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COMPUTERS IN SCHOOL. A CASE STUDY WITH CHILDREN 6 TO 12 YEARS OLD.

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***Abstract**: For more than thirty years computers in schools has been a challenging research topic. Starting with Computer Aided Learning (CAL), Computer Aided Training and Instruction (CAT and CAI) and up to present e-Learning, the research main goals were to improve learning and teaching in schools, to adapt teaching and learning to individual needs through personalized software, and last but not least, to provide the necessary learning resources at a lower cost. With the same aims in mind, we have carried out several experiments in order to better understand how educational software has to be designed and developed to better answer teachers and students expectations, to enhanced e-learning usability. In our paper we are presenting some of the experiments concerning school children 6 to 12 years old. Children were introduced to a virtual environment – a library (the virtual image of the central university library) and their behaviour was observed. Children participating in the study were computer literate. We were interested in identifying key factors that can motivate children to read books from the library. The study started in 2009. Based on our observations the virtual library application was modified several times in order to obtain better answers to educational aims and a higher degree of satisfaction from the young user.*

***Keywords:** Digital libraries, eLearning, Software Architecture, Interaction Design, User-Centred Design, Computers in School*

I. INTRODUCTION

Software applications created for education have a long history and have evolved in line with the technological development, growing from simple pieces of program to full fledged eLearning platforms.

The fast development of some technologies like computer gaming, which are very attractive to children and teen, may present an opportunity. Indeed those who have worked with children and teen on a day to day basis have seen how much they love computer games. This is backed up by a number of researchers that have conducted empirical studies [1]. Thus the technology used in computer games could be used to create educational software, raising the motivation and engagement of children and making the learning process a fun activity.

Many researchers agree to use computer games for educational purposes. In [2] we see that computer games help teach children faster, the lessons being more dynamic and engaging. This is seen as a great alternative to the slow pace and the boredom of regular school lessons. Boyle [3] points out that computer games can lead to greater engagement and pleasure in the learning process, strengthening the educational environment. Moreover there are studies that show that carefully selected computer games can improve thought processes [4]. In response to these studies many researchers have developed games for educational purposes [5], [6].

1.1. Initial case study

The design and development of educational applications, as an integral part of the eLearning process, presents a challenge and an opportunity at the same time. A study that I have conducted on a sample of 395 children aged 6 to 12 coming from both the urban and rural environments shows that an increasing number of children use computer related technologies. The structure of the sample can be seen in Figure 1.

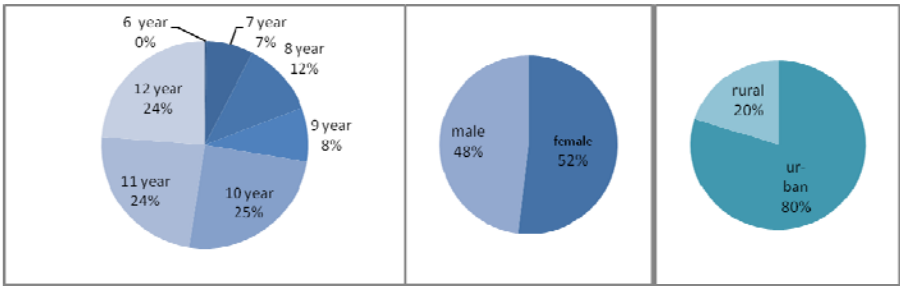

Figure 1. The structure of the sample

Out of all the results we would like to mention: the number of children that have access to a computer at home, computer usage habits, internet navigation habits and the time allocated to computer usage at home (Figures 2 and 3).

