Conference Paper

Designing an Interactive Technological Book for Children with Mental Disabilities

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Abstract

Graphic design works as a medium between human beings and technology, and can be transformed according to human needs. Graphic design has a potential for developing adaptive educational material for children with mental disabilities. At the same time, graphic design can be integrative with innovative digital technology in order to modernize education process in our digital era. This article describes an attempt to develop a graphic design project aimed at the creation of an innovative solution for schools for children with special need. By combining graphic design and technology, it was possible to create an interactive book that could help children and teenagers with mental disabilities in their learning processes and improve their quality of life. The experiment took place in one of the specialized schools in Yekaterinburg (Russia). The proposed project factored teachers' opinions (obtained through teachers' interviews) into the development process, and was subsequently tested in the classroom.

Keywords: graphic design, mixed reality, education, children, digital learning, special needs, mental disability, interactive book

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1. Introduction

Kids and teenagers with mental disabilities live with a serious condition which impacts their life. Their environment and their education must be adapted to their needs, according to their level of capability.

Graphic design works as a medium between humans and technology, which can be transformed according to our needs [1]. Therefore, graphic design can provide the tools for developing adaptive educational material for children with mental disabilities, but also it possesses the possibility of integration with innovative technology in order to modernize education process in our digital era [2, 3].

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2. Materials and Methods

Mental disabilities can affect classroom, learning and social interactions, all of which are critical for the success of the students. However, if appropriate services are put in place to support a young person's mental health needs, we can often maximize success and minimize negative impacts for students [4, 5].

Sometimes the task of meeting mental health needs in schools may require special instruction and/or practice. I believe that with the right adaptive educational content combined with interactive learning, it is possible to improve the education processes and quality of life for children and teenagers with mental disabilities. In this project the selected target age group comprised children between 8 and 14 studying at the 4th grade in the school No. 4 in Yekaterinburg (Russia). testing the proposal that a technological interactive educational solution require a more cognitive capability but also the theme of subject is more advanced compared to basic learning. The target age group included children with wide range of conditions such as autism, Down syndrome, schizophrenia, anxiety disorders, depression, and attention deficit and hyperactivity.

3. Discussion

3.1. Teacher Interview

In order to understand the both the school and the kids' needs, a list of forty questions was provided and interview with the teachers was carried out. [6] The interviewed teacher works with children with special needs in the school No. 4 located in the city of Yekaterinburg (Russia). The goal of the project was to help the school in developing the right content for these children and understanding their needs.

Based on the results obtained from the questions and interview, it was possible to determine that the school need to have more interactive content for children, but it should be an educational content adopted for children with special needs. Subsequently, based on the teachers' opinion and experience, we defined design style, colour and interactive content, which could improve the learning processes.

For example, it was determined that the colour palette should be predominantly cold and not include bright colours such as bright yellow or red due to the fact that children react negativity to these colours. At the same time, it was established that the illustrations and images should feature more heavily than text, in order to make the learning processes easier for special needs children. It was also required to use more

interactive material, such as texture, pop up images, and technology such as augmented reality, virtual reality and mixed reality.

3.2. Interactive book solution

The interactive book for children proposed in this project is a solution that can improve the learning process for children with mental disabilities, at the same time using technology and interactive media as a tool for improving the learning experiences [7].

The designed adaptive interactive book combines traditional learning and digital learning process with tactile and virtual experiences. This adaptive interactive designed book utilizes all available resource such as: audio, texture, images, colour and technology such as virtual reality (Vr), augmented reality (Ar) and mixed reality (Mr) in order to offer a wide range of interaction in which children can learn in an amusing and interactive way [7].

The chosen theme of the book was space exploration. The reasons for this choice are the fact that this theme fits better for the interactive solution; it is a very interesting theme; it provides opportunity to use and the entire range of interactive resources for the project. The resulting product is a book where the children have the possibility to explore the content in a traditional way by reading the text with the help of illustrative images combined with tactile experiences in order to associate texture to figure. At the same time the book utilizes digital technology allowing children to explore the moon in a virtual reality mode or watch the 3-D model of the planet above the book with the use of augmented reality [8].

