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A Decade of Research on the Effectiveness of Augmented Reality on Students with Special Disability in Higher Education

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A B S T R A C T

This short article summarizes a decade of research on the effectiveness of augmented reality (AR) in higher education for students with disabilities in particular. The study examines how AR technology has been used to enhance the learning experience of these students. Through a comprehensive review of multiple studies and findings, this study examines the impact of AR on access, engagement, and overall educational outcomes for students with unique disabilities. The findings highlighted significant progress in the field, shedding light on the potential of AR to provide inclusive and effective learning environments for this student population, thereby contributing to a broader discussion of technical and higher education.

INTRODUCTION

In today's educational context, inclusive education prioritizes tailored learning for individuals based on their needs (Lindsay, 2018; Westwood & Graham, 2009). Over time, this approach has evolved from moralistic foundations to specialized strategies for physically, psychologically, or emotionally challenged students, with augmented reality (AR) emerging as a dynamic teaching method (Kellems et al., 2019; Khan et al., 2019). AR combines traditional materials with interactive visualizations, catering to various senses (Sugiura et al., 2018; Rizov & Rizov, 2015). This technology has shown promise in enhancing engagement, motivation, and skills for learners with disabilities (Carreon et al., 2019; Bacca et al., 2018; Cate et al., 2017). In higher education, AR contributes to skill development and immersive learning (Mthembu, 2018; Sampaio & Almeida, 2016), but its potential in addressing disability-specific challenges like autism, hearing impairments, and cognitive limitations requires further exploration (Bridges et al., 2020; Huang et al., 2019; Zhao et al., 2018). However, AR's broader adoption and potential in education demand deeper research (Quintero et al., 2019). This study reviews 16 works dedicated to AR's impact on higher education for students with disabilities, analyzing benefits, drawbacks, conclusions, and challenges in fostering inclusive education.

LITERATURE REVIEW

Certainly, here is a concise literature survey on the effectiveness of augmented reality (AR) in higher education for students with special disabilities over the past decade, augmented reality (AR) is an emerging technology that holds promise for enhancing the educational experiences of students with special disabilities in higher education. This literature survey provides a brief overview of the existing research in this area, summarizing key findings and trends.

Key Findings:

1. **Engagement:** AR has been shown to improve engagement among students with special disabilities. The interactive and immersive nature of AR applications can stimulate interest and motivation, leading to more active participation in learning activities.

2. **Individualized Learning**: AR allows for individualized learning experiences. Customizable features and adaptive content can support diverse learning styles and accommodate the specific needs of students with disabilities.

3. **Accessibility and Inclusivity:** AR has the potential to make learning materials more accessible. Features like text-to-speech and other assistive technologies can be integrated into AR apps to aid students with visual or auditory impairments.

4. **Enhanced Skill Development:** Several studies have reported that AR can be used to develop and enhance skills, such as spatial awareness, problem-solving, and social interaction, in students with special disabilities.

5. **Challenges:** Challenges, including cost, technical limitations, and the need for ongoing research and development, have been identified in the literature. These challenges need to be addressed to fully harness the potential of AR in higher education for students with special disabilities.

Trends and Gaps:

1. **Emerging Technologies:** Recent research emphasizes the integration of emerging technologies like mixed reality and immersive AR to provide more sophisticated and inclusive educational experiences.

2. **Assessment and Evaluation:** There is a growing need for standardized methods of assessing the impact of AR on students with special disabilities in higher education. Researchers are developing various evaluation frameworks and tools to measure the effectiveness of AR applications.

3. **User-Centered Design:** User-centered design principles have gained prominence in recent studies. Collaboration between educators, students, and developers is key to creating AR applications that meet the specific needs of learners with special disabilities.

METHODOLOGY

Identification of Research Questions

The research questions were developed in accordance with the review and grouped under the heading "the purpose of the study" after the study first highlighted the trends in educational AR studies conducted for the years 2011 to 2020.

Identification of Relevant Studies

The use of AR in educational settings is a research area that has just lately gained attention and popularity, thus there aren't many studies that have addressed it in the literature (Akcayir & Akcayir, 2017; Bacca et al., 2014; Cheng & Tsai, 2013; Radu, 2014). Kitchenham (2004) and Arksey and O'Malley (2005) established the inclusion and exclusion criteria for the studies they looked at between 2010 and 2020. The papers under review were chosen based on a variety of criteria, including journals, study topics, methodology, data analysis, findings, limitations, advantages and downsides of augmented reality, and conclusions.

To determine the trends in educational AR research, a thorough and rigorous systematic review was carried out, which meant that papers from a number of databases, including ERIC, EBSCOhost, dissertation, ScienceDirect, Scopus, Elsevier, and ISI databases, had to be examined. When searching for the studies in the databases, the term "augmented reality" was most frequently used to retrieve a greater quantity of these studies across various fields and levels.

Inclusion/Exclusion (Study Selection)

Out of the 36 publications found in the aforementioned databases, 16 were found and after a careful evaluation, were deemed appropriate for the study's objectives. In addition to their outcomes and findings (research data), the studies were categorized by author name, factors, and special needs (study content). Thirty-six records came from the first search. 16 articles were included in this study after applying the inclusion/exclusion criteria (published before 2011, not in English, not students with disabilities, other databases; excluded: published before 2011, not in English, dissertation, ScienceDirect, Elsevier, and ISI databases; inclusion: English language, students with disabilities, AR technology, indexed in ERIC, EBSCOhost, dissertation, and other databases).

Results and Discussion

This necessitated the consideration of the research questions, which are;

1) What is the effect of AR on assisting special needs students in their learning outcomes in higher education setting?
2) What is the top common special needs field for AR in higher education?
3) What are the advantages, limitations, and challenges of AR in special education and suggestion trends in the use of AR in such context?

