Augmented Reality in Children's Education in the Republic of Macedonia

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Abstract. The aim of the research presented in this paper is to support the hypothesis that augmented reality is a good educational tool compared to the traditional ways of learning. In order to understand the level of knowledge, attitude and preferences towards the use of augmented reality (AR) in education in the Republic of Macedonia, we have conducted a survey where we designed several questions and examples that helped us to collect initial insights on the topic. The second part of the study was a practical experiment showing us that regardless of the environment, children prefer this visual way of studying compared to the traditional one. The AR applications used in this experiment were Skyview, Augment and Anatomy 4D, introduced to two classes of 6–8 and 10–12 years old. Additionally, AR applications were used by two children with dyslexia, 9 and 12 years old.

Keywords: Augmented reality · Education · Republic of Macedonia

1 Introduction

Augmented reality (AR) is a technology that allows virtual, visual and descriptive computer-generated information to be overlaid onto a live direct or indirect real-world environment in real time [6]. With AR the information about the surrounding real world of the user becomes interactive and digitally manipulatable. AR is variation of a Virtual Reality (VR). VR technologies completely immerse a user inside a synthetic environment and while immersed, the user cannot see the real world around him. In contrast, AR takes digital computer generated information, whether they be images, audio, video, and touch or haptic sensations and overlaying them in a real-time environment [4]. Research indicates that student participation in an AR-integrated learning environment could lead to enhancing students' spatial abilities and motivational factors [2, 7]. Augmented reality has pedagogical potential to improve critical thinking, creativity and critical analysis [1, 5]. AR contents developed for teaching science were evaluated by teachers and students as effective one year ago [3]. There are many AR based applications that can be used for education, starting with simple games through which children could learn, and later they can be used in primary school and high school education in subjects such as Mathematics, Geography, Biology, Chemistry, as well as in higher education such as the Medical Faculty. The era of making hybrid

mobile AR application for education is emerging, and it is expected that in a short period of time the number of AR applications will grow rapidly, covering different areas.

2   Research

2.1   Pre-research Study

In order to understand the level of knowledge, attitude and preferences towards the use of AR in education in Macedonia, we conducted a survey where we designed several questions and examples that helped us to collect initial insights on topic. The survey was conducted on 229 respondents and 95% of them think that use of AR in education will have motivating effect on children and will develop attraction for science. The respondents' explanations were that the child's attention is better retained in comparison with traditional education method, it is fun to study the material and the creativity grows. Parents would encourage schools that implement augmented reality lectures (partially or completely). Visual learning has been effective for generations. The most common explanation given by the interviewees about visualization and 3D projection is that it is more realistic, children do not study by heart and students acquire quality knowledge, it is faster and better to remember and easier to understand the material. Since visual learning is effective, the use of AR would be a great help for children. The number of positive opinion is greater than negative, so a conclusion is made that the interest for augmented reality is rapidly increasing and that it can transfer knowledge in a way that is more closely and immediately related to the world around us. Negative comments are also taken in consideration. Children nowadays are using tablets and phones constantly for playing, because for them that is more interesting than reading a book. But, if we combine the technologies with education, knowledge will be fun and challenging.

2.2   Research

The study was conducted in three different cities in the Republic of Macedonia: Skopje, Kavadarci and Strumica, to see that no matter what kind of childhood or environment kids might have, they all prefer this visual way of studying compared to the traditional one. The primary schools "Dimo Hadzi Dimov", "Petar Pop Arsov" and "Aleksandar Makedonski" located in Skopje were part of this study with kids 6–8 years old, attending first and second grade. Firstly, the children were taught in the traditional way, with explanation on a board. Afterwards, when they were asked about the topic, there was little response in answering and remembering. Then, the lesson was taught with help of AR application, such as Skyview, Augment and Anatomy 4D, with help from an author of this paper with phones and tablets. 30 kids from each school participated in our project. Skyview was the first application, showing the planets and some stars. Children interacted with the application by clicking on stars or planets they liked and information about them was popping out, helping them to learn. Following that Augment was presented. Children were able to see how Earth looks like, animals,

human's skeleton or some geometric figures like a sphere. Anatomy 4D makes the children understand in an interactive way the human body and heart through AR, providing fun facts to keep their attention. After two days, children were used to the applications and they were able to use them on their own. In the end we were asking them for things taught the previous days to check what they had remembered. We were also giving them instructions to them to show us a particular thing, to rotate it, to zoom it, etc. In Kavadarci, a volunteer teacher assisted in conducting this study in the school "Dimkata Angelov Gaberot", in two classes with children 10–12 years old, who worked on the applications Augment and Skyview. They were observing galaxy and learning about planets with Skyview. After that they were supposed to tell some information from the application that they understood, for example, what they learned about the planet Pluto, while the teacher was assisting them. The rest of the days they were using Augment. During the experiment, kids reacted with curiosity and interest using the AR applications. Afterwards they could repeat all the information they received by observing. The attention was constantly retained and it was fun to study the material. It saved time of the lecture because there was no need to explain abstract terms from the textbook. Retained knowledge was good, as the child observed in detail and visually remembered each part. In the end, the pupils from both cities answered affirmatively to the question if they liked this way of learning. When children were asked which is their favorite part, most of them answered they liked Augment 4D the most thanks to a heart beating representation. From here we conclude that children like the new technology and they want to use it, especially for natural sciences. Teaching them in this way saves time and helps them to remember better, instead of learning by heart. Children learning with AR easily master the material and acquire knowledge that will be used in forming them as individuals and professionals. They were amazed when they saw how the heart pumps, excited when they were able to see galaxy around them and nearly all of them stayed breathless when they were observing human's body only with muscles and turning it.

2.3   Using Augmented Reality for Education of Children with Dyslexia

In the city of Strumica, all applications were used by a specialist working with two children 9 and 12 years old who suffer from dyslexia in the school "Vidoe Podgorec". The aim of this study is to prove that it helps those children to learn without problems, without reading and to start using it for that purpose in Strumica. The specialist and the children were using Augment 4D, she was translating the explanation and they were writing down the things they have learnt. Afterwards, they used Skyview for learning the planets, same as the children from Skopje and Kavadarci. Learning with AR helps a lot because the children see what is supposed to learn, self-confidence increases and they are able to attend normal classes with children their age. This kind of learning will help children with dyslexia to have the same knowledge and everyday life as everyone else.

3   Conclusion

The aim of this paper is to support the hypothesis that augmented reality is a good educational tool, compared to the traditional way of learning. As an introduction to the study, descriptive research was done with a survey and according to the responses, a conclusion was made that visual learning is more effective, easier to remember, inspiring innovation, fun and interaction. Moreover, 94% of the interviewees supported using AR application for education. According to the research, by involving children in the augmented reality learning process, they master the material more easily and acquire quality knowledge that will be used in forming them as individuals and professionals. The lessons are modern, interesting and attract children's attention, thus saving teachers' time. The visualization gives a better idea of what is being taught and increases children's imagination. Also, AR helps children with dyslexia so they can fit in normal classes, progress intellectually like everyone else and be accepted by the society. Benjamin Franklin said: "Tell me something and I will forget. Teach me something and I will remember. Involve me and I will learn." Augmented reality is this future that Benjamin Franklin described, changing the way we learn by involving us.

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