Developing Digital Storytelling Applications for Preschoolers. An Experience Report

Anamaria Moldovan[1], Adriana-Mihaela Guran[2,] Grigoreta-Sofia Cojocar[2]

[1] Albinuța Kindergarten, Cluj-Napoca, Romania
27 Gr. Alexandrescu, Cluj-Napoca, Romania
E-mail: anabeekindergarten@gmail.com

[2]Babes-Bolyai University, Faculty of Mathematics
1 M. Kogălniceanu, Cluj-Napoca, Romania
E-mail: {adriana, grigo}@cs.ubbcluj.ro

Abstract. Digital storytelling is a worldwide known concept, adopted by many countries for its educational uses and studied in various forms, unfortunately less explored in the Romanian teaching-learning space due to other priorities regarding education. The lack of related case studies in the Romanian educational space brings the opportunity to adapt the concept to the needs of preschoolers and teachers. Stories, spoken or written, have always been a part of human life, an experience to learn, to know or to be known. Technology, as well, became a part of everyday life and its usage should be oriented to the benefit of the next generations. These brought the idea of combining stories and technology and adapt the combination in order to serve educational purposes. This paper is a report of building digital storytelling applications for Romanian preschoolers attending the public formal kindergarten system. All the applications were built by students during the Design of Interactive Software Systems (DISS) compulsory course for Software Engineering Master Degree.

Keywords: Digital Storytelling, Kindergarten, Education, Preschoolers.

1. Introduction

For the Romanian preschool education the last decade meant a period of profound changes in the conception of the curricular program but also in the level of the didactic approaches. Faced with important challenges of reforming the educational strategy and practice, the kindergarten proved open and able to integrate the new one, the curricular reform so present in recent years being regarded as a real opportunity to diversify the didactic approaches, to test the newest theoretical principles, implementing and

evaluating the efficiency of innovative teaching practices, the beneficiary of all these approaches being the preschool child.

This paper illustrates an attempt of preparing the preschool child for literature integrated with using technology. We use a technical approach to support the development of some human skills: to listen, to memorize, to discover, to express their feelings, to transpose in their own drawing images from an audited text, precisely to emphasize the need of these skills to be formed, learned and practiced using modern devices (computer, mobile phone etc.) and other instruments.

Children are fascinating because they resemble adults, but at the same time they are different from them: on one hand they have the potential to develop the whole range of human capacity that we value in mature individuals, and on the other, they have skills and requirements on their own, specific to each age, that we must consider, respect, and needs to be satisfied. The essence of childhood is the evolution (transformation), one coordinated, guided and even organized by the adult. For the teachers these represent challenging activities from an intellectual point of view, but also many emotionally satisfying ones.

The evolution of society depends on how we grow and educate current and future generations. If we teach them to appreciate, to read, to taste the book, implicitly the literary text, they will do it perfectly, but including a computer in performing these activities, makes it innovative.

According to the research of the American psychologist A. Gesell, up to 3, the child is a conformist, at 4 he becomes excessively fantasist and, at 5, he reaches the "golden age" (Gesell, A., 1940).

In order to act optimally in favor of children during the mentioned age periods, it is necessary to implement appropriate working methods with them, validated modalities and use the experience gained in the field.

Considering optimizing the preparation of children aged 5-6/7 in order to adapt to the school activity period, the focus should be on those types of activities that support the development of communication, the development of children's creativity and their ability to use their knowledge gained to new situations, as well as those that keep awake the desire to know, to explore the environment.

The introduction of Marin Sorescu's children's texts at the preschool level was intended to be a unique experience, beneficial for the development of language, thinking, creativity and imagination. The new curriculum gives teachers freedom to choose "play" texts, and in our opinion, these fulfill the

conditions of readability, humor, didactics, and strengths in "tasting" them by preschoolers. Accompanied by images and even illustrated, they provide children a wide range of information about the concrete world, broad possibilities for language enrichment, as well as possibilities for phonemic listening, as it will be revealed throughout the activities.

The present paper presents our approach to the development of a literary "foundation" of the preschool child, on which the knowledge will be built in the following school cycles, all these through the use of a computer.

Preschool stage, kindergarten time is dominated by discovering the world through games and playing (Piaget, 1968; *Romanian National Curriculum For Preschoolers aged 3 to 6/7, 2008)*. This stage is the proper start in making acquaintance with using devices in a joyful and pleasant way, making a transition from listening to a song or a story, to pressing a button to listen to them, to interact according to rules and pay attention to the process of interacting. This brought the idea of building applications to serve the teaching environment as well as the learning process and cover the literary foundation side of the process, as the development of the communication skills of the preschoolers occupies a main place in the educational process from kindergarten, the language being one of the essential conditions of the personality formation of the child.