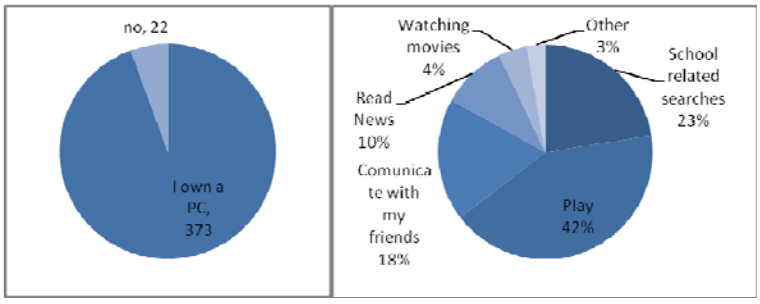

Figure 2. Number of children who own a PC / what children use the PC for

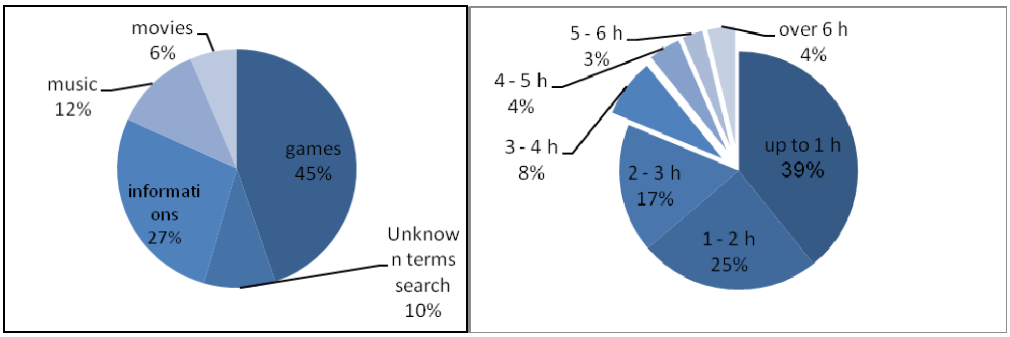

Figure 3. Child's internet search topics / number of daily hours spent in front of the PC

A predictable conclusion is that the line between the educational and the recreational aspects favours the latter. Having said that, 72% of the children from the sample responded with YES to the question: "Have you ever played a computer game that has taught you things useful for school?".

An increasing number of children (18%) use their computer to communicate with their friends, surprising maybe for their age. A negative aspect is that only 20.3% have read a book in electronic format.

The influence of informational technologies over children manifests itself by the increased number of hours that they spend in front of a computer (Figure 3). Two-thirds of those asked spend under two hours in front of a computer and very few seem to go over the computer dependent barrier.

We have assumed that a possible cause is the children's age. They are 7 to 10 years old and still in primary school where the influence of parents and educators is much higher. This assumption is validated in Figure 4 where we see that the number of hours spent in front of the computer is correlated with the child's age. As expected, an increasing number of hours in front of the computer (3 to 4) is observed once the child is over 10 years old.

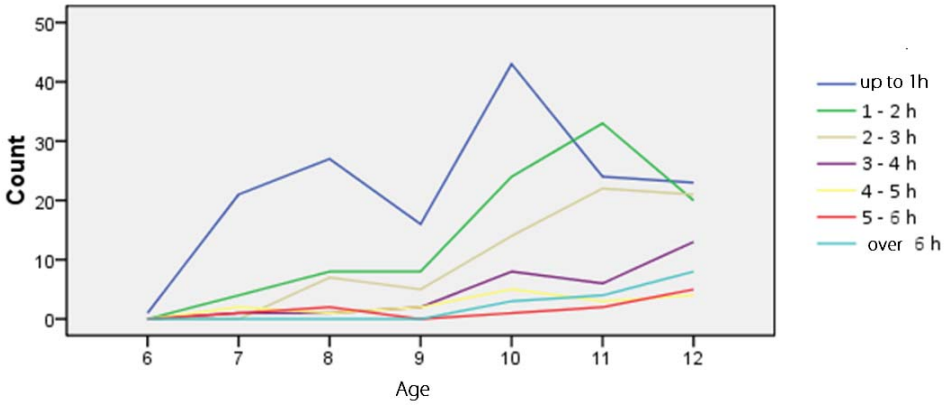

Figure 4. The relation between the child's age and the number of hours of daily PC usage

Given this exposure to technology it is imperative that educational applications be designed in a way that takes into account the abilities, interests and demands for the children's development.

1.2. Observations and conclusions of the initial study

Some of the observations from this initial case study can be summarized as follows:

- The number of hours spent in from of a computer increases with age;
- Children prefer games and accessing multimedia content;
- There is a large number of children accessing the internet;
- Even if the computer has second place in extracurricular activities, it still occupies an important place;
- Few children have read books on the computer;
- Many children have played educational games.

Based on these observations we have some conclusions:

- The usage of the computer in the educational environment must grow;
- Educational applications should contain such attractive elements;
- Educational applications on the internet could have a big impact;
- The interest in text format is low;
- Learning through play and discovery must be a priority.

