

# Augmented Reality And Virtual Reality To Aid Students With Learning Disability: A Review

Carolyn Joseph

**Abstract:** Augmented reality and virtual reality have been around here for many years. These technologies are used in various fields of marketing, military, entertainment and much more. There are researches for the implementation of these technologies for education purpose especially for students with learning disability. Simple tasks such as reading and writing can become exhaustive and frustrating for such students and they furthermore loose the interest in education. There is a need for a different approach for educating these students and thus AR and VR comes in aid. Studies have found that AR and VR can enhance the learning ability of children by making the learning process more interactive and enjoyable. This paper covers the researches done in past years for the cause and gives a roadmap to future researches in the field.

**Keywords:** Augmented Reality, Virtual Reality, Learning Disability, Education.

## 1 INTRODUCTION

More than 10% of the population has learning disability. And it is found that individuals with learning disability are three times more likely to drop out of school among the average dropouts of all the students. According to [1], children normally with IQ below 70 are considered to have learning disability. Such students are called to be mentally retarded. But extensive researches show that children with superior IQ sometimes may not reach the standards of the curriculum. Language also becomes a barrier sometimes. It is difficult to design one system with one default language that can be used in every situation. Systems designed should help with the language as well. All students should get the opportunity to education irrespective of the disabilities they have. But sometimes simple tasks such as reading and writing can become such cumbersome tasks for these students. In [2], with the help of just a smart phone students can interact with the environment and learn using augmented reality. And the research has proved the involvement of the students through this technology has enhanced their learning ability. Online mentors, specialized for people with disability can also help them reach the goals, helping students through their college life internships etc. [3]. Augmented reality is the result of image processing techniques on different frames of the video taken. Different techniques can be applied to make the application more interactive [4]. Sometimes there can be more than one type of disability present in an individual. So special frameworks have to be introduced to aid both or even more disabilities [5].

There are many barriers encountered by students with learning disabilities like awareness, infrastructure, teaching, project acquisition, project management, and mobility to name some[6]. It is important to keep these in mind and design system that works across all of these to help the students with learning disability. Virtual reality can also help the students emotionally to overcome social awkwardness sometimes [7]. Virtual and augmented reality environments help in creating safe environments for the students to study. This helps them to open up more without caring of others and their opinions. Virtual and Augmented reality sometimes provides therapeutic effect to the students and helps in their overall development as an individual. The study covers research on VR and AR implementation in school and college for students with learning disability and the results of their execution. With this review we hope that the future researchers in field develop better designs of AR and VR systems, which will help the needy and better the future. The learning disabilities we we'll be dealing during this review are mainly five, and a gist of them are given in the table 1.

**Table 1:** Five learning disabilities (adapted from 1).

Learning Disability	Definitions
<i>Developmental dyslexia</i>	<i>Developmental disorder in learning to read</i>
<i>Developmental dyscalculia</i>	<i>Substantial underachievement on a standardized test of arithmetic relative of the level expected.</i>
<i>Attention Deficit/Hyperactivity disorder(ADHD)</i>	<i>Inattention, hyperactivity and impulsivity.</i>
<i>Autism spectrum disorder</i>	<i>Impairments of social interaction and communication, stereotyped behavior.</i>
<i>Specific language impairment.</i>	<i>Significant deficits in expressive or receptive language.</i>

- Carolyn Joseph School of Computer Science Engineering Vellore Institute of Technology Vellore, India

## 2 METHODS

To do the review of the topic for this study, we collected

research papers published between the years 2013-2018 from IEEE xplora and Google Scholar. The articles or the research papers were found using the keywords; Augmented Reality, Virtual Reality, Learning disability and Education. Out of all the topics that were found, a total of 50 articles were used for this paper. Most of the papers that are used have experimental results to support the cause. We eliminated the papers that used Augmented and Virtual Reality in fields other than education. The collected papers were only relevant to the topic of thereality enhancement. With the help of three modules, i.e. storytelling, supervision and personalization module, it makes the game interactive and maintains high concentration of children to the game. The storyline also helps children to improve their social skills. Interactive videos can help children in learning language. These can be implemented in schools at low costs. The device is comparatively less expensive to the bulky AR devices. This device is also very intuitive and grabs children's attention with its sleek design and the videos and images add up as well. These videos can be made as activities in school and help children to improve their vocabulary skills as well [10]. In [11], the researchers have brought in mobile/tablet application into schools which implemented the augmented reality framework. In this framework, each student had a mobile device and made to answer questions based on the storyline the device presented. The answers get stored in the database which will then get corrected by the teachers. There are researches done in multilingual languages as well, this is done in order to aid students in more homely way. One such research is done in Thailand, where the researches have worked in order to develop software that predicts Thai-words, which helps the students to get a more insight in the understanding of the language and to broaden their vocabulary [12]. In [13], the researchers have developed an interactive text book based on augmented reality which is specially designed for students with learning disability. This system uses a web camera and focuses on document to capture. The keywords are captured and then compared to the existing keywords that are available in the database. Then using an AR module the pictures are depicted over the document making it appear like an image of the thing is formed over the textbook. This way, their attention is reviewed and were used that met the criteria of our study. Significant informations are depicted through tables and the references are also mentioned to prove the validity. Our discussions about the papers are given in a detailed manner in the following section.