3.3. Adaptive character creation

Furthermore, it was decided to create a virtual character based on the first dog that successfully survived space exploration (Laika). This character was presented as a virtual teacher who could explain to the children the content from the book, bringing the possibility for children to study in home or outside of the classroom. Such interactive character offers a positive learning experience utilizing amusing style and adaptive design aimed specifically at the children with mental disabilities.

In order to make the character more adaptive, version 2 of of Laika the Dog was created as a 2-D illustrative image for the book, and a 3D model of the same character for the virtual environment.

4. Results

4.1. Practical test

To test the results of the project, a practical test was carried out. It included children with mental disabilities in the age group in the age between 10 to 14-year-old, studying at the 4th grade in the school No. 4 in Yekaterinburg (Russia).

The practical test included three levels whose goal was to analyse the level of knowledge obtained from children, reaction and interest of children who were learning with the use of this innovative solution.

This Practical level test was divided in the following stages.

1. Practical Test 1: Use of Traditional Book *Explore space with Laika*.

2. Practical Test 2: Use of Augmented Reality Application.

3. Practical Test 3: Use of Virtual Reality Application.

4.2. Practical test 1

At the first level of practical test, the children learned about the space exploration using the space exploration book with the help from their teacher.

It was possible to observe a positive interest from children in learning about space, thanks to the use of attractive adaptive illustrative images about space exploration.

4.3. Practical test 2

At the second level of practical test, children learned about space exploration with the use of the augmented reality app, which made it possible to see the 3D images of Laika and the planets above the book, as in the real world.

The positive reactions from children when using the interactive application from the book, by the fact, that the children can see Laika, and planets in their 3D from in the book, but also the first time to see a 3D element, blended with the real world, increasing their attention in the content but also their curiosity.

It was also possible to observe interest from the teacher, who clearly appreciated this type of solution in their classroom and its potential to improve learning process.

4.4. Practical test 3

At the third level of practical test, the children used virtual reality eyeglasses, in which they could become virtual astronauts, see a virtual environment of the moon, experience life inside the spaceship and view of the outer space. All of this provided a unique experience for the children.

All children enjoyed the virtual reality experiences, but they also were very curious to understand this experience. Furthermore, the children were able to recognize Laika the dog from the book in the virtual environment, as well as understand and follow the teacher command.

Also, children with anxiety were able to better control their anxiety and have more relaxation during the virtual reality experience. Children were playing and learning at the same time, which is always a good feature of an educational material.

It was possible to observe high interest from all children in the classroom in using the virtual reality eyeglasses and live a virtual reality experience.

The project application was designed with a simple user interface, which uses image recognition for the augmented reality application placing 3D images over elements automatically and give an impression of blending with the real world. It was possible to determine, that if each child has their own virtual reality eyeglasses, they will have better classroom experience, avoiding waiting lines and reducing anxiety and possible conflict between children.

4.5. Designing for augmented and virtual reality application

In order to allow the children to enjoy an interactive educational content through augmented, virtual and mixed reality application, they have to be adapted for the children's needs as well as be easy to understand and use.

Also, children or teachers can choose to enter the virtual reality environment by clicking the virtual button in each page of the book.

Additionally, the virtual button can be clicked by the user in the smartphone device, or by pointing the virtual pointer. When holding down the virtual button for more than 5 seconds, the virtual pointer clicks the virtual button automatically. This is very important when the children or the teacher are using the virtual reality eye glasses allowing users to continue using the virtual reality without the need to remove them.

5. Conclusion

The hope that guided this study was that it would help children and teenagers with mental health conditions improve their quality of life and learn more about space exploration but also. The results can be offered to schools and specialized educational centres around the world as an educational material, which can be used in classroom settings, but also may be utilized medically during the diagnostic process by helping health professionals improve doctor-patient interaction and to analyse their condition observing their interaction with the educational material.

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