EFFICACY OF TABLET PROGRAMMED MATERIAL TO ENHANCE SIGHT WORD READING IN CHILDREN WITH AUTISM

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ABSTRACT

The purpose of the Study was to find out the effect of Tablet Programmed Material to Enhance Sight Word Reading in Children with Autism. Single group, pre and post tests experimental method was used. The sample consisting of five children with autism and mild Intellectual Disability in the age group 8 to 12 yrs was selected through Stratified Random Sampling. A standardized tool Childhood Autism Rating Scale, Functional Academic Assessment Tool and Reading Assessment Tool developed by the Investigator were used for data collection. A Tablet Programmed Reading Package was developed for the twenty words to be taught to the children through the Sight Word Approach. A PRE – TEST was done to find out the current level of reading using the Reading Assessment Tool developed for the five children with autism selected. The Tablet Programmed Reading Package to enhance reading skill was used for the sample for 25 sessions. The duration for each session was 30 minutes . Each session commenced with general conversation, an introduction activity for 5 minutes followed by teaching to read through Tablet Programmed Material for 20 minutes. Each session was ended with an activity of the child's choice At the end of 25th session a POST – TEST was done. To analyze the efficacy of Tablet Programmed Material to Enhance Sight Word Reading among the sample selected statistical analysis "t" test was done. The comparison of the Means score of Pre – test and Post – test and "t" test value obtained at 0.05% revealed that Tablet Programmed Material is effective in developing reading of Sight Words, Comprehension and reading of Sight Words in Functional Situation among the sample selected for the study.

Key term : Autism Spectrum Disorder, Reading, Tablet Programmed Material

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Introduction

Autism Spectrum Disorder (ASD) is neurological condition involving mild to severe impairments in socio-communication skills along with stereotyped behaviors and limited interests and activities as highlighted by Diagnostic and Statistic Manual V (DSM V). Children with autism may exhibit little or no interest in social interaction with their peers and may actively avoid social contact with others (Humphrey and Symes 2011), although some children are socially active and interested but are not sure how to interact effectively. About one in 88 children has been identified with an autism spectrum disorder (ASD) according to estimates from Centre for Disease Control and Prevention (CDCs, 2008) and Autism & Developmental Disabilities Monitoring Network (ADDM, 2008). ASDs are almost five times more common among boys (1 in 54) than among girls (1 in 252).

Individuals with Autism have been shown to have structural and chemical differences in their brains compared to normally developing peers. However, the manner by which these differences come about is the subject of considerable research. Autism is believed now to be due to multi-factorial disorders; that is, many factors come into play when determining the cause. These factors include complex genetic interactions, nutritional deficiencies or overloads, pre- and post-natal exposure to chemicals or viruses, errors during the embryonic neural tube closure process, dysfunctional immune systems, and even allergies. (Norris 2006)

Reading skills are necessary for participation in a democratic society. The ability to read is also essential to work performance. Learning to read involves mastering the constellation of skills. According to the National Reading Panel (NRP, 2000) the ability to read requires proficiency in a number of language domains; phonemic awareness, phonics (sound symbol correspondence) fluency, vocabulary and text comprehension.

Reading ability is not a specific skill attribute. It is made up of a hierarchy of many skills and abilities, attitudes and tasks. The process, skills and affective dimensions of reading are essentially the same for the children with special needs as they are for the normal children. The education of children with autism focuses on preparing them for independent living in their own environment. As reading is a major means of conveying information and ideas, so training in reading skills will expand opportunities for living an independent life and also open doors for enrichment.

Reading deficits in children with ASD may be attributed to impairments in their communication and due their unique cognitive style. This thus makes learning to read more difficult for these children. Learning to read requires the students attention to be focused more on task and in addition that student's attention to be maintained during the completion of the task One of the most important academic skill learned at school is Reading comprehension.. A variety of materials, methods and approaches have been used for teaching and learning to read words to the children with autism.

