

CHAPTER**Effect of Virtual and
Augmented Reality
Applications on the
Education of Persons
with Disabilities****10**

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Introduction

It uses the information it has received from 5 sense organs in order to make sense of the phenomena and activities taking place around individuals. About 80% of this information is provided to individuals through the eye organ. For individuals who have lost their sense organ, which has such an important effect, this situation causes many difficulties. Visually impaired individuals can access information by having others read to them or by reading sources written in Braille when the conditions (technology) are limited. Along with this situation, some internet applications are also provided to visually impaired individuals. Some web pages transmit information audibly, allowing our disabled individuals to use the web page and access information more easily. At this stage, all web applications should have additional features for visually impaired individuals; It is of great importance that the visuals, videos and sound recordings are in an explanatory state. In addition, virtual reality environments can be developed for our disabled individuals who are in the background in the normal education process and have a more difficult learning process compared to normal individuals, and for our visually impaired individuals, images can be perceived, even with low resolution, with the systems produced (Ferhat, 2016).

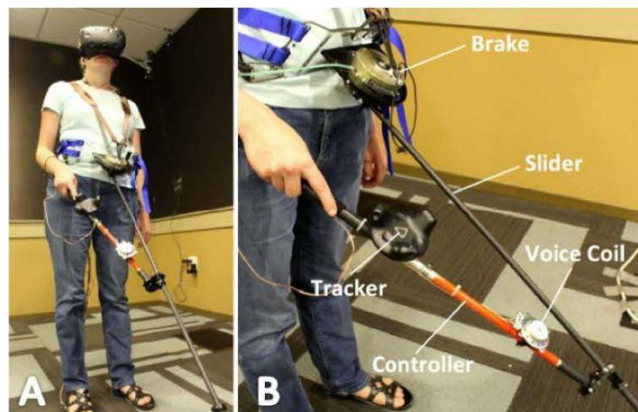


Figure 1. Augmented reality technology developed for visually impaired individuals.

Disabled in the World

According to OECD-EU data, approximately 15% of the world's population consists of individuals with disabilities. By looking at this rate, we can say that there are close

to 1 billion disabled people in the world. If we take a look at the age distributions, 27% of these individuals are between the ages of 0-21, 36% are between the ages of 22-49, and 37% are between the ages of 50-64 (Disabled People in Turkey and the World, 2021). According to the data of the “Lancet Global Health” magazine (The Lancet Global Health, 2020)., the number of visually impaired people in the world is approximately 36 million, and this rate is considerably higher than the number of individuals with other types of disabilities. In addition, the regions with the highest rate of visually impaired individuals are South Asia and Sub-Saharan Africa. Studies have shown that more than 200 million people from 188 countries have a moderate and severe visual impairment, and this figure will exceed 550 million in 2050 (The Number of Visually Impaired in the World May Reach 115 Million, 2017).

Enhanced Virtual and Augmented Reality Applications for the Disabled

Augmented Reality technology is two different concepts from Virtual Reality technology. Virtual Reality; While a virtual environment is created by means of computer technology and the user’s access is aimed on this environment, Augmented Reality is a technology developed by overlaying the designed graphic data on real-life objects. This difference in the use of Augmented Reality and Virtual Reality provides diversity in the development of applications that appeal to the use of individuals. If we consider the systems made on Virtual and Augmented Reality for the Disabled; With Location Based Augmented Reality applications, the location of the visually impaired individual can be detected by GPS, WLAN, etc. It adds virtual data (sound data) to the real image by detecting it with devices, and thus the guidance of the visually impaired individual is carried out very easily (Sirakaya & Seferoglu, 2016). If we examine the ITOAG-based systems developed for disabled individuals, the system takes place in the environment instead of signal data. The application of this technology, which is realized by the movement of a field object or superimposing Augmented Reality data on a certain field surface, can be given as an example by Mirzaei, Ghoshi, and Mortazavi (2012). That can convert the sound data obtained in the speech of hearing-impaired individuals into writing. The most important advantage of the Signless Tracking System Augmented Reality Technology (ITOAG) is that the area where the object is displayed is not fixed. Due to this situation, it is possible to direct the disabled person depending on the object area or region that is perceived as motion sensitive(Mirzaei et al.,2012).



Figure 2. ITOAG technology developed for hearing impaired individuals (Tsai et al., 2013).

A study was carried out by the VI. Yıldız International Social Sciences Congress (Dolunay & Akkan, 2019) in order to enable visually impaired individuals to access written information, bibliography and documents more easily during their university education. As a result of the interviews and evaluations made with visually impaired individuals before this study; 60% of the information documents they had difficulty with were electronic, 52% were Braille, 48% were cassette/CD and 8% were large print source documents. In the continuation of this study, 60% of the information document types that visually

impaired students have difficulty in making use of were journals, 52% were books, 44% were theses, 36% were conference proceedings, 32% were counseling resources, and 4% were websites. . As a result of these preliminary studies, on the web pages;

- Font size: Written data is visible to individuals with low vision.
- Use of contrasting colors: Contrasting colors and tones are included for color-blind individuals.
- The text of the visuals: The pictures must be readable in written form and appealing to the visually impaired user audibly.
- Availability of information resources: As a result of preliminary work, disabled people can access their frequently used Internet data documents as a result of no more than three clicks. Thus, it has been ensured that our disabled individuals can benefit from internet documents during their education.

Virtual and Augmented Reality in Special Education Process

Virtual and Augmented reality applications are technologies that have an important place in the interactive learning and knowledge discovery of individuals with disabilities. For this reason, studies have been carried out to increase the learning opportunities of individuals with disabilities by making use of Augmented Reality technology in the special education process of individuals with disabilities. We can show the anatomy learning mobile Augmented Reality application for the education of disabled people in Türkiye as an example to this study. In this study, cards with pictures and information about the skeletal structure were prepared and signs were placed on the cards in order to perform sign-based tracking on these cards. 3D skeleton models were designed to be used in the Augmented Reality mobile application. (Uzun et al., 2017).

