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About the Journal

Journal of Disability Management and Special Education (JODYS) is a bi-annual peer reviewed and open access journal to publish research articles. JODYS is published by Faculty of Disability Management & Special Education, Ramakrishna Mission Vivekananda Educational and Research Institute (RKMVERI), Coimbatore Campus. JODYS aims to bring out original research articles and quality scholarly reviews on research, policy, and practice in the field of special education. The journal publishes case study, book and literature reviews, meta-analysis, service utilization studies, community surveys, public policy issues, training and current research in special education.

JODYS supports the publication of research and development activities, provides technological information and resources, and presents important information and discussion concerning important issues in the field of special education technology to scholars, teacher educators and practitioners. JODYS seeks new contributions based on original work of practitioners and researchers with specific focus on or implications for the field of special education. JODYS has the panel of referees and experts who are dedicated to review the research papers for getting the high impact factor.

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Editorial

The current issue of JODYS covers the articles that discuss the importance of computer based education for children with learning difficulties and disabilities. It is an interactive instructional technique where the computer is used to present the instructional material and gives feedback through monitor. These instructional materials are the combination of text, graphics, sound and videos to enhance the learning process. Learning process covers tutorials, simulation, drill and practice for better understanding and this approach helps to teach mathematical subject in an easy way. It will be useful for both students with and without disabilities to get deep knowledge about the subject.

Adaptation in the curriculum/ subject helps the students to learn the content without any complications. Adaptations can also be followed in instructional strategies to handle students with learning difficulties and disabilities. These processes engage the students in the classroom and this motivate them to learn. Based on their capacity and individual needs they read the given content in their own pace and get feedback immediately. To conclude, the computer based learning helps all students irrespective of their abilities and disabilities to get deeper understanding about the content. It is suggested that the teachers, special educators in different school setups can follow this method to enhance their quality of teaching.

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USE OF COMPUTER ASSISTED INSTRUCTION (CAI) TO ENHANCE MATHS LEARNING IN STUDENTS WITH MATHS DIFFICULTIES

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ABSTRACT

Students with difficulties in maths learning form a sizeable school population and maths learning difficulties are exhibited in various forms. Predominantly math is taught using explaining and modeling modalities. Using ICT in imparting maths education is documented to produce positive learning outcomes. The current experimental research aimed to study the effectiveness of computer assisted instruction (CAI) package as measured by math achievement in 44 students following Pratham Level A curriculum and having maths difficulty. The CAI package developed by researchers followed linear programming and used the drill and practice mode. The analysis of data collected during the study supported the hypothesis that students taught using CAI along with traditional method performed statistically significantly better than students taught using traditional instructional method alone. The paper describes the tools used in the research, the methodology of research, and the data analysis procedures. The research results are discussed in light of use of ICT in classrooms to further inclusive education efforts.

Key words: *ICT, Computer Assisted Instruction (CAI), Maths difficulty*

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INTRODUCTION

In India, the Right to Education Act (2009) has highlighted the idea of education of all the students including those from the various marginalized sections of society. This marginalization was defined in terms of socio-cultural, economic, gender or disability sections. These ideas have led to the development of curricula to cater to individual learners, development of teaching learning material and assistive technology for them, and also use of numerous tools to represent information, keep the students engaged and provide opportunities to express their learning. The proliferation of information and communication technology (ICT) is witnessing the propulsion of the educators to embrace the pedagogies of technology.

Challenges in Math Learning

The classrooms of today consist of diverse learners having different abilities and this learner diversity is seen in maths learning as well. Some students struggling to cope with challenges of learning maths are found in every class (Kroesbergen & Van Luit, 2003). The difficulties observed in these students are of various types ranging from fleeting difficulties in one domain while severe difficulties in many other domains.The difficulties faced by these students may be due to deficits in memory, problem solving and generalization o even merely inadequate opportunities for maths learning. Thus, a considerable amount of gap exists between low and high performers. These students require special help and some type of maths intervention. One of the most important goals of resolving the issue of struggling maths students should be to develop the students' understanding of basic mathematicalconcepts and procedures. The idea should be to equip them with knowledge and skills that will enable the students to solve maths-related problems that they encounter at home and at future work situations on a consistent basis. All students must have a strong foundation in math in order to function successfully in the modern world. Mathematical skills are an essential prerequisite for both school achievement and success in the workplace. Without mathematical skills, individuals will not be able to hold gainful employment or manage their personal finances (Abraham, Slate, Saxon, & Barnes, 2014).

Computer Assisted Instruction (CAI)

The use of computers as a part of the instructional procedure was presented by B.F. Skinner way back in 1958. Computer-delivered instruction was considered an effective teaching methodology throughout the 1980s and 1990s (Christmann & Badgett, 2000) and it is equally important even today. The method most used for computer-delivered instruction is called Computer

Assisted Instruction (CAI) or Computer Managed Instruction (CMI). The Association for Education Communication and Technology define CAI as "an instructional method used with students where the instructional design is used to teach, guide, and test the student until a desired proficiency level is reached" (Jenks & Springer, 2002). CAI is most often drill-and-practice, tutorial, or simulation activities offered as a supplement to teacher-directed instruction, traditional method instruction, or the aforementioned activities by themselves.

