

# A Survey on Effects of Computer Based Technology for Special Needs Learners

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## -----ABSTRACT-----

With e-learning, the much talked technology in education, various learning environments and activities have come up to promote more effective, efficient and meaningful learning. As the learning requirements of general learners differ from that of special learners, learning technology comes to the rescue of special need learners. Special needs can be broadly categorized as physical and mental. This study concentrates on the special needs of mentally challenged learners. Learning disabilities for mentally challenged learners have a broad spectrum. Many learning technologies have come up with specialized programs for special need learners but satisfactory results have not been obtained. The study carried out focuses on the survey of various specialized programs such as ‘Math Explorer’, Teach Town: Basics, Animated Pedagogical Agents, to name a few, that have been used for special needs learners for their social, emotional and cognitive skills. Also the paper reviews the research work that uses Computer Assisted Technologies or other Learning Technologies carried out for the spectrum for special needs learner.

**Keywords – Computer Assisted Technology, Computer Assisted Interface, e-Learning, Learning Disabilities, Special Needs Learner.**

## I. INTRODUCTION:

Learning technology (LT), Computer assisted technology (CAT), Computer assisted interface (CAI) are technologies that enhance the learning ability of learners [1, 2, 3]. Much work has been carried out in this area where by students have benefitted by these technologies but it is equally true that needs of specially challenged learner have not been satisfied. Special need learner can be broadly categorized as physically challenged and mentally challenged learners [1]. The needs of mentally challenged learners are very different from that of physically challenged learners. In the former case cognitive and other brain related aspects of the learner needs to be addressed, which is not always true in the latter cases. Various mental challenges such as learning disability, autistic disorders, down syndrome, attention deficit hyperactive disorder to name a few, have to be dealt in an appropriate manner. The learning technology programs that are developed suffer various limitations: (a) the program do not understand the unstable attention patterns of the special need learners, (b) poor design of CAT programs and (c) limited acts or programs available [3]. Various experiments were carried out using learning technologies [1, 4, 5, 6]. The analysis shows, experimentation done using technology in a controlled manner yields positive results in areas of

behavior and cognitive skills [4]. The rest of the paper presents a review on various technologies used for research purpose for mentally challenged learners.

## II. LEARNING TECHNOLOGY FOR DIVERSE LEARNERS:

With the advent of new technological devices and virtual worlds, new pathways to online learning and student retention have emerged. This fact is true for diverse learners who have difficulty learning with the traditional pedagogies used in teaching [7]. In a review research, [1] talk about the use of learning technology (LT) with computer assisted technology such as web-based mentoring, use of laptops and the use of computer based educational games. Two major research questions were addressed:

1. What are the major research aims, methodologies, and outcomes in these studies of implementing LT in the field of special education? and
2. What types of LT are mainly used with special education students, and for what kinds of students?

It was observed from the analysis done by [1], that LT using computer assisted technologies is more effective in special education for mentally challenged learners. It was also observed from the research that more studies were

carried out investigating the use of LT with mentally challenged learner rather than physically challenged ones. This gives an implication that mentally challenged learners face more problems with learning target abilities as compared to physically challenged learners. These abilities can be acquired vocabulary or being able to understand geometry. Thus it is more urgent to help mentally challenged learners to be able to learn academic knowledge and help them solve more practical physical problems with the aid of technology as compared to physically challenged learners.

It is a general observation that learning done through audio-visual representation has a long-lasting effect on special needs learners. Research work in this area has been initiated since many years [8], but little has been published. The major questions to be addressed in the case special needs learners are:

1. Who will be the major beneficiaries of the system
2. What are the major research aims
3. What are the methodologies of implementation
4. What kind of learning technology is to be used with special need students
5. While learner faces challenge in the learning process, teachers face challenges in meeting the requirements of their learners.

