Developing edutainment applications for Romanian preschoolers

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Abstract. Edutainment 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 case studies related to this concept in the Romanian educational space brings the opportunity to adapt the concept to the needs of preschoolers and teachers. Technology became a part of everyday life and its usage should be oriented to the benefit of the next generations. This paper is a report of introducing edutainment applications into the formal kindergarten system, as introducing was seen as a process consisting in: a) understanding users' needs, b) co-design, and c) actually introducing them into a class in kindergarten. All the applications were built by students attending the HCI optional course for undergraduate Computer Science students.

1. Introduction

The Romanian educational system has faced several reforms along the last twenty-eight years regarding curriculum, forms of organization, redefining the objectives of education according to the EU requirements. It is organized in three stages: preschool stage (children aged 3 to 6), school stage (children aged 6/7 to 18-primary, secondary and high school) and university stage. Only primary and secondary school are compulsory for the moment, but further legislation in the area states that preschool stage will become as well.

Political, social and economic development following the transition from dictatorship to democracy came with mandatory changes regarding education. Along the way, several measures were taken as a mean to improve the teaching-learning process and get better results at national exams and international contests, as well as developing competencies and skills needed to integrate youngsters in different work fields. Thus the need to have digital skills formed from early ages, preschool stage, even earlier.

It started with preparing teachers, giving them the possibility to enroll to dedicated courses in order to achieve certain digital competencies, promoting e-learning, continued with introducing computers, useful devices (cameras, printers) and internet in schools in order to provide resources to improve, ease and increase the benefits of education. It was followed by preparing children, an ongoing process that needs a special attention. Using technology in teaching and teaching children how to learn using it seems to be the challenge of the 21st century in Romania.

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 entertainment side of the process.

Edutainment is a hybrid genre combining learning and fun. It relies on visual material, on narrative or game-like formats, and on more informal, less didactic styles of address. In the digital age, many of these products and technologies seek to make education more attractive to young people and students (Buckingham & Scanlon, 2000).

Edutainment technology comes in many forms. A streaming video platform or a prepackaged learning product can be categorized as edutainment if it has both entertainment and educational value. An app for a mobile phone, auto dashboard or projection screen can also be classified as examples of edutainment technology. Many edutainment tools may make use of delightful mascots or characters, either digital or in real-life films, in order to sell the entertainment value of the product. Edutainment is very much an issue in developing modern digital and hybrid curriculum for the classroom,

and for supplementary educational use (Rapeepisarn et. al., 2019). Recent studies and research show a great interest in involving several institutions in the process of developing digital teaching-learning materials, as a partnership between university and school, with students building lessons for a computing school and visible results in classroom (Venn-Wycherley & Kharrufa, 2019).

In this article, we expand with examples and illustrations our previous research on introducing edutainment applications to Romanian preschoolers (Moldovan et al., 2019), as a tool to support the teaching activities in the formal kindergarten system. This research was possible due to a collaboration agreement between the Faculty of Mathematics and Computer Science from Babeş-Bolyai University and Albinuţa Kindergarten, that provided benefits for each part, as it will be shown in the following.

2. State-of-the-art

The idea of combining education with entertainment has been widely used for many formal and informal educational purposes (Rapeepisarn, 2019). Egenfeld-Nielsen analyzes the concept through its history relating it with behaviorism and underlining the lack of teaching elements in computer games that sustain the concept (Egenfeld-Nielsen, 2007). Other studies focus on small aged children (2-3 years old) and investigate the ability to perform a series of gestures on multi-touch surfaces (Nacher, 2014). Some researchers were preocupied by the abilities that kindergarten teacher should have in order to sustain activities related to human-computer interaction, abilities that help them in the process of teaching young children, using technology (Markovac, 2009).

The main idea of all the directions in research is that edutainment becomes a neccessity and involving children in the process of design, under the supervision of specialists in education and curriculum provides useful teachig-learning material, especially for Science and Maths (Cascales, 2013).

3. Method

3.1 Understanding users' needs

Phase 1: Users' needs analysis

Third year students from Babeș-Bolyai University, Faculty of Mathematics and Computer Science have an optional course called Human-Computer Interaction (HCI) 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 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*)*. In addition, the client gave them some possible answers to the questions:

- *What does a teaching activity in kindergarten consist on?*
- *Why do teachers choose different materials in teaching a content?*
- *How do teachers introduce a new topic through a song or a short film?*
- *How can educational software improve the process of teaching-learning? Why are narratives so important in children lives?*
- *How are learning and playing combined as the main activity in the kindergarten is game-playing?*

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 building application for preschoolers, middle group, and aged 4 to 5.