There are many approaches to reading instruction. Of these, explicit and systematic instructions have been considered as the most effective methods when teaching fundamental reading skills (Browder et al 2006). Explicit instruction refers to the direct teaching of reading skills with clear outcomes, explaining the purposes for learning, and providing consistent feedback to correct mistakes. Systematic instruction identifies carefully selected skills that are organized into a logical sequence for instruction. Advances in technology have expanded the possibilities for computer-based devices to provide explicit and systematic instructions in academic skills which includes reading (Douglas, Wojcik, & Thompson, 2012).Furthermore, interactive and portable technological devices, such as tablets and smart phones, have increased the accessibility and ease of use of computer-based technology for academic applications among students with a variety of disabilities. Using devices such as the iPad® to augment instruction can be less stigmatizing and more socially inclusive than traditional AAC devices (Kagohara et al., 2013; Mechling,2011), and these devices may be more familiar to teachers and therefore easier to incorporate into instruction (Bortoli et al., 2010).

Operational definition of key terms of the study

Interactive Gadget Based Strategy

A small mechanical device or tool, especially an ingenious or novel one is known as a Gadget.

Tablet is Gadget it is built around the device's multi-touch screen serves primarily as a platform for audio-visual media including books, news, movies, music, games, presentations and web content. The novelty of the Tablet is that it is a multi-sensory learning tool, delivering more than just visual support and auditory feedback, in that it provides tactile and kinesthetic feedback for learners. In this research study the term **"Interactive Gadget Based Strategy"** refers to a

program of Interactive Instructional Material presented by means of a Tablet to develop reading skills in children with autism

- **Reading**

The term **"Reading"** refers to the student's actions or responses resulting from reading printed words. In this study the term "reading" refers to reading and comprehension of Sight Words and Two – Word Phrases. This also includes reading the Sight Words and Two – Word Phrases in functional situation.

- **Children with Autism**

The term **" Children with autism"** includes children who have deficits in communication, social skills, exhibit some odd behaviours and whose IQ is between 50 to 69 that it affects a child's educational performance.

Review of Literature

Heimann et al (1995)reported on the effect of using an interactive and child-initiated microcomputer program (Alpha) when teaching three groups of children *(N*=30) reading and communications skills: (a) 11 children with autism (chronological age, CA=9:4 years), (b) 9 children with mixed handicaps *(M*CA= 13:1), and (c) 10 normal preschool children *(M*CA=6:4 years). Their mental age varied from 5:8 years to 6:9 years and all children received computer instruction supplementary to their regular reading and writing activities. The children with autism increased both their word reading and their phonological awareness through the use of the Alpha program. Clearly significant gains were observed during the intervention, but none during the follow-up period. Analyses of the children's classroom behavior indicate that the intervention succeeded in stimulating verbal expressions among the children with autism and mixed handicap. A significant increase in enjoyment was also noted for the children with autism.

Using a theoretical framework of multimodal processing, Bosseier & Massaro (2003) developed and evaluated a computer-animated tutor, Baldi, to teach vocabulary and grammar for children with autism. Baldi was implemented in a Language Wizard/Player, which allows easy creation and presentation of a language lesson involving the association of pictures and spoken words. The lesson plan includes both the identification of pictures and the production of spoken words. The research indicates that children with autism are capable of learning new language

within an automated program centered around a computer-animated agent, multimedia, and active participation and can transfer and use the language in a natural, untrained environment.

Coleman-Martin et al(2005) determined if the use of computer-assisted instruction would be an effective method to promote word identification using the Nonverbal Reading Approach (NRA). Three students with severe speech impairments and concomitant physical disabilities or autism were provided decoding and word identification instruction using the NRA across three conditions simulating the natural progression of classroom instruction from teacher-directed to computer-assisted instruction. The three conditions Were (a) teacher only, (b) teacher plus computer-assisted instruction, and (c) computer-assisted instruction only. All participants reached criteria in each of the three conditions. Results indicate that the NRA can be effectively delivered through computer-assisted instruction, thus freeing up teacher time and providing students with the ability to practice decoding and Word identification independently.

The purpose of the study by Sansosti, & Powell-Smith (2008) was to investigate the effects of computer-presented Social Stories and video models on the social communication skills of three children with High-Functioning Autism/Asperger's Syndrome (HFA/AS). Using a multiple-baseline across-participants design, computer-presented Social Stories and video models were implemented and direct observations of the participants' identified target behaviors were collected two times per week during unstructured school activities (e.g., recess). Data demonstrated that the combined treatment package was effective for improving the rates of social communication for the participants.