In an exhaustive study carried out by [3], they concluded, computer assisted technologies (CAT) enhances the social, communicative and language aspects of autistic spectrum disorder (ASD) children. The study included four basic categories: Remediation of deficits in language skills, including reading, teaching social skills, including verbal and non-verbal communication, play skills and daily life skills, enhancement of face processing and emotion recognition and comprehension and teaching Theory of Mind. The study concludes with the observation that properly designed CAT programs are advantageous to ASD children. However, majority of these kinds of programs are not designed for these children. Even if some are designed, there are some limitations such as:

1. Providing complex multi-dimensional or multi-modal information for making understand a concept or some relevant information is to be conveyed, may result in undesirable behavior of the children as for ASD children the attention patterns of these children are abnormal.
2. Poorly designed CAT programs may isolate the children from being social.
3. There are very limited acts of behaviors and ways for ASD children respond to various stimuli. Majority of CAT programs lacks in generalization of treatment effects which become a problem for ASD children.

With the plethora of games developed using multimedia technology and its easy availability has shown an affinity for children for computers. This trend is also observed in most of the children, including children with Autistic disorders as well as other mental disorders [3]. Children with autistic disorders have one or a few of the following characteristics such as (a) failure to develop peer relationships, (b) lack of engagement in play with peers, (c) lack of emotion recognition, (d) difficulties in communicative interactions, (e) generally poor social skills, (f) difficulties related to pragmatics, (g) misinterpret speech by relying on the literal rather than the contextual meanings of words (American psychiatric association), [9]. Due to the aforementioned reasons, such children are often subject to inappropriate behaviors like (a) throwing tantrums and (b) self-injurious behavior. Use of individualized computer programs for such children has great potential for their treatment. However, there is no generalized program that can work out in these children as each individual has a unique area to be focused. Study also reveals that CAT programs that are developed generally give good results in the case of normal children, but in the case of special children the results are not up to the mark. This is due to the following reasons: (a) the program does not understand the unstable attention patterns of the special need learners, (b) poor design of CAT programs and (c) limited acts or programs available [2, 3]. Developing CAT programs for special need children is still an open research area with great challenges since each learner is special and has special needs.

Another important issue observed by [10] is how computer assisted technology (CAT) is at par with the traditional way of teaching. Certain questions arise, such as can the special need children be given a fully CAT enabled environment or should only the traditional method be followed or should there be a combination of CAT + teacher? The aforementioned questions need to be addressed. Also it is important to know for a CAT + teacher combination what should be the percentage of contribution or intervention of the teacher in the whole process. Study reveals that the combination of CAT + teacher gives slightly better results than CAT alone. No evidence was found revealing whether CAT alone was better or teacher alone was better.

Animated pedagogical agents [11] are viewed as positive and motivational support in multimedia instruction. The article provides five design principles for learning benefits of these pedagogical agents. They include: (a) description of the need for adequate controls that are required for specific type of learning and/or motivational support the agent is providing; (b) suggestion for different measures to test a variety of learning and motivation outcomes that may be influenced by agents; (c) advice to the researchers to pay special attention to the reliability and construct validity of experimenter designed measures; (d) recommendation for the collection of data on the relative cost of producing agent and non-agent treatments; and (e) providing alerts to those

who plan treatments for experiments to exercise caution when developing and testing agents that are visually and aurally "noisy" or complex.

According to [12], learning outcomes can be enhanced by using learning technology into the instructional curriculum for special need learners. In their study, [12] designed and developed a computer assisted instruction program, 'Math Explorer', for students with learning disability. The main focus of the study was the design features that would assist the learners in better learning and understanding of a given basic mathematical word problem for addition and subtraction. The results of the study indicated that given a critically designed user interface feature facilitate the special need learners to mathematical learning.

In a study carried out by [6] for preschool and K-1 students, a computer assisted instruction program TeachTown: Basics were implemented for three months. This program was carried out for 47 ASD children. The program also consists of supplementary off-computer activities. The program lasted for 3 months and each approximately the duration was 20 minutes per day on computer and 20 minutes per day off-computer. The students taking part in the TeachTown: Basics program showed more improvement than the students not taking part in the program. A significant progress was observed in the control over language and cognitive skills. However, authors have found the use of CAI for remediating the deficit found among ASD children and other special needs children.