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 which entertains at the same time. 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*, 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 is, 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 4 to 5, middle group in kindergarten. The study domains are established by the National Curriculum: Science, Language and Communication, Human and Society, Sports, Arts but only Science was taken into consideration, both parts: Science and Mathematics (Bloom, 1956; *Romanian National Curriculum For Preschoolers aged 3 to 6/7, 2008)*. The Science content included nine themes, each with a specific number to be taught through, as shown in *Table 1.*

The methodology of integrating the contents follows pedagogical principles and features of the age (Bloom, 1956; *Romanian National Curriculum For Preschoolers aged 3 to 6/7, 2008;* Piaget, 1968). Content is organized during activities based on playing, from simple to complex, from concrete to abstract in order to support and encourage the social, emotional and cognitive development of the child. Thus, the principle of accessibility and systematization, the principle of intuition (Gînju et al., 2012) require adaptation of each content to the child's needs, age, interests and cognitive skills.

Each content is introduced in an integrative manner, in a context, in a story as exploring the world means seeing, hearing etc., and actions, situations are not singular but related to each other.

The National Curriculum also states the number of activities for each domain per week. Science and Mathematics has just one class weekly, reason why numbers are studied in stages: introducing and consolidating through different contents. The second column in Table 1 shows the numbers thought through each theme.

The educational activities are carried out in the form of integrated activities that bring together several fields. These can be classified into: activities for teaching new content, review and consolidate, teaching games. Depending on the type of activity, each one has well-established stages: capturing attention, updating knowledge, presenting new content, reviewing knowledge, testing game, game variants, etc. and the application could be used at any of these times.

Such an application can be a pretext for a new theme (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 were familiar with the content. For example, each animal that appears 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.

Table 1.Themes and numbers to be taught

Domain	Theme/Content	Number
Science	Domestic Animals	1
Science	Wild Animals	2
Science	Harbinger of Spring	3
Science	Mother's Eyes	1,2,3
Science	Migratory Birds	4-teaching
Science	Travelling by car	4-consolidation
Science	Travelling by boat	5-teaching
Science	Travelling by plane	5-consolidation
Science	Insects and small bugs	1,2,3,4,5-consolidation

The requirements for the design teams were to introduce a new subject to small children through an application and each scientific content to be related to learning a number in an intuitive way as much as possible, both parts: teaching and consolidating.

Small aged children, middle group in kindergarten, don't read, don't write, so all the applications should be based on audio and video. This was followed by other specific requirements such as: forcing 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.

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 theme, to follow the given criteria and to personalize their application according to their view and imagination. Each theme was approached by three teams of students and each had to provide three design ideas and then follow just one, which was considered the best. During the semester, students had the chance to meet the client periodically (every two weeks) in order to present their ideas, to ask additional questions, receive guidance in organizing the content. They also met the 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.

3.3 Introducing the application

Phase 4: Prototype evaluation

Although the students had the chance to meet the users before, this was the first moment when they showed them the applications designed especially for them. The meeting took place in the kindergarten and at the beginning the children were all involved, but at a certain point they had the option to choose