Benefits of using CAI

According to numerous studies, the use of ICTs in teaching can help to bridge the gap between diverse learners. Many studies examine the teaching and learning of maths, and more specifically, how technologies such as Computer Assisted Instruction (CAI) can be used to enhance maths instruction (Heid & Blume, 2008; Jenks & Springer, 2002; Ku, Harter, Liu, Thompson, & Cheng, 2007; Slavin & Lake, 2008; Zbiek, Heid, & Dick, 2007) and ascertain that ICT plays an important role in aiding teaching and learning processes at all levels, and all academic fields (DuPaul & Stoner, 2003) including learning in children with mathematical learning difficulties (Küçükalkan, Beyazsaçlı, & Öz, 2019). The use of computers gives students real time feedback and monitors their progress (Godfrey, 2001), helps students learn more in lesser time (Hasselbring, Lott & Zydney,2005), and when a computer is integrated as a tutor giving real time feedback, it offers an enjoyable experience for students with learning disabilities (Smaldino, Lowther and Russell,2008). CAI is also found to be an effective instructional strategy on mathematical operations' performance either of students with ADHD or typical ones in an individualised 'working at home' educational set up (Botsas, 2015). A meta-analytic study (Ran, Kasli, & Secada, 2021) on effect of computer technology on maths achievement in low performing students revealed that there are statistically positive effects on maths achievement when students learn using various forms of computer technology. On similar lines, another meta-analysis revealed that using digital-based interventions benefit students with mathematical difficulties (Benavides-Varela, et al., 2020) as compared to regular classroom teaching.

Need and Significance of the Study

Technology is a great equalizer for students with learning difficulties and this holds true for students with maths learning difficulties too. Technology serves as a kind cognitive prosthesis to overcome or compensate for differences among learners. The use of CAI in the classroom has become widespread,

especially visible in the maths classroom. Many in the educational field have considered that somewhere in between traditional instruction and computer-assisted instruction lays a healthy balance for instruction. This would be the type of classroom where computers are integrated into the curriculum, but there would still be face-to-face time with the instructor (Gesbecker, 2011).

Children with learning difficulties, school drop outs, those living in institutional set ups, and those who have difficulty attending formal schools for various reasons attend open schools. In India, these students appear for exams conducted by the National Institute of Open Schooling (NIOS) to complete their secondary and higher secondary education. Pratham, a well-known NGO in the educational sector has created a curriculum for open basic education programme to prepare students for NIOS (Pratham Mumbai Education Initiative, n.d.). Thus, Pratham offers the curriculum at three levels – Pratham level A, Pratham level B, and Pratham level C. The three levels correspond to Maharashtra State Board curriculum for grades I to III, grades IV to VI, and grades VII and VIII respectively. Institutes for teaching students to appear for Pratham and NIOS exams are functioning in many places in Mumbai. The profile of student diversity in these institutes is tremendous -there are students with learning difficulties, learning disabilities or simply students who need flexibility offered by the NIOS board. As would be the case with any educational set up or school, some students here too have difficulties in learning maths.

In the present study, an attempt was made to teach the students studying for Pratham level A exam a maths topic (division) using CAI along with traditional method of instruction and compare the performance of these students with those who were taught the same topic using the traditional method of instruction alone. A study of this nature will provide insights into whether the use of CAI along with tradition instructional method will benefit students studying maths. On the basis of this, schools offering the open school Pratham and NIOS curriculum may be recommended to use CAI in addition to traditional method of instruction to teach maths. This technology integration will immensely benefit the students.

METHODOLOGY

Research Design

The research employed a pretest-posttest control group design. The pretests and posttests provided the measures of maths achievement of students studying Pratham A level, prior to and after the intervention. The independent variable was the CAI and the dependent variable was maths achievement.

Sample and Sampling

The sample for the study comprised of 44 students studying Pratham level A curriculum and were from two English medium schools in Mumbai offering the Pratham and NIOS curriculum. Based on the maths performance in their class test, the school teachers identified the students achieving less than 35% of marks. These students were operationally defined as having maths difficulties. From school one, 20 students were identified to be part of the study and from school two, 24 students were identified as having difficulties in learning maths. Half the students from each school were assigned to the experimental group (EG) and half to the control group (CG) using random assignment. Accordingly, from school one there were 10 students in each group. There were 12 students in EG and CG each from school two. Consequently, there were 22 students in the EG and 22 in CG.

A two-stage sampling procedure was followed to select the students for the current study. Thus, purposive sampling was used in stage one to identify the institutes and this was followed by random selection and random assignment of students to the EG and CG. A need to use purposive sampling was experienced in the process of selection of schools for the study because the intervention entailed use of computer assisted instruction (CAI); this required that the chosen schools have a computer facility. It was also essential that the students included in the study were familiar with the use of computer.

Tools for the Study and their Development

For the current study, the researchers developed two tools – tool for measurement and tool for intervention.

Tool for measurement was a Curriculum-Based Achievement Test (CBAT). The content for the CBAT was the topic ‘division’ based on Pratham A level curriculum. As was guided by the school teachers, the textbook of grade 3 (Maharashtra State Board Curriculum) was used to develop the CBAT. For the purpose of collecting pretest and post test data, parallel CBATs were constructed and used. This was done to reduce the effect of familiarity of the test items for the students during posttest. A table of specifications was developed and the items were developed accordingly. The tool had 30 items initially that were reduced to 28 items each after content validation. The maximum attainable score on the CBAT was 54. The content covered in the CBAT was division facts, computation, and problem solving. The CBAT was content validated by teachers and they made suggesting pertaining to reframing the items and inserting brackets for the pictures. The content validated CBAT was pilot tested on six students and on the basis of

the observations, some pictures in the test were rearranged.