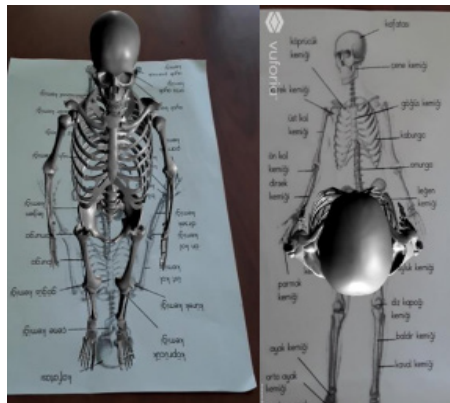


Figure 3. Augmented Reality model of human skeletal structure.

With this study, an interactive learning style was introduced by providing convenience in the education process of disabled students. Another study for this area is the adaptation of Augmented Reality technology supported storybooks for disabled children. With the audio support in this study, our visually impaired individuals will be able to benefit from the storybook comfortably, and for our individuals with other types of disabilities, the storybooks will be supported with 3D models and brought to an understandable level (Dogan, 2016).



Figure 4. Augmented Reality supported storybook.

The Effect of Virtual and Augmented Reality Technology on the Mental Development of Individuals with Disabilities

In order to see the effect of Virtual and Augmented Reality technology on individuals with mental development disorders, research was conducted on the basketball game application developed with the support of Augmented Reality technology. Disabled individuals were asked to play the game without any prior information. Movement, sliding, throwing, etc. of disabled individuals during the game metaphors such as these have been examined and it has been emphasized that these individuals can be recommended both in terms of providing physical practice and improving their conscious mind levels (Altan et al., 2019).



Figure 5. A few sample images taken during the application.

In this study, it was determined that the Augmented Reality game, which was evaluated with certain metaphors, contributed to the mental development of individuals with disabilities.

If we examine another study carried out to determine the mental development of disabled individuals; In this study, which was conducted on a total of 93 students, 11 of whom were cognitively disabled, in a French primary school, the performance and behaviors of students in using Augmented Reality technology, as well as the attitudes of cognitively disabled individuals in such techniques were examined.

As a result of this study, it has been determined that disabled individuals are very enthusiastic when using the application and exhibit higher motivation compared to other students (Richard et al., 2007) Virtual Reality applications also make positive progress in the recreational development of our disabled individuals. If we examine the studies on this situation; It seems impossible for an individual with walking disability to do mountain climbing sports, but with virtual reality applications, they can experience such activities in a safe and unlimited way. However, before traveling on unfamiliar roads,

individuals with physical disabilities can provide effective planning on the road with Virtual Reality application (Kulakoglu Dilek & Istanbulu Dincer, 2020)

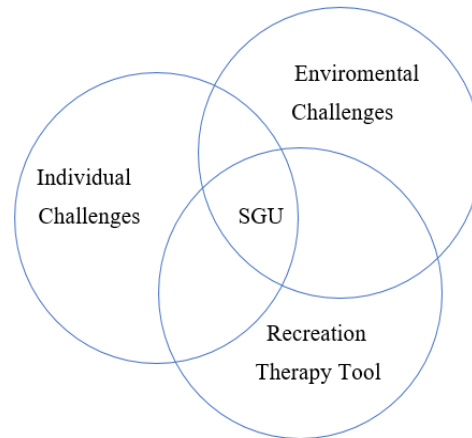


Figure 6. Supporting role of Virtual Reality applications (SGU) in the participation of people with disabilities in recreational education activities.

By looking at these studies, it was predicted that individuals with mobility impairments achieved positive results in recreational treatments with Virtual Reality applications, and that they could perceptually realize the experiences they were intended to gain.

Conclusions

While the rate of disabled individuals around the world is at high levels, certain studies and studies have been observed in order for these individuals to maintain their lives, especially their education. It has been observed that especially the number of visually impaired individuals constitutes a large community around the world, and that they suffer from great disadvantages such as not being able to access written documents and internet resources, and not being able to access visually supported information, and these disadvantages are tried to be minimized with Virtual and Augmented Reality technology applications. In addition, during the education of our individuals with different types of disabilities, AR and SG supported educational books were designed and these books were supported with sound, image, video and 3D graphics, contributing to their development. It is expected that these evaluated studies will be used in a wider range and will be improved to optimum levels. In addition, it has been determined that Virtual and Augmented Reality technology has positive effects on the mental development of young individuals and increases the level of motivation. It is predicted that such studies can be supported more and further differences can be achieved in the mental development of individuals with disabilities. AR resources, which include learning behaviors that students with disabilities are expected to achieve, are among the resources that will be included as an alternative during education. By increasing the AR model image quality of such sources to higher levels, it is foreseen that an environment will be created in which especially hearing impaired students will actively participate in the education environment. Apart from these, the existence of disabled individuals is also undeniable in the new generation, which is called the Z generation, and the technology, methods and materials used today in the education process of these individuals are insufficient (Richard et al., 2007). It is expected that by eliminating this inadequacy, individuals with disabilities will be able to acquire the learning behaviors expected to be acquired.

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To Cite This Chapter

Uzun, Y. & Gozel, O. (2022). The Effect of Virtual and Augmented Reality Applications on the Education of Persons with Disabilities, M.H. Calp. & R. Butuner (Eds.), *Current Studies in Digital Transformation and Productivity* (pp. 147–154). ISRES Publishing.