The research study by Whalen et al (2010) highlighted that Computer Assisted Instruction (CAI) has shown increased popularity recently and there are many studies showing promise for this approach for children with Autism Spectrum Disorders (ASD). In this study, 47 preschool and K-1 students in ASD classrooms participated from Los Angeles Unified School District. *TeachTown: Basics*, a CAI program which also includes supplementary off-computer activities, was implemented over 3 months for approximately 20 minutes per day on the computer and 20 minutes per day in supplementary *TeachTown: Basics* activities. Compared to the students in the control group, the *TeachTown: Basics* students showed more improvement overall on language and cognitive outcome measures. In addition, students who used *TeachTown: Basics* demonstrated significant progress overall in the software and those students who used the program for more time demonstrated larger gains within the software and in

outcome measures. In addition, CAI may offer solutions to schools and parents with insufficient funds for more expensive treatments.

Kagohara et al(2012) analyzed the effectiveness in teaching two students with autism spectrum disorders (ASD) to check the spelling of words using the spell-check function on common word processor programs. A multiple-baseline across participants design with baseline, video modeling, and follow-up phases was implemented. During baseline, the participants performed less than 40% of the task-analyzed steps correctly. When the video modeling intervention was introduced via an iPad, both participants reached the 76–100% correct level on the task analysis and became more successful in using the word processor programs to check the spelling of words. Follow-up data showed 100% correct performance by both participants. The results suggest that the video modeling intervention, delivered via an iPad, was effective in teaching two adolescents with ASD to check the spelling of words using common word processing programs.

Using an Applied Behavioural Analysis (ABA)reversal design, the study by Juliet & Kelly (2012) examined the impact of Video Self Modeling (VSM), delivered using a video iPad, on the academic responding of a secondary student with ASD and intellectual disability during science instruction. Results indicated positive treatment effects, with the participant increasing correct, unprompted academic responding during the VSM intervention,

The purpose of the study by Leslie et al (2013) was to compare academic instruction delivered with an iPad[R] to instruction delivered through traditional materials for two students with autism spectrum disorder who engaged in escape-maintained challenging behavior. An ABAB reversal design was utilized in which academic instruction with an iPad[R] and academic instruction with traditional materials were compared. Both participants demonstrated lower levels of challenging behavior and higher levels of academic engagement in the iPad[R] condition and higher levels of challenging behavior with lower levels of academic engagement during the traditional materials condition. Results suggest that the use of an iPad[R] as a means of instructional delivery may reduce escape-maintained behavior and increase in academic performance in children with autism.

Crowley, Mclaughlin & Kahn (2013) implemented and evaluated a Direct Instruction (DI) flashcard system as well as the reading racetrack, to teach sight word acquisition to two elementary students diagnosed with autism. A multiple baseline design was used across word

sets with each student to evaluate the effectiveness of the combined flashcard and reading racetrack procedures. Due to the limitations of one of the participants, an ipad application called," Proloquo2Go™ "was also employed. A functional relationship was demonstrated between the use of these strategies and the reading of sight words for both participants. The study showed that DI flashcards and the reading racetrack can be an effective way to teach students with autism sight words.

Burton, Anderson, Prater, & Dyches (2013) used a multiple-baseline-across-participants design to investigate the effects of video self-modeling (VSM) on the mathematics skill acquisition of adolescents with autism. Four adolescent male students viewed videos of themselves on an iPad solving mathematical problems to estimate the amount of money used to pay for a given item and the amount to receive in change. Findings support a functional relationship between VSM and performance on math skills for each participant. Subsequently, the VSM was systematically faded during maintenance sessions, with little deterioration of skill

Need for the study

The review of literature highlights that in the past two decades Computer Assisted Instruction has been instrumental in enhancing the quality of life experienced by children with autism at the international level. In the current decade children, adolescents and adults with autism at the international level are being enriched in all walks of their life through various interventions and software embedded the iPad - the most advanced technology which is a magical and revolutionary device that can be replaced for computers in training, educating and enhancing the quality of life of children with autism. The tablet belonging to the family of iPad with its touch screen facility and small size provides these children with a boundless opportunity to learn and respond appropriately to situations. The iPad being a multi-sensory learning tool, provides tactile and kinesthetic feedback for learners apart from providing just visual support and auditory feedback, One of the iPad's most attractive features is the extensive availability of applications (apps) to support literacy learning. The iPad has the additional benefits of being portable, cost effective, socially desirable, multi-sensory, and flexible to the needs of the students.