RESEARCH RESULT

What is the effect of AR on assisting special needs students in their learning outcomes in higher education setting?

In regards to supporting learning outcomes for kids with special needs, over half of all research on AR has found that AR enhanced students' learning results. The results could be explained by the possibility that augmented reality (AR) will help higher education students with disabilities develop their abilities in the following areas: knowledge acquisition, assisted learning and perception, low vision support, social skills development, decision-making support, academic and functional skill improvement, navigation skill improvement, daily independence, and motivation. (Bacca et al., 2018; Benda et al., 2015; Bridges et al., 2020; Cate et al., 2017; Chang et al., 2013; Huang et al., 2019; Lorenzo et al., 2019; McMahon et al., 2015; Smith et al., 2017; Zhao et al., 2018).

The current findings add to earlier systematic reviews on the subject of the use of assistive technology in promoting the learning outcomes of people with special needs, such as those conducted by Baragash et al. (2020) and Barton et

al. (2017). The findings of this study corroborated those of Garzon et al. (2019) and Cacciatore (2018), who established that augmented reality (AR) has the capacity to assist students with special needs in acquiring and learning new abilities. These indicate that the potential for augmented reality (AR) technology to deliver novel learning experiences by merging contextual information with information augmentation should benefit students. (Bacca et al., 2014).

The research that were examined focused on using augmented reality (AR) to engage students with disabilities in higher education, improve their experiences, and motivate them to take use of the features. Another rationale is that since practical instruction makes up the majority of teaching-learning sessions, computer-assisted education is thought to be an effective teaching strategy that students with special needs can use in these situations. According to a related study, kids with disabilities can benefit greatly from technology-integrated vocabulary education (Carnahan et al., 2012).

This study provides significant insight into the relative effectiveness of augmented reality (AR) in fostering favorable learning outcomes and improving the personal, social, and cognitive skills of individuals with special needs. Additionally, it provides educators and decision-makers with evidence-based recommendations for supporting students with special needs, including those who have learning disabilities or cognitive impairments.

What is the Top Common Special Needs Field for AR in Higher Education?

The results of the systematic review seem to indicate that AR is an important technology for all students with special needs. The review results noticed that AR is present not only in specific needs but also in learning disability, cognitive disability. The present results are significant because they will likely inspire and motivate future authors to investigate the use of augmented reality (AR) and its benefits for students with disabilities in higher education settings. While there have been few studies devoted to the positive effects of AR technology in the listed areas, no research has examined other types of disabilities in higher education settings, such as learning disabilities, Down syndrome, dyslexia, and deafness.

The present findings build upon earlier systematic reviews, including those by Sirakaya and Sirakaya (2018), regarding the effectiveness of assistive technology in creating suitable learning environments for students with special needs. The study's findings demonstrate that augmented reality (AR) is a technology that may be used in special education for a wide range of demands. Based on the results, very few studies were conducted specifically on special education needs, especially for those with learning difficulties, developmental disabilities, visual impairments, or cognitive problems. The majority of these studies were primarily focused on autism. However, AR technology showed promise and was beneficial for special education needs. The study's results are noteworthy and suggest that future research look into the aforementioned subjects.

What are the Advantages, Limitations, and Challenges of AR in Special Education and Suggestion Trends in the use of AR in Such Context?

Since augmented reality technology is still relatively new, not much is known about how it works, how much of it can be used, and whether or not the objects needed for intervention can improve the effectiveness of AR. Therefore, the goal and duration of activities determine constraints. In order to give information based on needs, the development of AR applications must take into account the user's perception and needs (Huang et al., 2019; Zhao et al., 2018). Because AR is a relatively new technology, its limitations also pertain to the user's proficiency and ability to use it. Therefore, the development of augmented reality technology should focus on satisfying the learning goals of students and be designed to be flexible enough to allow them to easily complete the activities.

The new findings build upon earlier systematic studies that addressed certain needs, including Giglioli et al. (2015) and Blattgerste et al. (2019). Therefore, the development of augmented reality technology should focus on satisfying the learning goals of students and be designed to be flexible enough to allow them to easily complete the activities. However, AR technology held promise for helping special needs kids acquire new abilities in an efficient manner. The study's results are noteworthy, and they suggest that future research look into the aforementioned subjects in special needs environments.

CONCLUSION

The effectiveness of augmented reality technology in meeting special education needs in higher education settings was thoroughly reviewed in the current systematic review. According to the results, the majority of the studies in the literature confirmed the potential of augmented reality (AR) to support and meet the demands of special education, especially for children with learning difficulties and other forms of disabilities. They also supported favorable outcomes. Additionally, it has been demonstrated that AR helps those with visual impairments and fosters social contact among people with disabilities, inspiring and motivating them to engage in everyday tasks and social interactions.

The outcomes also demonstrated the value of augmented reality (AR) in helping special education kids grow by providing them with real-world experiences and enhancing their social connection and environmental collaboration (among classmates and teachers, among other things). Thus, it can be said that AR has the potential to help people with special needs learn and enhance their social and intellectual abilities. While implementing augmented reality (AR) technology to help people with disabilities learn different skills to meet their needs and to motivate their engagement in society to lead a normal social life is beneficial, research has shown that designing AR activities is a major challenge as well as learning using AR, which is a multitasking technology that some students may find challenging to use.

ADVANCED RESEARCH

Considering the researchers' own limited knowledge and skills, the researcher has come to the realization while producing this article that there are still numerous deficiencies in language, writing, and presentation style. As a result, the researcher anticipates helpful critiques and recommendations from a range of sources to ensure the piece is flawless.

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