Tool for intervention was the CAI developed by the researchers to teach the topic 'division'. The CAI developed using HTML 5, JAVA Script and Flash had a total of 135 slides. The CAI was a self-paced, self-instructional linear programme using the drill and practice mode. Accordingly, there were instructional slides and slides for drill and practice. The CAI included five strands of the topic 'division'. These were meaning of division, terminology of division, using tables for division, dividing numbers (one-digit number by single digit number, two-digit numbers by one-digit number, and three-digit number by one-digit number). The number of slides per strand differed. After every drill and practice slide a smiley would appear and reinforce the student, and lead the student to the next slide. A happy smiley appeared when the student gave a correct response and a sad smiley would appear if an incorrect response was given. The CAI was content validated by maths teachers and was then introduced to the students. Table 1 shows the details of the structure of the CAI package. Out of the total number of slides (135), 107 were drill and practice slides.

Table 1 - Structure of CAI Package

Sr. No.	Content	No. of Instructional Slides	No. of Drill and Practice Slides	Total no. of Slides
1	Introduction	4	-	4
2	Meaning of division	6	4	10
3	Using tables for division	2	9	11
4	Terms used in division	5	7	12
5	Dividing a one-digit no.	4	7	11
6	Division with the help of tables	1	8	9
7	Dividing a two-digit no.	1	12	13
8	Dividing a three-digit no.	2	12	14
9	Word problems	2	25	27
10	Practice sums	-	23	23
11	End	1	-	1
	Total	**28**	**107**	**135**

Data Collection

The research data was collected in three phases – pretest, intervention and posttest. The students were administered the CBAT in the pretest and posttest phase. The time taken to complete the CBAT was 45 minutes. During the intervention phase, the 22 students in EG were introduced to the CAI package which was on a pen drive. The EG used the self-instructional self-paced package for 10 sessions of one-hour duration per day. This was in addition to the classroom teaching by their teacher that followed the traditional method. The CG was instructed by their teacher using the traditional method alone.

RESULTS

The aim of the study was to study the effect of intervention using the CAI on maths achievement of students having maths difficulties. These students were attending Pratham level A. The topic on which the CAI was developed was division. For the study three null hypotheses were developed with the view to understand the gain score for the CG and EG pre and post intervention independently, and identify whether there is any difference in the gain score between the CG and EG post intervention.

Data was analysed using descriptive and inferential statistics. Two-tailed t-test statistic at .05 level of significance was employed to ascertain whether the CG and EG differed significantly after CAI intervention.

The mean as measure of central tendency was computed and standard deviation was calculated to provide a measure of variability for the CG and EG. The table below (Table 2) shows that CG and EG were performing similar at the beginning of the experiment as evident for the mean scores of both the groups (*M* of CG = 7.09 and *M* of EG = 7.00). Likewise, both the groups have similar variability (*SD* of CG = 2.16 and *SD* of EG = 2.12) indicating that the individual differences within the two groups is comparable with regard to the obtained range of scores. The groups have similar heterogeneity. From figure 1, it is also evident that the bar for mean posttest score on CBAT is higher for the EG (*M* = 34.14) as compared to the CG (*M* = 26.05) indicating improved performance after intervention.

Table 2 - Mean Scores and SD obtained by Students in CG and EG on CBAT in Pretest and Posttest

Groups	Pretest Scores				Posttest Scores			
	Minimum obtained	Maximum obtained	Mean	SD	Minimum obtained	Maximum obtained	Mean	SD
CG	3	11	7.09	2.16	13	40	26.05	7.68
EG	3	11	7.00	2.12	22	47	34.14	5.80

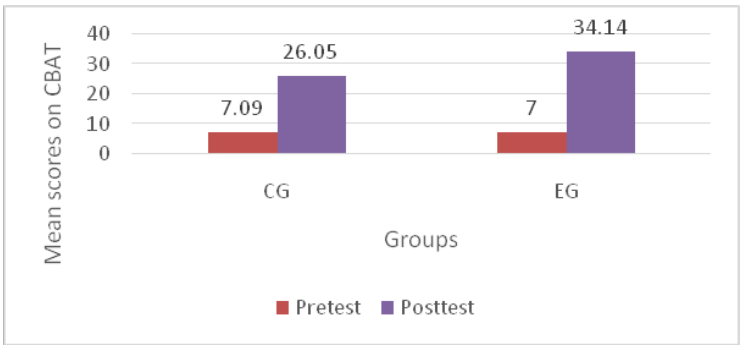

Figure 1 - Mean scores obtained by students in CG and EG on CBAT pre and post intervention

Figure 1 indicates that the mean score of students in CG is higher during posttest as compared to pre-test. In addition, that all students in CG benefitted from receiving instruction using traditional methods is evident from figure 2 which shows the performance of each student pre and post intervention. The scores on posttest are higher than on pretest for all students.

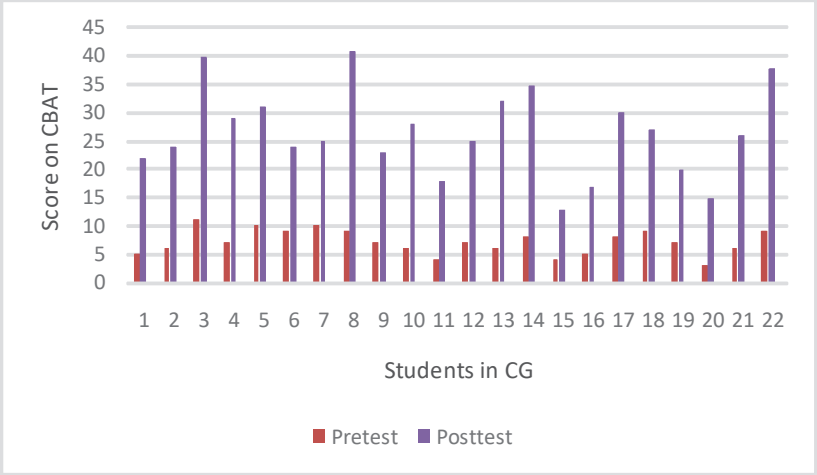

Figure 2- Scores obtained by students in CG on CBAT pre and post intervention

To know whether there was a statistically significant difference in the mean achievement scores on the CBAT obtained by students in the CG before and after being instructed using the traditional method, correlated samples t-test was employed. The results as presented in table 3 indicate that the students in the CG benefitted from being taught the topic division using the traditional method that included explanation and modeling from the teacher. The gain score of 18.96 showed the increase in the mean scores from pretest (M = 7.06, SD = 2.16) to posttest (M = 26.05, SD = 7.68). The difference t (21)

= 14.59, $p<.05$ indicated that use of traditional method for instruction has a significant effect on maths achievement of students with maths difficulties.