whether to participate or not. Children were attracted by the characters, by the storyline, by the sounds and content. The students were able to observe the amount of clicks that children performed 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 (eg. *match the hen with her favorite food*-children just pointed the answer*, instead of* with a click, match the hen-children solve the task using the mouse….see *Figure 1*), that they were delighted when the application gave them feedback and their honest reaction when they weren't content. Figure 1 illustrates the interface for Domestic Animals application. The boy in the picture invites the children into an adventure, to meet domestic animals and to learn a lot of things about them. The same character introduces them in the games that follow the learning part, as each application has two specific parts: one that provides the content, information about habitat, food, features of domestic animals in this case, and a part with games, puzzle where children are invited just to play. As they don't read and write all the tasks are audio and the application gives them feedback each time a task is solved.
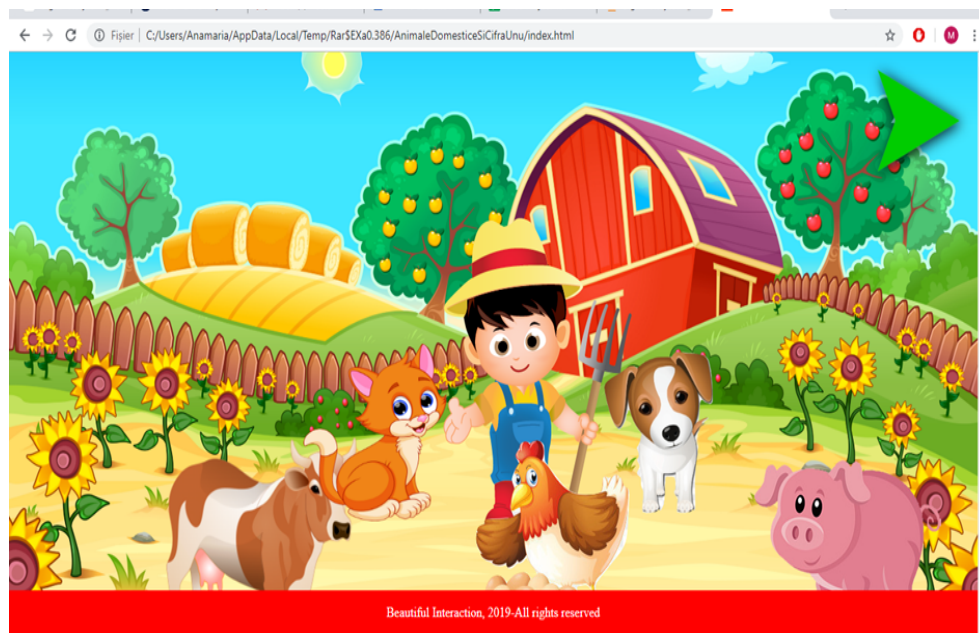

Figure 1. Interface for Domestic Animals application

The students were advised to make the necessary changes and deliver the product according to the findings they gathered.

The most common suggestions were: to introduce a narrative flow and to keep it (eg. a character invites the children into an adventure); to formulate the tasks as clear as possible for the child to perform them; to make sure that he/she understands what the application wants him/her to do; to match in content the theoretical part with the games part; to provide different degrees of difficulty in tasks in order to stimulate the cognitive skills; to control the sounds, the exit points.

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 client appreciated students' interest and implication and invited them to see the children using the products.

Phase 6: Exploiting the application

Each theme, as shown in *Table 1*, except one (Mother's Eyes, which wasn't chosen at all) was approached by three teams of students and the client had the possibility to receive all the applications. She chose one application for each theme to work upon with her class of small children for the following weeks, as an experiment on the efficiency. The criteria of choosing were: the quality of adapted content, the integration of the information, the tasks, the originality in dealing with the subject.

The applications provided teaching material as well as games, puzzles, songs and different playful tasks (see Figure 2).

For the next eight weeks the kindergarten teacher as well as another colleague used the applications to introduce new subjects to children and let them practice as long as time permitted to.

So, on Mondays, at Science they started the application they needed according with the weekly theme, following the order stated in *Table 1*. After a short announcement of what they would study, the teachers showed them how-using the computer. The first time the application ran, all the children in the group participated as it was shown on the big screen with the help of the video projector. The children were the ones who gave all the answers but the teacher was the one who used the mouse. They listened to the theoretical parts and they even recognized some of the application from their evaluation. (*I know this since the laptop came!*- children associated the students only with

their laptops and the games they provided). They asked questions, gave additional answers, they laughed, clapped and expressed their joy each time they heard *Good job!* or *Well done!*.
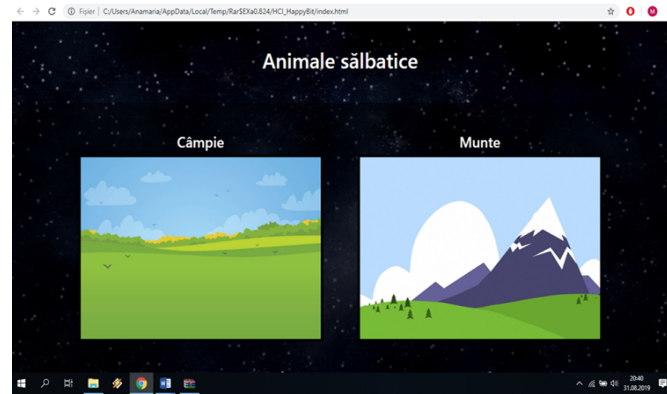