In India Computer Assisted Instruction has been initiated for the training, educating and in transition of children with special needs such visual and hearing impairment, locomotor disability, and also for those with mental retardation but yet documented research studies are

very few. Though various research studies on the usefulness of iPad to teach children with autism are being investigated and results documented scientifically, to date, there is still limited empirical research on use of the iPad as an instructional tool to teach reading skills among children with autism in India. Therefore the investigators aimed through this research to find out the "Efficacy of Tablet Programmed Material to Enhance Sight Word Reading in Children with Autism"

Objectives of the Study

The objectives of study are to:

- Measure the effectiveness of Tablet Programmed Material in enhancing reading of sight words among children with autism
- Estimate the effectiveness of Tablet Programmed Material in enhancing comprehension of sight words among children with autism
- Analyze the impact of Tablet Programmed Material in reading of sight words in functional situation among children with autism

Hypotheses

The Hypotheses of the Study

- There will be no significant difference in the Pre –test and post – test scores in reading sight words in the children taught using Tablet Programmed Material.
- There will be no significant difference in the Pre –test and post – test scores in the comprehension of sight words in the children taught using Tablet Programmed Material.
- There will be no significant difference in the Pre –test and post – test scores in the reading of sight words in functional situation in the children taught using Tablet Programmed Material.

Methodology

The investigators followed the quasi - experimental design involving only the experimental group for the pilot study. Pretest –post test design was used in the study. The researcher used Random sampling technique. The sample chosen for the study consisted of five children with autism including both boys and girls attending from a local Special School in Coimbatore. The children are in the chronological age group of 8 -12 years.

Tools

The details of the tool and its description are outlined as per its proposed use in the Study.

Diagnostic Assessment Tool

The Childhood Autism Rating Scale (CARS) was used by the investigator to diagnose the selected children for the pilot study for autism. The investigator took the help of the Psychologist to conduct the diagnosis and to obtain their IQ.

Academics Assessment Tool

To assess the current level of functioning in academic skills an assessment tool named Functional Academic Assessment Tool (FAAT) was developed by the Investigators for the age group 8 to 12 years. The Functional Academic Assessment tool consist of included 5 Domains with 14 sub – items in each domains. The domains in FAAT such as Concept formation; Reading Skills; Vocabulary skills; Writing Skills and Arithmetic skills. The child's performance is rated along descriptive scale for each item in the 5 domains in the following way :-

Independent – score 5

Clueing – score 4

Verbal Prompting –s core 3

Physical Prompting – score 2

Totally dependent – score 1

The total score that can be obtained for one domain is 70 and grand total for five domains together is 350.

The prepared FAAT was circulated for face validation to 30 special educators. The Special Educator were asked rate each sub- item in the five domains as whether they are Most Appropriate (3 marks) or Appropriate(2 marks) or Not Appropriate (1 mark). Cronbach alpha test was done using Split – half method. The reliability coefficient obtained was 0.83.

A Reading Assessment Tool

The investigators prepared a Reading Assessment Tool for reading in English. The Tool consisted of 20 Sight words (Food items and Vegetables; 10 words in each category)

This tool was used for PRE-TEST and POST – TEST

The scoring for each sight word is as given in table below

Reading of the Sight Words - 1mk x20 = 20 mks.

Comprehension of the Sight Words - 2mks x20 = 40 mks.

Reading of the Sight Words in Functional Words – 3 x 20 = 60 mks.

The Reading Assessment Tool prepared was circulated for face validation by 10 special educators. The Special Educator were asked rate each sight- word of the list whether they are Most Appropriate (3 marks) or Appropriate(2 marks) or Not Appropriate (1 mark) for teaching children with autism who also have mild Intellectual Disability through the Sight Word Approach.