Table 3 - Comparison of Mean Scores of Students in CG on CBAT Pre and Post Intervention

Test condition	Mean	SD	n	df	t
Pretest	7.09	2.16	22	21	14.59*
Posttest	26.05	7.68	22		

*Significant at .05 level of significance

With reference to the performance of students in the EG, figure 3 shows that every student in the EG (n = 22) students benefitted from being taught using CAI along with traditional teaching. The scores on CBAT posttest are higher than on CBAT pretest.

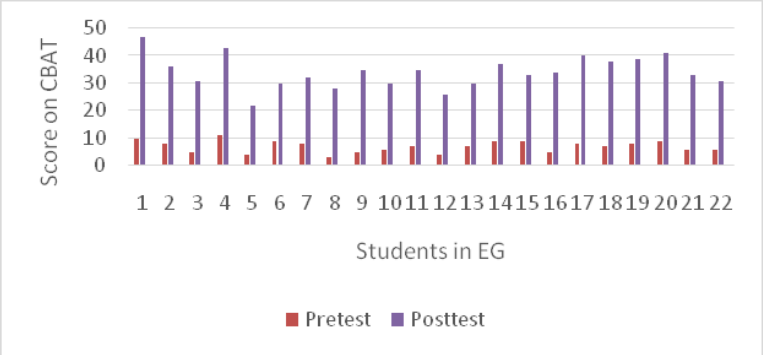

Figure 3- Scores obtained by students in CG on CBAT pre and post intervention

The effect of teaching division to the students in EG using traditional method along with CAI package developed for the purpose was further analysed to comprehend whether the difference in the mean scores was statistically different. The data in table 4 shows that the mean gain for students in EG was 27.14 from pretest (M= 7.00, SD = 2.12) to posttest (M = 34.14, SD = 5.80). This mean gain score was found to be significantly higher indicating the effect of intervention on maths scores,$t(21)$= 28.85, $p<.05$.

Table 4 - Comparison of Mean Scores of Students in EG on CBAT Pre and Post Intervention

Test condition	Mean	SD	n	df	t
Pretest	7.00	2.12	22	21	28.58*
Posttest	34.14	5.80	22		

*Significant at .05 level of significance

Lastly, posttest data on CBAT was analysed using independent samples t-test to ascertain whether the students in CG and EG performed statistically significantly different than each other. It was seen that the performance of EG (M= 34.14, SD = 5.80) was significantly better than CG (M= 26.05, SD = 7.68), $t(42) = 3.72$, $p<.05$ (refer to table 5), thus concluding that the intervention with the help of CAI combined with traditional teaching has caused betterment in maths learning. To ascertain whether this statistically significant difference has any implication for practical use of CAI combined with traditional teaching, the effect size was calculated. The effect size (d = 1.12) was found to exceed Cohen's convention for large effect (d = .80) demonstrating that teaching division to students using CAI in addition to traditional teaching methods will benefit students with maths difficulties immensely.

Table 5 - Comparison of Mean Scores of Students in CG and EG on CBAT Posttest

Group	Mean	SD	n	df	t	d
CG	26.05	7.68	22	42	3.72*	1.12**
EG	34.14	5.80	22			

*Significant at .05 level of significance
**Large effect size

DISCUSSION

Based on the reported data, students receiving intervention through a CAI program, showed significant gains compared to the control group indicating that teaching using CAI was an effective method of intervention for students having difficulties in learning maths. The findings support previous research findings signifying that CAI has a positive effect on student learning.

From the view of use of Differentiated Instruction strategies or Universal Design for Learning framework, CAI offers flexibility and individualized support within their framework; it affords extensive one-to-one practice within classrooms thus reducing the teachers' supervisory time (Basturk, 2005); ensures skill mastery. CAI can be considered important specifically for low achieving students or those with maths difficulties, for who tutorial instruction is found to be effective (O'Byrne, Securro, Jones, and Cadle; 2006) and this is evident in the present study too. Many struggling maths learners need support and scaffolds. Vygotskian theory indicates that ICT can bring difficult tasks within the ZPD (Zone of Proximal Development) because students receive

screen cues that provide scaffolding not available from the teacher at all times. Computer programs are interactive, can illustrate a concept through attractive animation, sound, and demonstration, offer a different type of activity and a change of pace from teacher-led or group instruction (Fuchs et al., 2006). Students are not just passive learners, but they understand the mathematical concepts by doing maths. This interactive feature and user-friendly software provided such an environment where mathematical concepts are presented in virtually concrete forms, activities are interesting and challenging. The CAI package developed by researchers in this study had the features that assisted students in gaining concrete, real-life based and basic knowledge, and also it provided them with the scope to construct their own understanding of division.

