Original Article

The effect of modern technology app on the self-regulation skills of students with disabilities

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Abstract:

BACKGROUND: Augmented reality (AR) is capable of facilitating constructive learning through the provision of a learner-centered environment, making for more flexible learning and providing a more distinct experience of learning. AR technology has a significant influence on the teaching approach provided to students with learning disabilities, particularly on their level of self-regulation, and this premise is what motivated the present study.

MATERIALS AND METHODS: The research is a quasi-experimental study that adopted a pre- and post-test control group design, involving 24 students who have disabilities. The students were divided into AR group and control group, and data were then exposed to the descriptive statistics and paired sample t test.

RESULTS: The results showed that AR technology has a significant effect on the enhancement of the self-regulation of students with learning disabilities.

CONCLUSION: The study indicated a significant effect of AR app on the self-regulation skills of students. The study, therefore, encouraged decision academicians to implement technology approaches in the disability setting.

Keywords:
Augmented reality, disabilities, learning, self-regulation

Introduction

In the face of several teaching approaches that have been utilized to enhance the achievement of students without learning disabilities, studies concerning the enhancement of those with disabilities and the required interventions are still lacking.[1,2] Developments in technology have extended the teaching and learning boundaries and have led to new delivery modes of courses (e.g., e-learning, virtual lectures, and augmented reality (AR)).[2-4] Specifically, AR refers to a technology with a promising potential of paving the way for new teaching and learning approaches, increasing the achievement and success among students

with and without disabilities.[2] AR was proposed based on three characteristics: 1) contextual by combining the real and virtual world that are displayed simultaneously, 2) real-time interactivity, and 3) registration in 3D.[5] Literature evidenced the need for AR technology for students, which is considered a promising tool to promote students learning, motivation, achievement as well as increase their confidence, daily life skills, and satisfaction.[6-8] However, there is a lack of evidence on the application and developmental trends of integrating technology into the realm of special education,[9] with e-learning application being suggested as a tool to improve learning and self-regulation among students.[10]

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The above premise is supported by some scientific evidence; for instance, AR enables children with disabilities to understand concepts in a more expedient and effective manner.[11] In addition, another study[12] revealed the exciting and fun teaching aids that AR can bring to the learning table for special needs children. Similarly, AR has a positive effect on the students' educational experiences, their confidence, and their commitment and interest levels.[13] AR was also reported to enhance students' learning toward mathematics among students with disability.[3] Additionally, AR has been reported to enhance the achievement of students and their success, interest, engagement, satisfaction, and promote positive learning and teaching environment.[6-8] Thus, the present study primarily aims to extend the literature concerning interventions toward the use of AR, which is a pioneering endeavor and response to the suggestions in previous studies.[14,15]

Materials and Methods

Research design and setting
The present study is a quantitative quasi-experimental study that used a pre- and post-test with control and experimental groups,[16] the former receiving AR technology learning, while the latter traditional learning approach. The study is a survey study as a survey was conducted to determine the characteristics, views, attitudes, abilities, beliefs, thoughts, and expectations of the respondents.[17]

Study participants
The study participants constituted 24 sixth graders enrolled at a school in a district of Jordan, and the data collection process took a period of 4 weeks. The students had learning disabilities, and they were selected using the purposive sampling method to identify the group to be examined. Purposive sampling is a type of sampling where the sample is identified based on the study purpose.[17] AR-supported instruction was applied to the experimented group where for 4 weeks they were taught units 1–4 through AR application. Students were randomly assigned to the AR group and the control group, and the instruction documented markers to activate AR activities providing them to specific activities and student group. The students were provided the same introductory basic science class prior to the experiment.

Ethical consideration
The ethical consideration of the study was conducted from the schools as well as from the Ministry of Education. Proper written permission was obtained from the schools.

Data collection
The study collection tools utilized in this study include demographic variables and AR applications self-regulation scales. First, the self-regulation scale called the Learning Strategies and Study Skills Survey (LSSS) was adopted from a previous study[18]. The scale assesses the strategies that students with learning disabilities use in general learning situations; there are three strategies to it, namely conceptual skills, routine memorization, and compensation strategies. A total of 19 items were categorized under three factors. A 5-point Likert scale was used that ranged from 1 (not at all typical of me) to 5 (very typical of me). The value of the internal consistency reliability coefficient of the scale was 0.91, which establishes its validity and reliability to assess self-regulation among 6th-grade students with learning disabilities toward AR applications.

Results

In the present study, *t* tests were carried out to examine the differences between pre- and post-test results for the groups in terms of overall self-regulation, particularly through ANOVA and ANCOVA. Paired sample *t* test was conducted for the mean scores of students' self-regulation in pre- and post-test. Table 1 shows that the overall self-regulation in pre-test mean was 2.31 (standard deviation (SD) = 0.365), while the post-test mean was 2.97 (SD = 0.453). Thus, there is an increased mean score from pre- to post-test in self-regulation level. The paired sample *t* test overall mean scores indicated significant t (5.569, df = 23, sig = 0.000), with the differences in the mean scores being 0.662, indicating a significant increase of ($P < 0.05$) in the self-regulation of the students as shown in Table 2.