Development of a reading programme

The investigator developed a Power Point Reading Programme in English. The design used for the preparation of the reading programme was Sight- Word Approach which includes the steps Matching, Identifying, Naming and Generalization. The reading programme included Basic Sight Word instruction, activities to enhance sight word reading, comprehension and reading of the sight words in functional situation

Development of Tablet Programmed Material

With the assistance of a software engineer the investigator converted the prepared Power Point into a Tablet Programmed Material. For its practical application Android Software was developed and installed into the Tablet.

The Tablet Programmed Material was designed to provide :

- Step by Step instruction to read sight words, to comprehend the sight words, activities to help the sample selected to identify the sight words in functional situation
- Reinforcements were part and parcel of the intervention programme to make the reading programme interesting

A Rating Scale was prepared by the investigator to be circulated among 10 Special educators for the validation of software programme to be used as Tablet Programmed Material . The rating scale consisted of 20 statements. Using the scale the Special Educators were to rate each statement as whether they Agree/ Undecided / Disagree to each of the statement. The scores

proposed for the rating scales were Agree– 3; Undecided – 2; Disagree - 1. Cronbach Alpha Test was done using Split – Half method. The reliability coefficient obtained was 0.8

Procedure

The investigator contacted the Principal of the Special School and permission was obtained for the conduct of the study. The investigator with the help Special Educators in the primary and secondary classes identified 12 children with autism and mild cognitive impairments. The children who been identified were referred for a Diagnostic Assessment using Childhood Autism Rating Scale (CARS) by a Psychologist. From 12 children identified, 9 of them were confirmed with the diagnosis of autism also have mild intellectual disability. From the nine children 5 of them were selected through random sampling for the study.

The current level of functioning in academics was assessed using Functional Academic Assessment tool(FAAT) and documented in the FAAT profile.

A Pre – test was done to find out the current level of reading skills for 20 words of Food items and Vegetables using the Reading Assessment Tool for the 5 children selected. The total score of the Pre – test for the 20 words was calculated as per scoring mentioned.

Tablet Programmed Material to enhance reading skill was implemented for the sample for 25 sessions. The duration for each session was 30 minutes . Each session commenced with general conversation, an introduction activity for 5 minutes followed by teaching to read through Tablet Programmed Material for 20 minutes. Each session was ended with an activity of the child's choice. Each sight word was task analyzed into 10 sub – tasks and entered into the Task analysis format. This was used to record the progress made by each child in each session. At the end of 25th session a POST – TEST was done.

Results and Discussion

The results of the study were analyzed on the basis of the progress made by the sample in each session documented in Task analysis format. The statistical measure t-test was adopted for the either accepting or rejecting the three hypotheses outlined in the study.

Hypothesis One

There will be no significant difference in the Pre –test and post – test scores in the Reading of sight words in the children taught using Tablet Programmed Material.

Table :1 Comparison of Pre and Post – Test Mean scores, Standard Deviation and "t" value of Reading Sight Words using Tablet Programmed Material

Variable	Test	N	Mean	SD	df	t-value	Sig
Reading of Sight Words	Pre - Test	5	4.6	3.44	4	5.04	0.05
	Post – Test	5	17.2	1.92			

Total Score = 20

Table 1 depicts the means scores obtained in the Pre-Test and Post –Test of Reading Sight Words among the five children with autism of the study. Means score of 4.6 and 17.2 was obtained in Pre – Test and Post Test Scores. The Standard Deviation of 3.44 indicates that the Pre – Test scores are scattered moderately from mean while the score of 1.92 of the Post – Test highlights that there is only slight variation of the scores from the mean. These values project a remarkable development in the sight word reading skills of the sample of the study. The 't' value obtained was 5.04 significant at 0.05 level. The comparison of the Means score of Pre – test and Post – test reveals that Tablet Programmed Material is effective in developing reading of Sight Words in children with autism. This is supported by research study of Chambers (2011), in which whole(Sight) word instruction was implemented through a computer-based sight word reading intervention and results demonstrated increased rates of accurate recognition of the Sight words and skills development. Therefore the Hypothesis One is rejected.

Hypothesis Two

There will be no significant difference in the Pre and post – test scores in the comprehension of sight words in the children taught using Tablet Programmed Material.