In the next sections, we describe the process of building digital storytelling applications in the context of using literature texts, already written stories for the intended purpose of teaching-learning in the formal kindergarten system.

2. State-of-the-Art

Digital storytelling at its most basic core is the practice of using computer-based tools to tell stories. There are a wealth of other terms used to describe this practice, such as digital documentaries, computer-based narratives, digital essays, electronic memoirs, interactive storytelling, etc.; but in general, they all revolve around the idea of combining the art of telling stories with a variety of multimedia, including graphics, audio, video, and Web publishing.

As with traditional storytelling, most digital stories focus on a specific topic and contain a particular point of view. However, as the name implies, digital stories usually contain some mixture of computer-based images, text,

recorded audio narration, video clips, and/or music. Digital stories can vary in length, but most of the stories used in education typically last between 2 and 10 minutes. The topics used in digital storytelling range from personal tales to the recounting of historical events, from exploring life in one's own community to the search for life in other corners of the universe, and literally, everything in between.

Despite its emphasis on computer technology, digital storytelling is not a new practice. One of the field's most noted pioneers is Joe Lambert, the co-founder of the Center for Digital Storytelling (CDS), a nonprofit, community arts organization in Berkeley, California. The CDS has been assisting young people and adults in the creation and sharing of personal narratives through the combination of thoughtful writing and digital media tools since the early 1990's.

Another pioneer in the field, British photographer, author, and educator Daniel Meadows defined digital stories as "short, personal multimedia tales told from the heart" (Meadows, D., 2003). The beauty of this form of digital expression, he maintained, is that these stories can be created by people everywhere, on any subject, and shared electronically all over the world. Meadows added that digital stories are "multimedia sonnets from the people" in which "photographs discover the talkies, and the stories told assemble in the ether as pieces of a jigsaw puzzle, a gaggle of invisible histories which, when viewed together, tell the bigger story of our time, the story that defines who we are."

Researcher and digital culture consultant, John Seely Brown (Brown, 2001) emphasized that children are now growing up in a digital world and to they have the ability to build interpretive movies very simply and lay sound tracks around the content. They condition or "sculpture" the context around the content. The serious interplay between context and content is key to what film—and rich media in general—are about.

Today the use of digital storytelling is being practiced in neighborhood community centers, schools, libraries and businesses, by novice technology users to those with advanced skills. In the field of education, teachers and their students, from early childhood classrooms through graduate school, are using digital storytelling in many different content areas and across a wide range of grade levels.

There are numerous ways that Digital Storytelling can be used in education. One of the first decisions to be made when deciding to use this

tool in the curriculum is whether an instructor will create the Digital Stories or have their students do it. Some educators may decide to create their own stories and show them to their students as a way to present new material. An engaging, multimedia-rich digital story can serve as an anticipatory set or hook to capture the attention of students and increasing their interest in exploring new ideas.

Teacher-created digital stories may also be used to enhance current lessons within a larger unit, as a way to facilitate discussion about the topics presented a story and as a way of making abstract or conceptual content more understandable. While many educators still lack a cohesive plan for integrating multimedia into their instruction, a growing number of teachers are interested in exploring ways to engage their students by including images, audio and video elements in their instruction. Research has shown that the use of multimedia in teaching helps students retain new information as well as aids in the comprehension of difficult material. Digital Storytelling can provide educators a powerful tool to use in their classrooms.

Relevant papers in recent literature describe the impact of introducing digital storytelling in schools, in the traditional approach of the concept, but starting with the first and secondary grade, when children already have literacy skills-reading, writing (Foley, 2013; Robin, 2016).

Preschoolers' Education in Romania

Preschool education has some essential characteristics:
- it is carried out on several levels (instructive - with emphasis on transmitting a set of knowledge related to the immediate environment of the child's existence and educational - with emphasis on the process of forming and developing the personality of the child and his ability to adapt to the environment);
- it is multidimensional, targeting all the defining compartments for the human personality: psychic processes and learning capacities (intellectual education), behavior in society and in relations with others (moral-civic education), valuing the beauty of nature, society and art (aesthetic education), the ability to act on objects and use them (technological education), enhancing the state of health of the body (physical and health education);
- it is adaptable to the changes that occur in the evolution of the child

by moving from one age stage to another, which means that it is dynamic, flexible, reconsidering its means, resources according to the needs of the child at a given time.