Figure 2. Interface for Wild Animals application

Each application ran at least two times in that way. The teachers could see how they pointed their fingers at the correct answer, hear them yell *There! There!* when they saw the arrow of the mouse moving around. Figure 3 illustrates an example of a task from Wild Application where children have to click on the number associated with the number of hares in the picture.
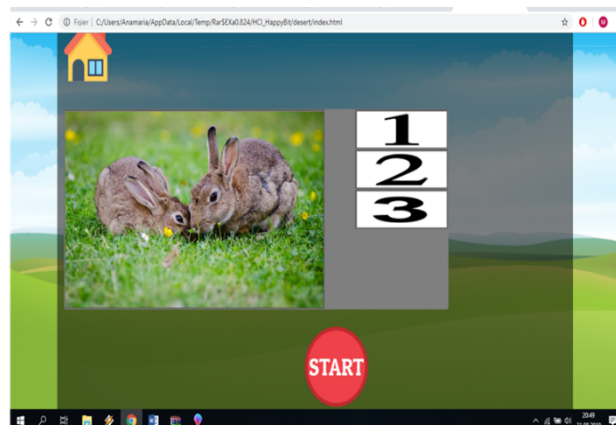

Figure 3. Capture of a task from Wild Animals application

Sometimes it was necessary to ask for their proper attention, to give other examples or to listen to the tasks carefully. With teacher handling the mouse, the most difficult part was at puzzles, where pieces had to be moved and the

word *there* was very much said.

Each application proved to be an excellent start in discussing a new topic with the children as they learned a lot of new things and then had the chance to entertain themselves.

Then, they were interested in playing by themselves and during the week they were able to do that. At first, mainly because they were allowed to use the computer, but after a while they began to ask for the content even if they had to listen to the theoretical part each time they played (see *Figure 4*). With just one computer in the room, at a certain point the children (over twenty) knew the answers by heart as they memorized them.
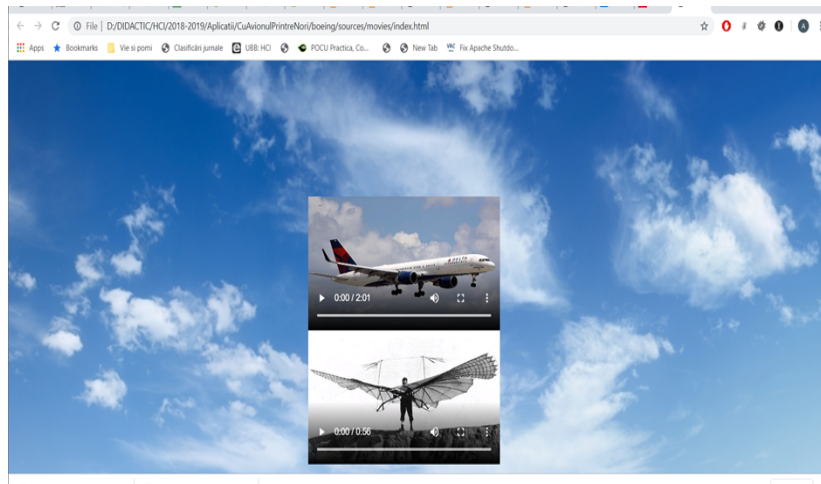

Figure 4. Interface for Travelling by Plane application

4. Discussion

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, for both educational and entertaining purposes.

There were challenges for all the parts involved in this project. The students had to fulfill all the requirements, both technical and educational, and watch the children using their applications. The professor had to advise, guide and grade a large amount of students (over one hundred), to organize the meetings between students and children at kindergarten and make sure students have all the theoretical information they needed for building these

applications. The client had to guide the students for the educational part without changing their approach and ideas and organize the children for the meetings.

The professor and the client agreed that there were several improvements needed: to work with more kindergarten teachers and enlarge vision, to spend more time with the children and involve them in the process of designing, to provide them devices to test the applications, to enlarge the duration of the course (for two semesters, not one), to initiate collaboration with other education providers (parents, other university education experts), but only some of them could be changed in the nearest future.

The kindergarten teacher underlined the utility of introducing materials that cover both the teaching-learning process, but also the entertaining part in education. She also expressed her willingness for further work and research.

There were students who expressed their wish to continue the project, to improve constantly and enhance to research.

5. Conclusions and further work

The present paper describes how the experience of introducing edutainment applications took place. As the purpose wasn't to explain in theoretical terms what the concept means, the attention was focused on explaining the process of building by adapting to educational and entertaining needs in certain terms and conditions.

The client (the kindergarten teacher) was just an intermediate between the designers (the students) and the real users (the children) and their reaction provided information and goal for further work. In the future we intend to assess the efficiency of using the developed applications in comparison to the classical teaching approach.

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