In a study carried out by [13], two children with moderate to intensive disabilities were investigated for their basic academic skills acquired and its maintenance. The special education teacher created individualized computer games corresponding to their individual needs. The computer games were created in such a way that children could practice independently. These games checked the basics such as letter-sound, number identification and word identification and provided discrete learning trials with quick feedback for every answer. The program helped the children in successful acquisition of the basic skills. The results demonstrate regular computer practice enables not only independence in work, but also increases the attention span of the moderate to intensive disabled children, as mentioned in the experimentation.

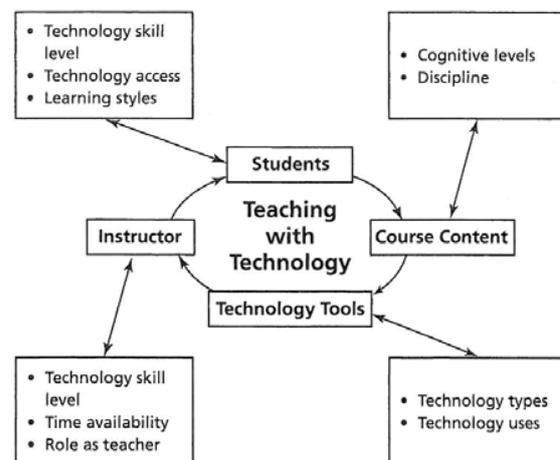


FIGURE .1 Teaching with Technology

The effect of video games was studied by [4], where the study reveals that playing violent video games may result in higher levels of aggressive behavior, cognition, and in higher physiological arousal and lower levels of pro-social behavior. They also suggest that on the positive side there are numerous controlled experiments utilizing video game training that show improvements in aspects of information processing such as motor skills, auditory and visual processing and spatial imaginary skills.

On the similar lines, [2] used CAT, to study the abnormalities in different aspects of spoken language (eg. What is said and how it is being said), using video games. In their study, they found that ASD children able to play the video games in comparison to their normal peers and were able to perform as well as their peers. The study focused on the assessment of attention span of the ASD children. The children showed atypical attention span as they were not able to prioritize the content that was conveyed to them.

In a study carried out by [14], feedback through computer interface was used to encourage ASD children to speak. The study was conducted for three ASD children and two children with both ASD and Down syndrome. The age group addressed was 3 to 8 years and all the children were low functioning children. The program was set in such a way that feedback could be presented visually or aurally such that the program's effect on children's attention, affect, and phonetic production could be analyzed. The study concluded that any type of feedback may be effective in enhancing spontaneous speech-like vocalizations in low functioning children, and applications that are customized to match the abilities of individual children show positive results. The researcher hypothesized that his program was successful because the children experienced CAT as a less anxiety-inducing situation and responded with less apprehension during play than in a typical human-to-human interaction. However, no non-computer (traditional instructions) condition was included, nor a control group of

typical children, that would permit direct assessment of the efficacy of this approach especially for ASD children.

### III. OBSERVATION FROM THE STUDY:

From the above background study following observations may be done:

1. Learning challenges can be met through audio-visual representation. Learning done in this manner makes learning simple, easy and has a lasting effect.
2. Learning can be simplified and retention can be made high when variety is added to the format of learning content.
3. Computer assisted technologies for learning technology are more effective in special education, although individualized programs have to be catered.
4. A design of interactive and self-regulated learning environment promotes learning and motivates the learner for learning.
5. Since it is difficult to have individual program for every learner, an adaptive system designed especially for need based learners will assist the learner to fulfill his learning requirements.

### IV. FUTURE WORK SUGGESTIONS:

Instructors and special learners are the major beneficiaries of CAT, LT or CAI enabled system. Looking to the above study and the contribution of computers and multimedia technologies, following future enhancements are proposed:

1. An adaptive system can be constructed that can sense the learners' need and accordingly show the content to be learnt.
2. The sequence of the content should not be fixed but should change dynamically as per the feedback provided by the learner in terms of clicks, hit rate of a specific content and assessment done, audio or visual assessment done. Thus if the learner begins to grasp the content easily, the level of learning can be increased by providing rich content. On the other hand, if the learner takes more time to learn, a variety of ways of learning can be offered so that the learning becomes easy.
3. In many cases where the intervention of the instructor is required at the initial levels, provision can be made for a smooth take off from the instructor to the learner learning independently.

