

A Brief Review on the Effectiveness of Computer-Assisted Instruction on the Academic Skills of the Students with Autism Spectrum Disorder

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Abstract

Computer-Assisted Instruction (CAI) has an increasing popularity due to its effectiveness on the education of the students with disabilities involving the students with autism spectrum disorder, one of the developmental disabilities which is seen among 60 individuals out of 10,000. CAI is used in the education of autistic individuals in various fields since it provides repetition, predictability and motivating learning opportunity which meets the needs of the students with autism. Specifically, CAI is effectively used in the teaching of academic skills, such as vocabulary, grammar, reading, writing and mathematics, to autistic individuals, and can be used in many different since it is widespread and easily reachable. Hence, the use of CAI in the teaching of academic skills has been widely investigated in recent years. In this paper we review the existing studies and evaluate the results obtained in these studies. Based on the results, it is clear that CAI is more effective than traditional teaching methods in the acquisition of academic skills in autistic individuals.

Keywords - Autism Spectrum Disorder, Computer-Assisted Instruction, Academic Skills, Open Research Issues.

1. INTRODUCTION

Computer-assisted instruction (CAI) is a tool which is used in teaching a lesson. The concept of computer actually includes many technological devices. These are iPad, laptop computer, mobile devices like iPod and technological devices like a desktop computer. It can be used for various purposes such as repetition and practice, self-teaching, simulation, problem solving and educational play. It also offers the opportunity to use thinking skills developed by the individual. Through appropriate teaching programs, the individual works at his/her own pace and has the opportunity to do as many repetitions as he/she wants (Watson, 2014).

CAI has an increasing popularity because of its effectiveness on the education of the students with disabilities involving the students with Autism Spectrum Disorder (ASD) (Root and Others, 2016). ASD is one of the developmental disabilities, which is seen among 60 individuals out of 10,000. Autistic children often display repetitive behaviors and difficulties in social skills and also problems in communicating with others (Zhao and Others, 2013). The use of CAI in autistic individuals is thought to be very appropriate because it suggests that this method is appropriate to the characteristics of autism (Watson, 2014). It provides repetition,

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predictability and motivating learning opportunity which meets the needs of the students with autism (Luckevich, 2008). Therefore, it is a commonly used method to support individuals with ASD.

CAI is effectively used in the education of autistic individuals in various fields. Today's conditions also require this. We are in the age of technology and all individuals who need regular or special education cannot stay away from technology. Therefore, this method is being effectively used in the teaching of academic skills, such as vocabulary, grammar, reading, writing and mathematics, to autistic individuals, in the development of life skills, and social and communication skills, and in the reduction of problematic behaviours (Watson, 2014). CAI can be used in many different environments like home, clinic and classroom. It is easily reachable, available and widespread (Luckevich, 2008).

2. THE STUDIES ON CAI

It is aimed to teach various academic skills to autistic children by using CAI model in most researches. Academic skills are classified into the categories like literacy, mathematics, science and social skills (Root and Others, 2016). For this reason, the changes observed in the academic skills of autistic children through CAI have been examined in many researches. The common conclusion from the five articles examined in this study is that the use of CAI is more effective than other traditional teaching methods in the acquisition of academic skills in autistic children. The results of the studies are briefly given below.

Smith, Spooner, and Wood in (Smith and Others, 2013), titled using embedded computer-assisted explicit instruction to teach science to students with autism spectrum disorder, have found that embedded CAI was effective in teaching and applying science terms to autistic and mentally handicapped individuals. Scientific literacy is very complex for students with ASD and mental impairment. It is necessary to teach new skills, especially academic skills, with single case study. The participants were three autistic students going to the secondary school students. The study was conducted in the inclusive science class. A multiple probe across participants design was used to assess the effectiveness of the intervention. The results have showed that there has been a functional relationship between the number of correct answers given at the beginning of the intervention and during the probe sessions.

Mc Kissick, Spooner, Wood, and Diegelmann in (McKissick and Others, 2013) have achieved a promising outcome that has helped autistic students to master map reading skills by combining explicit education and a model of CAI in their study. For students with disabilities, including autism, the education reform has a history that focuses solely on reading, mathematics and science. To date, very few experimental studies have been published that examine social classes. This study examines the effects of a computer-assisted open-instruction package on teaching map reading skills to three autistic middle school students. A multiple-baseline across participants design was used to measure the effectiveness of the intervention package. While the results do not show a functional relationship, they indicate that the three learners have had a change in their level of performance. Similar to other previous studies, the combination of computer-assisted explicit instruction has been effective in teaching a new academic ability to autistic children. In this study, the three students were able to identify symbols on previously untrained maps as well as identify new symbols on the demonstrations and new maps. CAI has many advantages in allowing students to work independently to gain skills, adapting the instruction to meet the specific needs of the students, and giving the teacher time to focus on other students or all classroom instruction. In short, this study has shown that CAI can be a practical approach in teaching map skills to autistic students.