CONCLUSION

The study contributes to the field of education as it provides evidence that use of CAI benefits students who struggle with maths learning. Though the study was conducted in institutes that teach Pratham and NIOS curriculum, the results obtained in the study are encouraging and can prompt the conduct of a similar study in inclusive classrooms or special education classrooms that use evidence based inclusive education practices. A study on the long-term gains of the use of the CAI package is essential to determine whether the effects of the intervention would be sustained for a longer duration.

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EFFECT OF COMPUTER BASED ADAPTED CURRICULUM IN LEARNING MATHEMATICAL CONCEPT AMONG CHILDREN WITH INTELLECTUAL DISABILITY

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ABSTRACT

Curriculum adaptation is a continuous process that modifies or adapts the standard of prescribed curriculum in terms of content or delivery of instruction to meet the learning needs of students with learning problems, including children with disabilities. The content, teaching process, assessment and evaluation, and the physical environment may be modified or adapted and activities must be flexible for the students to benefit and achieve success in the classroom. In this study investigator attempted to find out the effect of computer based adapted curriculum in learning mathematics among children with intellectual disability (CwID). True Experimental Research Design with Pre and Posttests has been employed in the study. Investigator has chosen two chapters namely 'patterns in shapes' and 'numbers' from II class math text book developed by Tamil Nadu Text Book Corporation. The researcher adapted the above stated two chapters by using clicker software version 6.0.Theadapted math curriculum (AMC) checklist was prepared with 75 items under 21 domains after validation. In total ten CwID were selected as sample for the present study by adopting purposive sampling under non probability sampling method. Among the ten students, five represent control group and remaining five were in experimental group. Computer based adapted curriculum for mathematics was implemented among the samples for 35 sessions. The collected data were analyzed quantitatively by applying Mann-Whitney test, Wilcoxon signed Rank test. The findings revealed that there is a significant difference in pre and posttests mean scores of the sample in learning mathematics. It also states that the performance level of the sample closely corresponded to the criterion shifts in all the items of computer based adapted mathematics curriculum.

Key words: *Computer Based Adapted Curriculum, Mathematical Concept and Children with Intellectual Disability*

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INTRODUCTION

Children with Disabilities (CwD's) are in great requirement of appropriate educational measures for helping them in meeting out their special needs and to cope with their deficits or extraordinary abilities. CwD's face numerous barriers in attending school and receiving appropriate education. An essential practice required for CwD's to access and progress in the education is the provision of accommodations and modifications in the curriculum. Access to assistive technology and accessible technology for CwD's is critical for many to access and benefit from education. For CwD's, technology can give access to learning opportunities previously closed to them. Education for intellectually disabled children is a challenging task. Children with mild Intellectual Disability (CwID) demonstrate wide diversity in their academic and behavioral performance. Moreover, within typical classroom settings they learn academic materials much slower than their normal peers that result in low achievement in all academic areas of subject including Mathematics.

According to American Association on Intellectual Disabilities (AAIDD) "Intellectual disability is a disability characterized by significant limitation in both intellectual functioning and in adaptive behaviour, which covers many everyday social and practical skills. This disability originates before the age of 22. Many of the disabled are affected throughout their lifespan. CwID are distinctly identified because they do not keep pace with developmental expectations in cognitive, social and motor functioning. Characteristically, significant developmental delays in early childhood are predictive of poor academic functioning in childhood, as compared with same age peers. Most of the studies have been conducted towards identifying the cognitive difficulties associated with intellectual disability, based on the deficit model of intellectual disability. The subsequent studies have adopted a developmental perspective, in which the functioning of CwID is compared with typically developing children of comparable developmental level (Williams, 2005). Currently, the emphasis has switched from assessing people' deficiencies to identifying useful support (Buntinx & Schalock, 2010). CwID generally follow the same developmental pathways as their typically developing peers but at a slower rate. Lower attainment rate influences their learning and academic achievement especially learning mathematical concepts.

Curriculum for Children with Disabilities

No country in the world has regular curriculum which is appropriate for all students. While most educational institutions

claim that their curriculum is acceptable for all students, this is never the case unless curriculum modification is implemented. Toilet training and self-feeding are two essential learning goals that few school systems cover in their regular curriculum. Similarly, educational goals relevant to intellectually gifted children frequently fall outside of what is scheduled in the standard curriculum for children up to the ending of secondary school. While good instructional design for the entire class can minimize the need for adaptation, adapting the curriculum to meet the learning goals of children with these diverse demands is sometimes the only way to satisfy their needs. Curriculum for CwID should aim at a) attaining personal adequacy, b) developing social competence, c) achieving economic independences (Msipha, 2013).

Curriculum Adaptation

The term "curriculum" refers to all aspects of teaching and learning, including learning objectives, learning programmes, assessment, and methods. It refers to all of the formal and informal learning opportunities provided by the school to prepare students for the opportunities and responsibilities of adulthood. In general, an adaptation is a goal-driven process that involves making a change to better satisfy the goals of an individual or a group. Curriculum adaptation, on the other hand, refers to making components of the curriculum accessible, such as teaching and learning resources, in order to meet the requirements of all learners (Msipha, 2013). As a result, curriculum adaptation is a change to the delivery of instructional techniques and the intended goals of student performance that does not affect the content but does modify the conceptual complexity of the curriculum slightly. Curriculum adaptation is based on the principle that the school must respond to the educational requirements of the students, rather than just providing a place for students with special needs among their peers with no difference in instruction. (Hassall & Rose, 2005).