II. THE “3D LIBRARY” APPLICATION

Making this application as a 3D Virtual Library was a natural choice, having the support of the University Library in Sibiu for this project and given my interest in the digital libraries concepts, interest that I have shown throughout my earlier works at conferences I have attended [7].

2.1. Application Development

In December of 2009 we had a 3D engine, written in C# and XNA that allowed basic operations on a 3D scene:

- loading a 3D scene;
- moving the camera backwards and forwards by pressing the "W" and "S" keys;
- rotate the view angle inside the scene by using a mouse.

We also had a 3D modeled scene that represented part of the University Library in Sibiu. A short history of the development process can be seen in Figure 5.

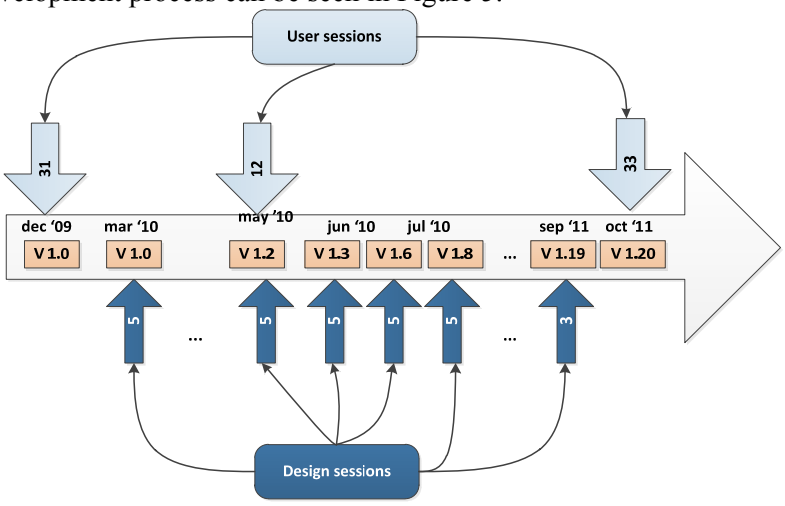

Figure 5. Development process history

"Armed" with the initial application and the 3D scene of the library we devised a user-test of about 5 minutes/child with a number of 31 children aged 8 through 9. The results have been promising to say the least:

- all children have liked it, even those who had a little difficulty in adjusting to the controller (keys & mouse);
- the majority have asked for a copy of the application to take home with them;
- all of them declared that 5 minutes where not enough even if all they did was explore the 3D scene.

Given this we have decided that developing a 3D educational application makes perfect sense.

The first development meeting took place in February 2010. A group of five children aged 8 to 9 and two adults took part in this first meeting and in the two subsequent ones, discussing technologies that allow work in a 3D environment. And here are the topics:

- instruments, technologies and the limits in passing from a real (natural) scene to a virtual one;
- the differences between a 2D and a 3D application;
- children's expectations regarding such an application, without deciding what to implement and what not to;
- the starting point for generating the 3D model (2D building schematics and photos taken at the site) (Figure 6).

Figure 6. 2D blueprints and initial photos

During the following design meetings a series of decisions were taken for the improvement of the 1.2 version of the application:

- the addition of new movement options inside the scene: left to right translation;

- adding books accessible by mouse click on the shelves; once accessed, books show some educational content through a series of pictures or in pdf format;
- the addition two more floors to the 3D model.

Using version 1.2 we conducted another user-test. Now a group of 12 children had the opportunity to test the application (all children took part in the first test session so they had a basic understanding of the application). They were told that a series of new elements had been added to the application. All children were given 10 minutes time to use the new version of the application. Some observations for this user-test:

- seven of them DID NOT open any books, limiting themselves to navigating the environment;
- of those who opened books not even one has finished browsing the content, preferring to return to the 3D environment;
- in other words, the children have completely ignored the educational content, preferring the 3D environment exploration instead.

As a conclusion we have decided to increase the children's interest towards the educational content. Starting in May and through September six design session where held and the app passed through a series of transformations especially regarding the way the educational content was delivered:

- v1.3: splitting the content of a story on successive shelves and reducing the movement speed;
- v1.6: the educational content was delivered through a series of colored orbs, in close vicinity;
- v1.8: each floor contains a single story, accessible through the colored spheres system.