The concrete educational action gains in content and efficiency by taking into account these characteristics on the basis of which a clear, coherent, unitary working methodology can be developed, capable of concentrating human and material resources in order to serve them for explicit purposes.

Considered global, the kindergarten is one of the educational environments with an essential impact on the process of development and socialization of the child.

The study domains are established by the National Curriculum: Science, Language and Communication, Human and Society, Sports, (Bloom, 1956; Romanian National Curriculum For Preschoolers aged 3 to 6/7, 2008). The educational activities are carried out in the form of integrated activities that bring together several domains. These can be classified into: activities for teaching new content, consolidating a known one or teaching games. Depending on the type of activity, each one has well-established stages: capturing attention, updating knowledge, presenting new content, consolidating knowledge, testing game, game variants, etc. and the application could be present at any of these times.

A digital application, based on a story, can be a pretext for a new theme (e. g. animals), for a literary text, for some words, or it can be in several activities on its own, or the children can use the application whenever they want, after they have got familiar with the content. Eg. an animal from a story can be presented separately - description of appearance, mode of feeding, breeding, usage (if any), description of habitat, family etc.

Unfortunately, there are not so many applications with such specific content, only various materials, and those that exist cannot be used by children without the help of the adult.

3. METHOD

3.1 Understanding users' needs

Phase 1: Users' needs analysis
First year Software Engineering Master students from Babeș-Bolyai University, Faculty of Mathematics and Computer Science have a

compulsory course called Design of Interactive Software Systems (DISS) where they study facts about users, usability of a product and user centered design (UCD). In order to illustrate all the theoretical explanations the professor invited a real client, a kindergarten teacher who described the activity of preschoolers and pointed out the necessity of teaching young children about technology and using different devices (computer, mobile phone) in an educational way. The presentation started with an introduction to the Romanian educational system regarding kindergarten from a general perspective: program, activities, national curriculum, age stages, features of development, content, knowledge (Bloom, 1956; *Romanian National Curriculum For Preschoolers aged 3 to 6/7, 2008)*.

The client (the kindergarten teacher) pointed out the use of several devices (computer, smartphone) in the process of teaching-learning but also the necessity of organizing their use for educational purpose in an entertaining way: *playing*. Her presence there was to provide content and assist the students in transporting textual stories into digital stories for preschoolers, large group, aged 5 to 6.

The client also provided some reading materials for the students: parts from the National Curriculum (content, themes, objectives), a reasoning on how to approach the curriculum, a description and features of child's development at this age, books and sheets for children with tasks examples.

All these materials were meant to help the students understand why certain requirements were mandatory, how to approach their task in order to provide a digital teaching-learning material based on a story. Materials they had access to, helped them realize that each project needed research and understanding in order to obtain a useful product.

Phase 2: Requirements gathering

The task for the students: *building applications for kindergarten children based on stories-digital storytelling applications*, came with a set of requirements for both, technical and content parts. Thus, the client asked for no installation kit, in order for the application to run on any computer device no matter how performant it was, as teachers are not interested in this aspect, since most of them don't understand technical issues and, by far more important, they need the children to work by themselves.

The client underlined the fact that small children use the computer and the phone in order to play, to listen to music, to watch cartoons or films. (Addis,

2005) They usually use the fingers on devices according to their previous experience and some of them are familiar to some generally used symbols, such as a red X for EXIT or a green cufflink for PLAY.

Regarding the content, the client brought specific requirements. She needed the applications to be built for small children aged 5 to 6, large group in kindergarten who doesn't read, doesn't write, so all the applications should be based on audio and video. This was followed by other specific requirements such as: constraining the child to listen to a certain content or to listen to a task till the end, in order to prevent misguide and organize teaching.

The requirements for the design teams were to introduce a new subject to small children through an application based on a given story and each scientific content to be related to it in an intuitive way as much as possible.

During the semester, students had the chance to talk to the client via email in order to present their ideas, to ask additional questions, receive guidance in organizing the content.

Here is an example of an interview conducted by a team with the kindergarten teacher (S-student; C-client):

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S:1. Why would you want such an application? In what
context do you want to use it?
C: Such an application represents a new approach for
this kind of content, it is an illustrated story, with
the purpose of being used in an instructive-educational
context, either only as a story or as a pretext for
introduction into the world of wild animals.