Computer Based Adapted Curriculum

Computer-based education has expanded the classroom experience by providing students with material directly pertaining to their selected subjects of interest, analyzing students' responses immediately to determine whether or not to spend more time on a specific topic. Moreover, computers are being used to expand the learning experience in different subjects such as Mathematics in classrooms (Chambers, et al., 2011. They can be used to teach new skills or to help learning Mathematical concepts that a student has been experiencing difficulties with. Students who struggled to study in a printed materials environment benefit greatly from multimedia applications. Students with disabilities benefit from Computer Based Instruction (CBI) since

they get rapid feedback and don't waste time practicing the improper skills. Computers hold students' interest since their programmes are interactive and encourage them to compete in order to improve their grades. Furthermore, CBI watches the students' progress and does not advance them until they have mastered the skill.

Need and Significance of the Study

The goal of curriculum adaptation is not to decrease educational standards, but modify the curriculum to make education more accessible in the first place, and to ensure that no student is unfairly biased or excluded. Math skills are essential for a student to be able to live freely in the community, care for oneself, and make decisions about their lives. Teachers should adjust the curriculum to ensure equality and match the needs of different students so that everyone benefits and can fully engage in classroom activities. This encompasses numerical awareness and ideas, time, money, measurement, calculator use, and so on. Understanding the notion of mathematics should be a priority for all students, including children with intellectual disabilities.

Effective technology integration such as computer based adapted curriculum can provide all learners the ability to access the general education curriculum, providing them multiple means to complete their work with greater ease and independence in performing tasks that they were formerly unable to accomplish, or had great difficulty in accomplishing them (Roberts et al., 2008). As a result, they are tackling the 'functional obstacles' by increasing, maintaining, or enhancing their learning outcomes in a wide environment of abilities and expectations. Computer assisted mathematics instruction programmes can demonstrate concepts, instruct, and remediate student errors in learning various Mathematical concepts. Considering that computers offered multiple activities, researchers also used them with special populations in order to “enhance the quality of life of SwID and other developmental disabilities” (Foshay and Ludlow, 2005).

A technology-oriented learning environment that makes use of accessible technology supports educational equality by offering access to and equitable learning opportunities through individualized and differentiated teaching that can fit each learner's requirements and preferences. As a result, there is a need to give instructors with adequate knowledge and abilities, which will aid in the development of a more favourable attitude toward the use of technology in the classroom (Afzal, et.al. 2014). The way educators educate has already been altered by technological advancements. McManis & Gunnewig, (2012) reported that Computer-Assisted Instruction (CAI) has been used to

teach a variety of academic skills and subjects such as Mathematics to teach students with disabilities including intellectual disabilities. Hence the need has arisen to know about the effect of Computer Based Adapted Curriculum on learning mathematical concepts of CwID. The present study attempts to develop Mathematical concepts particularly pattern in shapes and number in academic learning of the CwID through Computer based adapted curriculum.

REVIEW OF LITERATURE

Zilaey S.et.al. (2017) conducted a study to determine the effectiveness of attention training on the math performance of elementary school students with intellectual disability adopted quasi experimental study by pre-test, post-test design with the control group. Students with intellectual disabilities aged 10 to 12 years were included in the study. Subjects were selected by convenient sampling method and 30 students with intellectual disability were participated. The results indicated that attention training program has influenced math performance of the primary school students with intellectual disability.

Singh and Agarwal (2013) examined the effectiveness of teaching mathematics to children with mental retardation using computer games with conventional method of teaching. The result showed that the group taught with the help of computer games produced significantly greater remediation of mathematics skills as compared to the group taught through conventional method of teaching. It was found that gender did not affect acquisition of mathematics-concepts on two concepts. However, on one concept a contradictory result was obtained. Similarly, it was found on two mathematics concepts that boys benefit more from computer games as compared to girls. However on one concept, no difference was found. Educationists and other scientists believe that early interventions give children the best chance of developing their full potential.

Ghaywan and Arakh (2012) studied the effectiveness of computer assisted instruction on academic performance of the children with mild mental retardation at primary level. The major findings of the study were: CAI increased students learning outcomes, has an impact on learning literacy and numeracy skills of students with mild retardation. Students showed increase in their attention span, were highly motivated with increased communication and cooperation among the students. The study also revealed that computers could also help in developing social and interpersonal skills. The researchers suggested that more exposure was required to the special need children in operating the system independently

OBJECTIVES

1. To find out the difference between pre and posttests mean scores of control group of CwID in learning Math concept.
2. To find out the difference between pre and posttests mean scores of experimental group of CwID in learning Math concept.
3. To compare the pretest mean scores of control and experimental group of CwID in learning Math concept.
4. To compare the gain mean scores of control and experimental group of CwID in learning Math concept
5. To find out the effect of computer based adapted curriculum in learning Math concept among CwID.

Hypotheses

1. There will be no significant difference between the pre and posttests mean scores of control group of CwID in learning Math concept.
2. There will be no significant difference between the pre and posttests mean scores of experimental group of CwID in learning Math concept.
3. There will be no significant difference between the pretests mean scores of control and experimental group of CwID in learning Math concept.
4. There will be no significant difference between the gain mean scores of CwID in experimental and control group in learning Math concept.
5. There will be no significant difference in the effect of computer based adapted curriculum in learning Math concept among CwID.

METHODOLOGY

Research Design

The research design selected for the present study was true experimental design under experimental method.

Variables

The variables that have causative characteristics are called 'independent' variables, whereas the 'end result' is the dependent variable. The present study aimed at finding the effect of computer based adapted curriculum on learning mathematical concept among children with mild intellectual disability.

- Independent Variable: Computer Based Adapted Curriculum
- Dependent Variable: Mathematical Concept

Sampling Technique

Purposive sampling under non probability sampling method was adopted for selecting samples.