### 3 LITERATURE SURVEY

#### AR and VR in Pre-school

Education begins at home. School and Home are considered to be separate entities and are not made to be connected. In [8], the researchers have found a way to connect these both in order to be consistent in both. The frameworks they have designed here monitor child's development 24/7 and the addition of additional technologies to traditional paper-based learning. Gaming is a good way to educate children, especially serious games. Serious games are the games with special purpose and not just for amusement. A game developed by [9], uses Google

cardboard to convert smart phones into wearable virtual grabbed and ensures effective learning of the subjects. The words that are not in the database of the system can be added later manually by the teachers. In [14], the researchers have introduced a bot, through which students can interact with teachers and other peers as if they all were present in the same room. This way, a student who can't attend school can feel present and also participate. Sometimes social connections are important for the emotional development of the students. Through simple steps the student can log into the system and then interact in the class. This system can be remotely controlled by a human operator. In [15], the researchers developed an effective VR serious game which helps in educating the students with the help of intuitive games. The interface designed is extremely simple. The two main parts they tried to work on are the association and composition of elements. The game was on the theme of Marine ecosystem, specifically their food chain. This research was done on a specific field.

#### AR and VR in College

A comparison study was carried out on students with learning disability and students who do not have learning disability [16]. The researchers depicted the results in the form of tables where they analyzed the results and found out the students did almost equally well, in the examinations. This shows with proper support students with learning disability can enter into the engineering fields as well. Augmented Reality is stepping into all fields of education. In [17], the researchers did a study on the impact of virtual reality in information recalling. The study took about 10 undergraduates with learning disability. The results showed that the sense of presence is correlated to the ability of recalling of information. But still work should be done in order to carry out more intuitive environments that reduce the feeling of cyber sickness. In [18], Tobias Blum, Valerie Kleeberger, Christoph Bichlmeier and Nassir Navab have brought augmented reality and anatomy together. They have designed a magic mirror application that projects our system onto the display device. With this intuitive design it is helpful for students to visualize and understand different organ structure in our body. In [19], the researchers made a game-based application for students pursuing Civil Engineering, which made studying more interesting and fun to do. In [21], the researchers have worked across 52 higher educational institutes with 180 participants on education of students with learning disability. They worked with the institutes to offer online courses in Latin America, specially designed for such students. The courses offered proved beneficial and decent number of students passed the subjects with decent grades. [22], is another example where the researches have used online MOOC for students with learning disability. The researchers have employed semantic web technology which creates an e-learning environment which helps the students to better their knowledge. These web pages read out loud the functions which they are about to do which makes the user a proper understanding of their actions. These principles can be generalized for the students accordingly for different learning scenarios. In [23], the researchers have worked on word prediction software which helps the students to widen their vocabulary. Research shows that students usually work on a word processor rather than making handwritten notes. The software frees the student from extra work of editing and helps them in concentrating more on the building part which helps

their imagination to flow. Sometimes the software predicts the next word only on the basis of the sequence of letters or words typed. Thus assistive technology such like this is necessary to help the students with learning disability in order to get good education or training. Network technologies also play an important role in the education of students with learning disability. Information depicted through animation and videos can help the students to understand the concepts more clearly. That is why today MOOC courses are so much in play.

## 4 CONCLUSION AND FUTURE WORKS

In this paper, various methods of apply AR and VR has been discussed to aid students with learning disability. With all the discussion it can be said that, AR and VR applications have improved the learning conditions of these students. But since, AR and VR are still young, more researches can be carried out in the practical applications of such frameworks. AR and VR applications are used in higher education as well; studies should be done in the fields for students with disability in higher education so that they get to pursue their dreams irrespective of their disabilities. Researches on more complicated cases should be done for example for people with multiple disabilities. Thereby, implementing these methodologies may impact the future generation of people with disabilities and make their life a little easier. Sometimes, it is difficult to analyze whether the student has a learning disability. And it is important to know at the early stages of life itself. Therefore it is necessary to develop technologies that can understand the problem at an early stage and work with the students through their life. Augmented reality and Virtual reality are somewhat costly systems to launch or operate on a large scale i.e. in schools and colleges. There should be alternatives that can be used. Students thus with learning disabilities should be encouraged in general in schools and colleges to study and should be dealt with patient in the teaching procedure. Thus with proper guidance the students can reach heights that students who don't have learning disability can achieve.

## 5 LIMITATIONS

Cost is one and major limitation in the implementation of Augmented Reality as compared to Virtual Reality. To implement frameworks in school, it may be little hard. For the system to be specialized for students can cost the school a fortune and not everyone will be able to afford it. This may leave out a huge number of student's void of the luxury of education. One more limitation in the application of such projects is that the users should have a prior knowledge in using electronic devices and all these frameworks may be hard to use in the beginning phase of the usage. Language is also a problem for students belonging to places where English is not a common speaking language. Most applications are developed over English language.

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