S: 2. How will you use the final product? Is each child
playing individually on the computer, playing together
or presenting them to you?
C: Ideally, each child could use the application
individually, on the computer, that is to have all the
instructions accessible to the age level (5-6 years,
does not read, does not write, everything is presented
intuitively)

S: 3. What devices do children use? Do they have a
single computer in the group or do they have a lab?
C: The children use a computer but also have a video
projector. There is also the possibility to work with
the application on a smart board.
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S: 4. Do the children know grammar? Do they know what a
noun / adjective is?
C: No, children do not have these notions, but the
introduction can be done as follows: words that name
things, objects, beings and to which they can be
assigned a characteristic: eg.

S: 5. Do you want children to finally know the story
"At the Zoo"? Or is the purpose to learn the proposed
fields?
C: The purpose is: to explore different contents, using
as a pretext the story, so ... both!

S: 6. Is it necessary for the application to follow the
story step by step?
C: Yes, for the logical thread, within the limits of
possibilities.

S: 7. Do you want to use the internet when using the
application?
C: If possible, I would prefer that the use of the
application does not require internet connection.
S: 8. Examples of new words in the story.
C: Zoo, mule, ivy, dawn, etc.
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Students were invited to meet the children, to see how they react in front of a computer and how they try to use it.

3.2 Co-Design

Phase 3: Building the prototype
Organized in teams of three to five, students were asked to choose a story written by the Romanian writer Marin Sorescu -which are short and full of humor, or by Grimm Brothers, which are longer but useful for the purpose of language development-, to follow the given criteria and to personalize their application according to their imagination.

Table 1 and Table 2 illustrates their choice - the titles of the Romanian stories were translated for the purpose of this paper.

After choosing the story, the kindergarten teacher came with a set of different requirements regarding content for each team, even if the story was

the same.

Tabel 1. Stories in Romanian chosen by the students

Stories in Romanian	Number of applications
One and the Other Numbers	1
Knowledge upon Knowledge	1
At the Zoo	3
The Sea-a Useful Water	2
At the North Pole	2
In a Story	1

Tabel 2. Stories in English chosen by the students

Stories in English	Number of applications
Tom Thumb	1
Rapunzel	1
Hansel and Gretel	2
The Frog Prince	1

Here are some examples:

AT THE ZOO
Age level: 5-6 years (large group)
Integrated domains: Language and Communication (story text, with new words explained in context; names of animals-nouns-and their properties-adjectives), Mathematics (numbers between 1 and 9, illustrated problems based on the text).

AT THE ZOO
Age level: 5-6 years (large group)
Integrated domains: Language and Communication (the story text is built on an internal rhyme - extracting examples (minimum 7), one of the tasks for children to be: building similar phrases), Science (classification of animals, curiosities about animals, usage)

THE SEA – A USEFUL WATER
Age level: 5-6 years (large group)
Integrated domains: Language and Communication (story text, focusing on rhyme building based on words in the text), Science (What does a sea mean? What activities can be done at sea? Who conducts them? Names of species

fish, mammals - with illustrations -, their characteristics, useful; means of water transport - examples of boats used and useful), Education for society (large-family analogy, with emphasis on diversity sharing the same place).

THE SEA – A USEFUL WATER
Age level: 5-6 years (large group)
Integrated domains: Language and Communication (story text - with suggestive images, choice of words that are divided into syllables - about 6 or 8, and their integration into illustrated sentences - eg. The whale swims with a ... ship, and where the word is replaced by an image), Mathematics (groups formation by form: fish, marine mammals, boats; associating the figure with the corresponding set within numbers from 1 to 10; illustrated problems with marine life and crafts - eg. two dolphins are swimming together and here comes one more. How many dolphins are there?)

They also met the final users, as the teacher allowed them to observe children in the kindergarten: how they react when they see computers, what they expect computers to provide, how they use their fingers and basically what interaction means to them.