Table :3 Comparison of Pre –Test and Post – Test Mean scores, Standard Deviation and "t" value of Comprehension of Sight Words using Tablet Programmed Material

Variable	Test	N	Mean	SD	df	t-value	Sig
Comprehension of Sight Words	Pre - Test	5	8.8	7.16	4	3.65	0.05
	Post – Test	5	34	4			

Total Score = 40

The Mean Scores 8.8 and 34 obtained in the Pre – Test and Post – Test for the Comprehension of Sight Words among the sample is highlighted in Table 2. A high variation in the scores of Pre – test of the sample is revealed through the Score of 7.16 obtained in Standard Deviation. The SD score of 4 projects only a slight variation in the Scores obtained by the sample in the Post – test. Since there is remarkable enhancement in the Pre – Test and Post – Test Scores it can be concluded that Tablet Programmed Material is effective in enhancing comprehension of Sight Words among the selected children with autism who also have mild intellectual disability for the study . This significance is further strengthened by the observed 't' value of 3.65 at 0.05 significance which is higher the "t" table value (2.776)at 4 degrees of freedom and so Hypothesis two is also rejected. The fact that reading comprehension could be enhanced efficiently and speedily has been substantiated by the study of Price (2011). The results of the study highlighted that every child with autism of the study showed improved comprehension in reading when using the iPad and interactive e-book over text books.

Hypothesis Three

There will be no significant difference in the Pre –test and post – test scores in the reading of sight words in functional situation in the children taught using Tablet Programmed Material

Table :3 Comparison of Pre –Test and Post – Test Mean scores, Standard Deviation and "t" value of Reading of Sight Words in Functional Situation using Tablet Programmed Material

Variable	Test	N	Mean	SD	df	t-value	Sig
Reading of Sight Words in Functional situation	Pre - Test	5	11.4	9.1	4	7.26	0.05
	Post – Test	5	41.4	9.81			

Total Score = 60

Table 3 highlights a significant difference in the reading of Sight Words in Functional situation in Pre –Test and Post – Test Mean scores among the children of autism of the study. The Standard Deviation scores of the Pre – Test and Post – Test points out that the scores are slightly scattered from the mean scores. The Tablet Programmed Material is an effective tool to improve the sight word reading in functional situation is strongly indicated through the t value of 7.26 which significant at 0.05. Therefore the hypothesis three is rejected. Douglas, Wojcik, & Thompson, (2012) point out that advances in technology have expanded the possibilities for computer-based devices to provide multiple types of instructional and assistive support on one device. Research studies at the international level highlight that interactive and portable technological devices, such as tablets and smart phones, have increased the accessibility and ease of use of computer-based technology for academic applications among children with autism

Major Findings

The major findings of the study are :-

- Significant effectiveness in the Reading of Sight Words was found among children with autism who also have mild intellectual disabilities when taught through Tablet Programmed Material.

- Tablet Programmed Material facilitated the enhancement of Comprehension of the Sight Words among the children selected for the study speedily .
- A significant impact was found in the reading of the Sight Words in functional situation through the use of Tablet Programmed Material
- Though not statistically recorded the investigators found that a Tablet Programmed Material enhanced the vocabulary of the children of the study
- The reinforcements provided in the Tablet Programmed Material were a booster for the children to learn.
- The Tablet Programmed Material induced self – directed learning among the students of the study

Conclusion

This study is a stepping stone for further studies of this kind to emerge in India. It throws light on how effectively tablets can used to develop reading skills in children with autism. The study focuses how reading, comprehension and reading of sight words in functional situation can be enhanced among children with autism using the latest assistive technology of the decade – the tablet which belongs to the family of iPad.

The statistical analysis highlights a significant difference in pre and post tests of reading, comprehension and reading of sight words in functional situation among children with autism of the study. The study points out that Tablet Programmed Material significantly increased the independent functioning in reading, comprehension and reading of sight words in functional situation among children with autism by decreasing the amount of direct support needed from the special educators

Research studies of this kind have wide scope in India as no data based studies was found by the researchers while reviewing of Indian literature pertaining to this study. The use of assistive technology such computers / iPads / tablets need to be integral part of the classroom for children with autism as pointed by Hileman (1996) as they are motivating to children with autism, due to their predictability and consistency, compared to the unpredictable nature of human responses. The computer does not send confusing social messages. The computer places the children with autism in control, allowing them to become an independent learner.

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