Paired sample *t* test was conducted for the mean scores of students' self-regulation in pre- and post-test. For the experimental group, Table 3 shows that the overall

Table 1: Summary statistics for the sample on the self-regulation scores

Variable	Post-test	Pre-test
Self-Regulation		
Mean	2.97	2.31
SD	0.453	0.365

Table 2: Results of paired sample *t* test for self-regulation

Variable	*t*	df	Sig. 2 tailed
Self-Regulation Pre-Post	5.569	23	0.000

Table 3: Summary statistics for the experimental group self-regulation scores

Variable	Post-test	Pre-test
Self-Regulation		
Mean	3.03	2.22
SD	0.427	0.292

self-regulation in pre-test mean was 2.22 (SD =0.292), while the post-test mean was 3.03 (SD =0.427). Thus, there is an increased mean score from pre- to post-test in the experimental group.

The paired sample *t* test overall mean scores in Table 4 indicate significant t (−7.151, df = 11, sig = 0.000), with the differences in the mean scores being − 0.802, indicating a significant increase (*P* < 0.05) in the self-regulation of the experimental group students.

Discussion

Based on the reported finding in this study, a significant differences exist in the self-regulation of the two groups, with the experimental group outscoring the other in terms of higher self-regulation. The study concluded that AR activities enhance the ability of the students to visualize and understand abstract concepts, their motivation, and their self-efficacy. In the same way, the result of the present study may be related to the ease with which the students understand the activities, manage them, and memorize the knowledge obtained from them. According to a previous study,[19] AR assists students in acquiring information in various formats and controlling and managing the activity, in their quest to explore topics, revisit materials, and navigate through their learning. AR materials are invaluable to learners n that they pave the way to practical opportunities, among students with and without learning disabilities. Furthermore, AR teaching materials pave the way for opportunities to experience the online realm to support and maintain the ability to comprehend and perceive.[20] The authors revealed that AR materials enable special education children to meet their fundamental needs through their own efforts without depending on others, achieving equal opportunities and contributing to family and society. AR technology provides advantages to students, enabling them to achieve gains in the education process.[21,22]

More recently, it has been evidenced that technological development, including AR, has been used to enhance the skills of special education students; to begin with,[20] focused on developing AR teaching materials that can facilitate special needs students to meet their needs through their efforts without being dependent on others. The results showed that AR materials are effective in providing such students with real-life experiences, enhancing their eagerness and enthusiasm of the lessons and their level of readiness and interest on

the subject. In the same way, AR book was developed in a study[23] for ASD students to recognize various emotions and found AR to be a good tool for emotional recognition, and for enhancing skills relating to society and memory. According to a previous study,[1] the use of video-based instructions through AR is effective in improving problem-solving skills when dealing with mathematics, specifically for special education learners. Students with learning disabilities need real-life experiences to understand the studied topics and need to acquire basic skills and knowledge in the courses, and this is possible through AR. Thus, it is clear that the study results contribute to the literature of AR, in that self-regulation of students with learning disabilities is enhanced through AR.

Implications
The study results support the premise that delivering instruction in education with the help of instructional technology method leads to enhanced learning and academic skills success among students suffering from learning disabilities. First, researchers can avail effective intervention for students with disabilities by using AR technology. Second, practitioners can prevent the extrapolation of what is known about one population to another for decision-making based on the most effective instructional method. Therefore, the study findings are expected to contribute to the empirical literature on AR design in the context of 6th graders, and with support from further findings, the results can be held as evidence for effective academic instruction for the minor populations needing and deserving the most optimum teaching methods supported by technologies. This study has two distinct findings: effective instructions for students with distinct learning disabilities, instructions using AR as a direct method for students with disabilities, and AR technology effects on the self-regulation of students with learning disabilities.[24] The study results support the integration of students with disabilities into general education classes through their exposure to multiple instructional approaches that can generate positive outcomes. The results also supported previous studies that highlighted the importance of using a more effective teaching-learning method than the traditional one.[25,26]

Limitations and recommendation
This study has its limitations that should be kept into consideration by future authors in the same pursuit of research. First, the study's sample size prevents the generalization of results to the general population of students with learning disabilities as the study focused on a specific disability. The results of the study reflect the perception of the study participants; thus, the study sample has to be extended and other students should

Table 4: Results of paired sample *t* test for the experimental group self-regulation

Variable	*t*	df	Sig. 2 tailed
Self-Regulation Pre-Post	−7.151	11	0.000

be included in the experiment. The results showed enhancement of students' mean scores in terms of self-regulation, but the study period was limited to only 4 weeks; therefore, further studies have to extend the period of experimentation.

Conclusion

The result of the present study demonstrated that the implementation of the AR learning strategy is effective in the enhancement of self-regulation among students. Such a strategy is suggested to be implemented in school setting in general and special education students in particular. This study also shows that the overall mean scores of self-regulation indicated significant t (5.569, df = 23, sig = 0.000), with the differences in the mean scores being 0.662 in post-test compared to pre-test scores. The study also found that there is an increase in the mean score from pre- to post-test in the experimental group. The importance of the research is evident in the following theoretical and practical aspects as the study contributed to the literature by identifying the importance of AR strategy in educational settings, which was not tested previously. Further studies are needed to include other variables that were not included in this study. Thus, the results of the study can be used to develop education strategies to improve the positive educational outcomes of students.

Conflicts of interest
There are no conflicts of interest.

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