For the design steps the students were advised to follow a storyline, to use a character to catch children' attention, to balance the teaching part with the playing one, to give audio rewards and feedback constantly, to follow design guidelines for children (Bekker, Markopoulos, 2003; Crescenzi, Gran, 2016; Hourcade, 2008). All these to make sure that the child understands what are the application' goals but also has the idea that he/she controls the application. Most of the students' designs were expressed through mockups, such that no feedback on the design could be gathered from the children (see *Figure 1*.
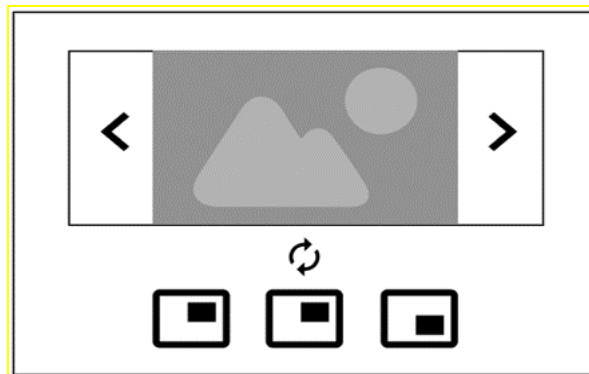
Figure 1. Design using wireframes

Still, some of the students have deeply considered the characteristics of their users and have prepared design that could be used as a starting point in including the children in the design process (see *Figure 2*).

Figure 2. Design for the At the Zoo Application

Other student teams have built executable prototypes such that the kindergarten teacher experience the interaction with the digital story (see *Figure 3 and 4*).
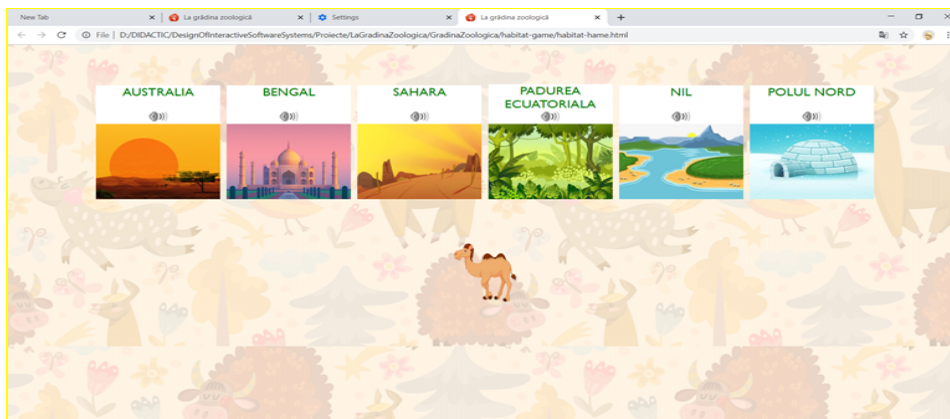
Figure 3.Design alternative as a prototype

Figure 4. .Example of task in At the Zoo application (choose the habitat for the animal)

3.3 Introducing the application

Phase 4: Prototype evaluation

The students had the chance to meet the real users before, but this was the first moment when they showed the children the applications designed especially for them. The meeting took place at the University and five children were involved but, after participating each of them alone (see *Figure 5*), they had the possibility to interact with the applications using peer tutoring.

Children were attracted by the characters, by the storyline, by the sounds and content. They hardly even noticed that there were tasks to solve, being caught by the performance of the story, especially where the story was fragmented and tasks integrated. The students were able to observe the amount of clicks that children perform whether it was necessary or not, the fact that they pointed to the answer showing the image on the screen when the task was not formulated properly, that they were delighted when the application gave them feedback, their desire to perform a task they liked over and over again and their honest reaction when they weren't content.

Figure 5. .Play –testing sessiom at the University

Phase 5: Presentation of the application

The final evaluation consisted in presenting the applications with the suggested changes following the experience with the real users. The most common ones were to pay attention how to formulate the tasks, to provide different levels of difficulty, to match the sound with the picture. The client appreciated students' interest and implication, how they integrated her suggestions (see *Figure 6 and 7*), and invited them to see the children using the products.
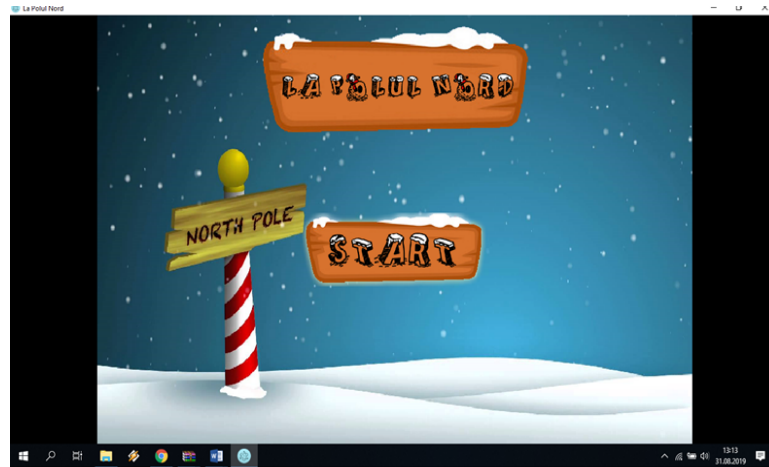
Figure 6. First screen of At the North Pole application (with audio description of teh text)