Inclusion Criteria

- Condition :Children with Mild Intellectual Disability
- School :Inclusive School
- Grade :Secondary
- Gender :Male and Female
- Age Group : 9 to 11 years

Sample size: A total of 10 students with mild intellectual disability pursuing secondary education at T.A.T Kalanilayam Middle School, Coimbatore were taken as sample for the current study. Among the 10 students, 5 represent control group and remaining 5 were in experimental group.

Table 1 – Details of Control Group

S. No	Name of the Child	Condition	Associated Condition (If any)	Age	Gender	Class
1	SA	Mild (MR)	No	11	Female	5th
2	HA	Mild (MR)	No	9	Male	3rd
3	PR	Mild (MR)	No	11	Female	5th
4	SR	Mild (MR)	Down syndrome	10	Male	4th
5	CH	Mild (MR)	No	11	Male	5th

Table 2 – Details of Experimental Group

S. No	Name of the Child	Condition	Associated Condition (If Any)	Age	Gender	Class
1	AD	Mild (MR)	Speech Problem	10	Female	4th
2	HA	Mild (MR)	No	11	Male	4th
3	SA	Mild (MR)	No	11	Male	5th
4	AS	Mild (MR)	No	11	Male	5th
5	PR	Mild (MR)	No	11	Female	4th

Development of Tool

The researcher has chosen two chapters namely 'patterns in shapes' and 'numbers' from II class math text book developed by Tamil Nadu Text Book Corporation. The researcher adapted the above stated two chapters by using clicker software version. The researcher developed and administered the Adapted Math Curriculum (AMC) checklist on the selected sample. The final checklist was prepared with 75 items under 21 domains after validation.

Date Collection Procedure

After obtaining prior permission, researcher explained the need and importance of computer based adapted curriculum for CwID to the headmaster. Orientation was given to the teachers who are handling the CwID about the adapted math curriculum checklist. Samples were taken to the allotted classroom and investigator established a good rapport

with them. Investigator started the 1st session with motivation, gradually the concepts (patterns in shapes and numbers) were taught to the selected samples. Periodical evaluation was done to check the progress of the students in the curriculum. All the 21 domains were taught in 35 sessions. After that, post test was administered and the scores were recorded.

Results and Discussion

1. Hypothesis (H_0)

There will be no significant difference between the pre and post-tests mean scores of control group of CwID in learning Math concept.

Table 3 - Pre and Posttests Mean Scores of Control Group of CwID in Learning Math Concept

	Test	N	Mean	SD	Z	Sig
Control group	Pre test	5	26.4	8.87694	-.271	.786
	Post test		27.6	12.66096		

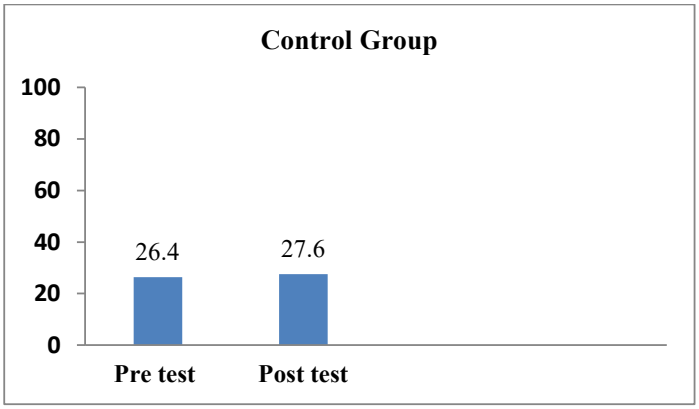


Figure1 - Pretest and posttests mean score of control group of CwID in learning Math concept

Table 3 and Figure 1 show the pre and posttests mean scores of control group of CwID in learning Math concept. The pretest mean score of control group of CwID in learning Math concept is 26.4 whereas the posttests mean score is 27.6. The calculated Z value 0.271 shows that there is no significant difference in the pre and posttests mean scores in learning Math concept. Therefore the above stated hypothesis is accepted.

2. Hypothesis (H_0)

There will be no significant difference between the pre and post-test mean scores of experimental group of CwID in learning Math concept.

Table 4 - Pretest and Posttests Mean Score of Experimental Group of CwID in Learning Math Concept

	Test	N	Mean	SD	Z	Sig
Experimental group	Pre test	5	28.6	16.00937	2.032	.042
	Post test		66	12.14496		

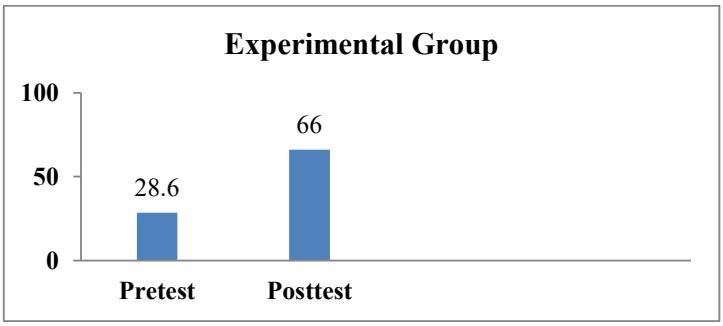


Figure 2 - Pretest and posttests mean scores of experimental group of CwID in learning Math concept