The interesting thing is that the children-designers (now in the role of testers) have expressed the wish for a greater interactivity of the educational content and where not happy with any of the versions 1.3 to 1.8. In the end, the following was decided:

- the whole environment should transmit a single content, split in different pages;
- pages should be adjacent, so that finding them should be a goal in itself;
- each page should contain direction to finding the next one.

Furthermore we've decided to include a module that allows the recording of the user's actions, decision in which the children did not take part. The architecture of the application became the one in Figure 7.

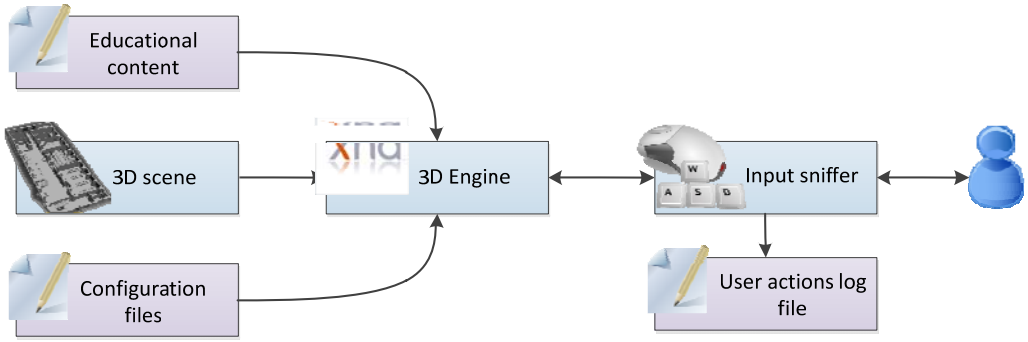

Figure 7. The final architecture of the application

In July 2010 the design session have ended, the whole team being happy with the results. From July 2010 up to September of 2011 the application and the 3D model passed through some minor changes without the children's participation, reaching version 1.19.

A final design session took place in September 2011 (with only 3 of the 5 children). During this session the children used the final version of the application. The most important decision taken during the session was the positioning of the four pages of the "The Steadfast Tin Soldier" story inside the 3D environment and the selection on additional texts that would represent clues.

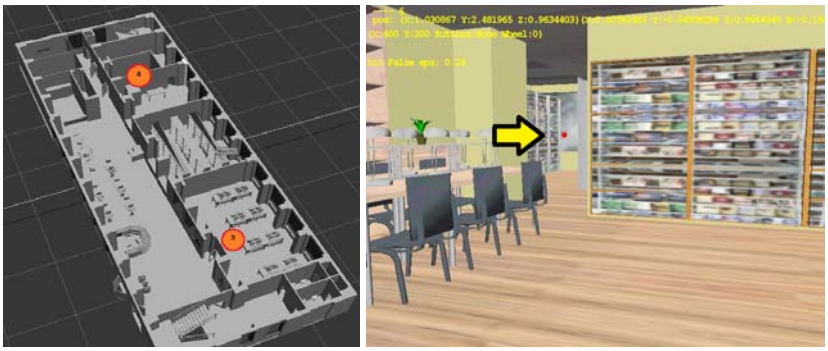

Figure 8. Positioning the pages

III. CONCLUSIONS

In December 2011 we did another study based on this version of the application on a sample of 33 children aged 8 to 10. We determined the fatigue and the happiness of the children in different stages of the application using a variant of the Affect-Grid for children method (reference…) that the application was interesting for the children involved in the study:

- only 9% of the children have felt a drop in their happiness, possibly because they did not find all the useful pages and were not able to finish the story;
- 24% felt increased happiness and the rest didn't change their emotional state;
- None of the children felt tired after using the application;
- 42% of them felt more stimulated.

As a final phase the children were given a questionnaire. And here are the results:

- 84% of them preferred the 3D applications;
- 12% of the children declared that they liked the 2D applications;
- 4% couldn't decide what they liked best;

Here are some of the arguments they had in choosing the 3D applications:

- 32% - "they are more real";
- 18% - "they are more fun";
- 14% - "they are more interesting";
- 11% - "you had to search" and 11% - "you don't get bored".

So, to summarize, the "3D Library" application was a success. The initial assumption has been proven right, as the combination of a 3D environment with some educational content leads to a raised interest from the children.

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