AT THE NORTH POLE

Age level: 5-6 years (large group)

Integrated domains: Language and Communication (story text, words related to the winter season - eg snow, snowman, etc; words related to clothing items - words, syllables, the use of Genitive), Education for society (How do we prepare an expedition? What does an expedition mean? , What are the steps?), environmental awareness (location of the North Pole - features and curiosities).
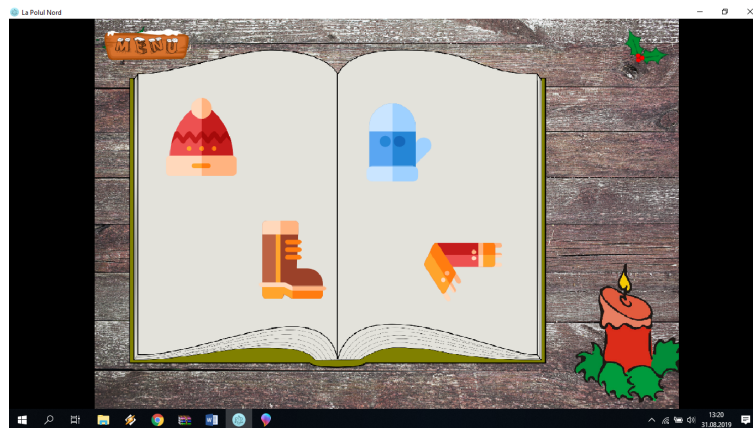

Figure 7. Example of task in At the North Pole application (clothes items-sentences using Genitive)

4. DISCUSSIONS

The experience of building applications for preschoolers brought a great satisfaction for the students, although some of them were reluctant at the beginning. They realized along the way that their work could be and would be used as teaching material as the main purpose was to introduce children to literature and different other subjects using the computer.

Insigths on the design process

Applying a User Centered approach when designing for preschool children is a challenging task. There are aspects that can inform the design team that can be easily observed and assessed (children digital skills, children vocabulary, domain knowledge), but there are design decisions that need assistance from an education expert. During the design process, the participation of the kindergarten teacher was very important, to guide the decision on the content presented and on the tasks required to be performed by the preschoolers. Children participation was very important in the evaluation step, as there were issues on the interaction that couldn't be foreseen by the kindergarten teacher (how the children understand the instructions on using the application, how they perform the interaction by using a mouse or the keyboard).

Insights on the use of the digital stories

Literature, as the art of the word, through which reality is reflected in all its complexity, offers the preschooler a whole universe of thoughts and feelings, of aspirations and daring, of enthusiasm and high ideals.

Therefore, in selecting literary texts for children it is advisable to take into account: the degree of psychic development (thinking, language, imagination, aesthetic or moral emotions), the sphere of interests, needs and concerns, the possibilities of identifying and understanding the ethical and artistic message. Taking into account the sphere of children's needs and interests, it will be considered the choice of those texts which reveal a world known by children, texts that awaken their feelings and pleasant affective states, that educate their positive attitude towards actions and situations revealed by stories. Realistic and fantastic stories are those works that introduce them into the sphere of social relations, which largely satisfy their desire for knowledge. Children love stories with animals, those with the central theme-the child, the world of childhood with everything it has most meaningful. Stories taken into consideration for this experience with the students manage to accomplish all

the necessary requirements.

But, the 21st century child seems to be very attracted by using devices to fulfill some needs and emotional states and digital experience is related to tablets, mobile phones, rarely laptops and computers, especially for listening to music or watching cartoons.

The idea of using and transporting literary, well-known texts into digital, otherwise mixing traditional and modern, the book with the computer, and building additional entertaining activities upon the stories, proved to become valuable tools for kindergarten teachers and children. These applications can be used when organizing a compulsory activity, stated by the curricula, or simply when playing freely, as their length and structure allows it, and the content is a supervised one.

5. CONCLUSIONS AND FURTHER WORK

In this paper we have described our experience in developing digital storytelling applications in a User Centered manner. We have included throughout all the stages the children (the final users) and an education expert (the kindergarten teacher). In the future we intend to identify methods to assess the effectiveness of exposing the preschoolers to digital stories.

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