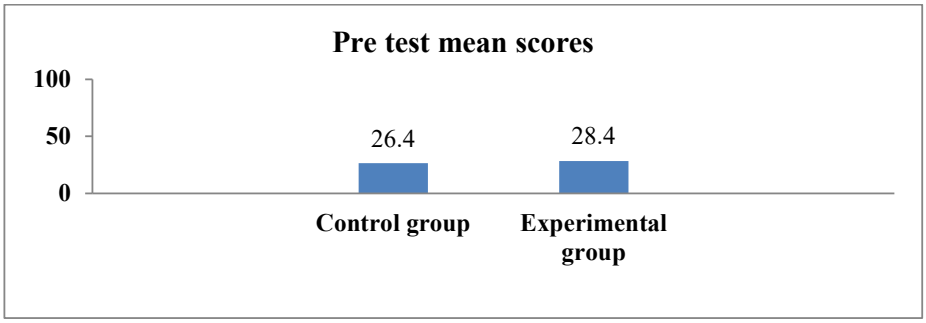
Table 4 and Figure 2 depict pre and posttests mean scores of experimental group of CwID in learning Math concept. The pretest mean score of experimental group of CwID in leaning Math concept is 28.6 whereas the posttests mean score is 66.The calculated Z value 2.032 shows that there is significant difference in the pre and posttests mean scores in learning math concept. Therefore the above stated hypothesis is rejected.

3. Hypothesis (H_0)

There will be no significant difference between the pretest mean scores of control and experimental group of CwID in learning Math concept

Table 5 - Pretests Mean Scores of Control and Experimental Group of CwID in Learning Math Concept.

	Group	N	Mean	SD	U	Sig
Pretests	Control	5	26.4	8.87694	11.000	.754
	Experimental		28.6	16.00936		



Figures 3 - Pretests mean scores of control and experimental group of CwID in learning Math concept

Table 5and Figure 3 depicts the pretests mean scores of control and experimental group of CwID in learning math concept. The pretest mean score of control group of CwID in learning math concept is 26.4 whereas the pretest mean score of experimental group is 28.4. The calculated U value, 11.000, shows that there is no significant difference in the control and experimental group of CwID in learning math concept. Therefore the above stated hypothesis is accepted.

4. Hypothesis (H_0)

There will be no significant difference in the gain mean scores of experimental and control group of CwID in learning Math concept.

Table 6 – Gain Mean Scores of CwID in Control and Experimental Group

	Group	N	Mean	SD	t	Sig
Gain Scores	Control	5	1.2	2.29347	6.704	0.001
	Experimental	5	37.4	4.82286		

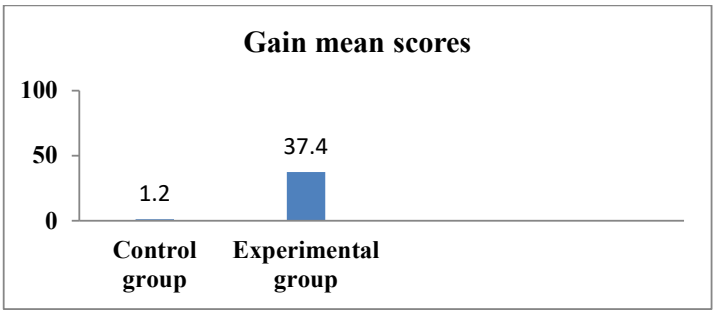


Figure 4 – Gain Mean Scores of CwID in control and experimental group

Table 6and Figure 4 depicts the gain mean scores of CwID in control and experimental group in learning math concept. The gain mean scores of control group of CwID in learning math concept is 1.2 whereas the gain mean scores of experimental group is 37.4. The t value, 6.704, calculated shows that there is significant difference in the control and experimental group. Therefore, the above stated hypothesis is rejected.

5. Hypothesis (H0)

There will be no significant difference in the effect of computer based adapted curriculum in learning Math concept among CwID

Table 7 – Post-tests Scores of Control and Experimental Group of CwID in Learning Math Concept

	Group	N	Mean	SD	U	Sig
Posttest	Control	5	27.6	12.66096	1.000	0.016
	Experimental	5	66	12.89574		

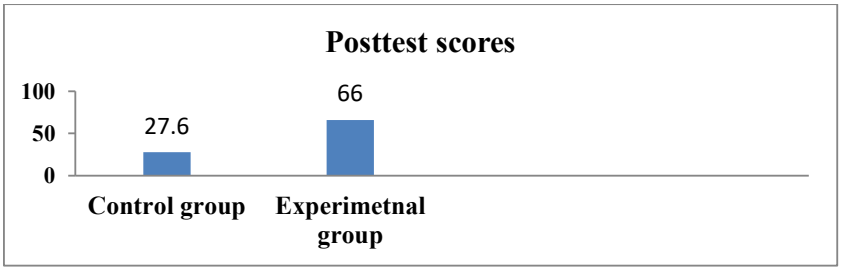


Figure 5 - Posttests Scores of Control and Experimental Group of CwID in Learning Math Concept

Table 7and Figure 5 depicts the posttests mean scores of CwID of control and experimental group in learning math concept. The posttest mean score of control group of CwID in learning math concept is 27.6 whereas the posttest mean score of experimental group of CwID is 66. The U value, 1.000, shows that there is significant difference in the control and experimental group. Therefore, the above stated hypothesis is rejected.

CONCLUSION

This study sought to find out that learning Mathematical concept among CwID get improved while using computer based adapted curriculum. After analyzing the data, it was discovered that there was a significant effect of computer based adapted curriculum on learning mathematical concept among CwID. It shows that computer based adapted curriculum facilitating learning Math concept. It also appeals to children through auditory and visual senses. The importance of the research study will include classroom teachers to employ instructional methods to using for teaching Math and improving arithmetic skills. It will assist them to prepare & to meet the diverse needs of all students learning the concept of Math such as Pattern in shapes and Numbers. Computer based adapted curriculum method helps the CwID to understand more easily, to see more clearly, to handle conveniently and to have better learning in Mathematics.

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