### V. CONCLUSION

From the above study, a summary can be drawn that although many learning technologies and computer assisted technologies are available, still the programs lack scientific approach in the method construction. Although, it is

difficult to understand the special needs of the mentally challenged children, a model can be prepared that can act as a model for content management for these children. Above all, the individual needs of the learner have to be understood, and as and when required, human interaction (in terms of instructor interaction) can be provided.

### REFERENCES

- [1] Liu, Gi-Zen, No-Wei Wu, and Yi-Wen Chen. "Identifying emerging trends for implementing learning technology in special education: A state-of-the-art review of selected articles published in 2008–2012." *Research in developmental disabilities* 34.10 (2013): 3618-3628.
- [2] Ploog, Bertram O., Snigdha Banerjee, and Patricia J. Brooks. "Attention to prosody (intonation) and content in children with autism and in typical children using spoken sentences in a computer game." *Research in Autism Spectrum Disorders* 3.3 (2009): 743-758.
- [3] Ploog, Bertram O., et al. "Use of computer-assisted technologies (CAT) to enhance social, communicative, and language development in children with autism spectrum disorders." *Journal of autism and developmental disorders* 43.2 (2013): 301-322.
- [4] Buckley, Katherine E., and Craig A. Anderson. "A theoretical model of the effects and consequences of playing video games." *Playing video games: Motives, responses, and consequences* (2006): 363-378.
- [5] Whalen, Christina, et al. "Behavioral improvements associated with computer-assisted instruction for children with developmental disabilities." *The Journal of Speech and Language Pathology-Applied Behavior Analysis* 1.1 (2006): 11-26.
- [6] Whalen, Christina, et al. "Efficacy of TeachTown: Basics computer-assisted intervention for the intensive comprehensive autism program in Los Angeles unified school district." *Autism* 14.3 (2010): 179-197.
- [7] Shepherd, Carol M., and Madelon Alpert. "Engaging diverse learners through new technologies." *Global Humanitarian Technology Conference (GHTC), 2013 IEEE*. IEEE, 2013.
- [8] Abdalla, Hafiza, YehiaMostafaHelmy, and Mohamed Marie. "The impact of e-learning on the hearing impaired (Empirical study on Hearing-impaired students in middle school)." *INTERNATIONAL JOURNAL OF COMPUTERS & TECHNOLOGY* 11.5 (2013): 2534-2543.
- [9] Grynszpan, Ouriel, Jean-Claude Martin, and Jacqueline Nadel. "Multimedia interfaces for users with high functioning autism: An empirical investigation." *International Journal of Human-Computer Studies* 66.8 (2008): 628-639.
- [10] Coleman-Martin, Mari Beth, et al. "Using computer-assisted instruction and the nonverbal reading approach to teach word identification." *Focus on*

*Autism and Other Developmental Disabilities* 20.2 (2005): 80-90.

- [11] Clark, Richard E., and Sunhee Choi. "Five design principles for experiments on the effects of animated pedagogical agents." *Journal of Educational Computing Research* 32.3 (2005): 209-225.
- [12] Seo, You-Jin, and Honguk Woo. "The identification, implementation, and evaluation of critical user interface design features of computer-assisted instruction programs in mathematics for students with learning disabilities." *Computers & Education* 55.1 (2010): 363-377.
- [13] Everhart, Julie M., Sheila R. Alber-Morgan, and JuHee Park. "Effects of computer-based practice on the acquisition and maintenance of basic academic skills for children with moderate to intensive educational needs." *Education and Training in Autism and Developmental Disabilities* 46.4 (2011): 556.
- [14] Hailpern, Joshua. *The spoken impact project: Using audio & visual feedback to impact vocalization in non-verbal children with autistic spectrum disorder*. Diss. University of Illinois at Urbana-Champaign, 2008.