In (Neely and Others, 2013) Neely, Rispoli, Camargo, Davis, and Boles have found that teaching through iPad reduces the problem behaviors of autistic children and increases their academic participation when compared with teaching through traditional materials. The use of iPads in education of autistic children is increasingly becoming widespread. However, there are very few empirical studies investigating the effects of the iPad on students' behaviour. The purpose of this study is to compare the academic instruction provided by the iPad with the academic instruction provided by the traditional materials for two students with ASD who have been experiencing escape-maintained challenging behaviour. The ABAB model was used to compare these two academic instruction models. Both participants exhibited lower levels of problem behaviour and higher levels of academic participation in the iPad application. Conversely, when using traditional materials, higher levels of problem behaviour and lower levels of academic participation have been observed. These results show that the use of iPad as an instructional tool has reduced the escape-maintained challenging behaviour in some autistic children.

Whitcomb, Bass, and Luiselli in (Whitcomb and Others, 2011) have studied the effectiveness of Headsprout, which is a computer-based early reading program, in an autistic student's reading the vocabulary lists and the corresponding text taking place in Headsprout correctly. According to the results obtained, this program has been seen to be effective in acquiring the intended academic skills. Headsprout is an internet-based program aimed at accelerating the early reading skills of students at primary levels. In this study, Headsprout's first class-based evaluation has been carried out. Thus, its items and the implementation of computer-based early reading programs with autistic children have been discussed. As a result, the participant has made progress in reading the Word Set and the related text in the Headsprout Readers following the intervention.

In (Pennington and Others, 2010) Pennington, Ault, Schuster, and Sanders have tried to teach writing story to autistic students by using simultaneous prompting and CAI in their work. In this study, the participants were three male autistic students aged 7-10 years. A multiple-baseline across participants design has been used to measure the effect of the implementation. According to the data, simultaneous clue and CAI seem to be effective in improving the story writing skills of the three participants as they have maintained this ability after the implementation.

Burton *et al.* in (Burton and Others, 2013) have tried to evaluate the effectiveness of video self-modeling through an iPad to help the adolescent participants with autism and intellectual disability in acquiring math skills. They used a multiple baseline across participants design to determine the effects of the implementation. Four adolescent male students were included in the study. During the application, they watched the videos about guessing the amount of the money paid for the object and the amount taken in charge. The results showed that the intervention was successful in teaching the math skills to the participants.

In (Malley and Others, 2014) Malley, Lewis, Donehower and Stone have investigated the effect of iPad applications in increasing the academic task completion and basic mathematics skill acquisition by the students with autism. Besides this, they also looked for the advantages and disadvantages of iPad application in teaching the target goals. To determine the effectiveness of the intervention, ABAB single subject design was used. The obtained results indicated that the participants became more successful in independent task completion and the intervention helped them improve their mathematics skill and independence.

In (Travers and Others, 2011) Travers *et al.* have studied on teaching alphabet skills to young children with autism. They compared two implementations in this study. The first one was group instruction in which alphabet books were used by the teacher and the other one was multimedia computer-assisted instruction. They tried to find out the effectiveness of the applications in acquisition and maintenance. The findings suggested that the two applied interventions were successful in teaching and improving the alphabet skills of the students with autism. It was also indicated that the students maintained this acquired skill after the implementation ended.

To sum up, it is clear from the results obtained from the studies mentioned above that CAI is an effective method for acquiring academic skills for autistic children according to many other teaching methods. As the educators are in charge of teaching academic skills to the students with autism whose number is increasing day by day, they need to find the methods which are effective and efficient in their education (Root and Others, 2016). Thus, CAI is a good sample for an implementation which can be useful to help these students to improve their academic skills.

3. OPEN RESEARCH ISSUES

There are various works on this topic. However, researches on these issues can be repeated and diversified in the future or new studies can be undertaken to complement the missing aspects of the studies.

- This model can be adapted to older children and adolescents.
- Studies like this can be done again with newer technological, easy to use devices.
- A prospective study measuring the commercially available computer-assisted instructional program can be conducted to teach the content of social studies to autistic students.
- Studies may be conducted to indicate social validity by asking parents, teachers, or individuals who use this device on the impact of iPad usage in reducing problem behaviours and increasing academic participation.
- The Headsprout reading program can be repeated with autistic students using different students, teachers, different school environments, and alternative forms of measurement.

The effects of simultaneous prompting and CAI on other writing skills can be examined. It can be writing an e-mail or mutual communication.

4. CONCLUSION

In recent years, CAI has become very popular on the education of the students with autism ASD. It is effectively used in the education of autistic individuals, especially in teaching academic skills, since it is readily available and affordable, offers interactive, measurable, and customizable training, and using it repetition, predictability, interesting instruction and motivating learning opportunity can be provided to autistic individuals in a classroom, at home, and in a clinic. This study has provided a short literature review to identify and evaluate the effectiveness of the existing works in teaching academic skills to autistic individuals. Based on the literature review we can conclude that CAI is more effective than traditional teaching approaches for this purpose.

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