: Pearson.

Nikolopoulou, K., & Gialamas, V. (2015). ICT and play in preschool: Early childhood teachers' beliefs and confidence. *International Journal of Early Years Education 23(4),* 409-425. doi: 10.1080/09669760.2015.1078727

Nir-Gal, O., & Klein, P. S. (2004). Computers for cognitive development in early childhood-the teacher's role in the computer learning environment. *Information Technology in Childhood Education Annual*, *16*, 97-119.

Nolan, J., & McBride, M. (2013). Beyond gamification: reconceptualizing game-based learning in early childhood environments. *Information, Communication & Society, 17(5),* 594-608. doi: 10.1080/1369118X.2013.808365

Plowman, L., & Stephen, C. (2005). Children, play, and computers in pre-school education. *British Journal of Educational Technology, 36(2),* 145-157. doi: 10.1111/j.1467-8535.2005.00449

Plowman, L., Stephen, C., & McPake, J. (2010). Supporting young children's learning with technology at home and in preschool. *Research Papers in Education, 25(1),* 93–113. doi: 10.1080/02671520802584061

Robin, B. R. (2008). Digital storytelling: a powerful technology tool for the 21st century classroom. *Theory into Practice*, *47(3)*, 220-228.

Robin, B. R. (2006). The Educational Uses of Digital Storytelling. In C. Crawford, R. Carlsen, K. McFerrin, J. Price, R. Weber & D. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2006* (pp. 709-716). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Sadik, A. (2008). Digital storytelling: a meaningful technology-integrated approach for engaged student learning. *Educational Technology Research and Development, 56*(4), 487-506.

Siraj-Blatchford, I., & Siraj-Blatchford, J. (2006). *A Guide to Developing the ICT Curriculum for Early Childhood Education*. Stoke-on-Trent: Trentham Books.

Spink, A. H., Danby, S. J., Mallan, K. M., & Butler, C. (2010). Exploring young children's web searching and technoliteracy*. Journal of Documentation, 66(2)*, 191-206. http://dx.doi.org/10.1108/00220411011023616

Turgut, G., Tunga, Y., & Kişla, T. (2016). Technology education in preschool: an applied sample lesson. *International Journal on New Trends in Education and Their Implications 7(1),* 81-92.

United Nations Educational, Scientific and Cultural Organization. (2010). *Recognizing the potential of ICT in early childhood education: Analytical survey*. Moscow, Russia: UNESCO Institute for Information Technologies in Education. Retrieved from http://unesdoc.unesco.org/images/0019/001904/190433e.pdf.

Verdugo, D. R., & Belmonte, I. A. (2007). Using digital stories to improve listening comprehension with Spanish young learners of English. *Language Learning and Technology, 11*(1), 87-101.

Verhallen, M., Bus, A., & DeJong, M. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of educational psychology, 98(2),* 410-419. http://dx.doi.org/10.1037/0022-0663.98.2.410

Weiss, I., Kramarski, B., & Talis, S. (2006). Effects of multimedia environments on kindergarten children's mathematical achievements and style of learning. *Educational Leadership, 63(4),* 29-32.

Wohlwend, K. (2009). Early adopters: Playing new literacies and pretending new technologies in print-centric classrooms*. Journal of Early Childhood Literacy, 9(2)*, 117–140. doi: 10.1177/1468798409105583

Wolfe, S., & Flewitt, R. (2010). New technologies, new multimodal literacy practices and young children's metacognitive development. *Cambridge Journal of Education, 40(4),* 387–399. doi: 10.1080/0305764X.2010.526589

Yang, Y. C., & Wu, W. I (2012). Digital storytelling for enhancing student academic achievement, critical thinking, and learning motivation: A year-long experimental study. *Computers & Education, 59*, 339-352.

Yelland, N. (2002). Playing with ideas and games in early childhood mathematics. *Contemporary Issues in Early Childhood, 3,* 197–215. doi:10.2304/ciec.2002.3.2.4

Yelland, N. (2010). New technologies, playful experiences, and multimodal learning. In I. R. Berson & R. J. Berson (Eds.), *High-tech tots: Childhood in a digital world*. (pp. 5–22). Charlotte, NC: Information Age Publishing.

Subscribe & Contact DER

In order to subscribe to DER, please fill the form at http://greav.ub.edu/der