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Research Paper

To study the effects of Direct Instruction on single digit subtraction skills among primary level students with Autism Spectrum Disorder

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ABSTRACT:- The major purpose of the study was to find the effectiveness of *to study the effects of Direct Instruction on single digit subtraction skills among primary level students with Autism Spectrum Disorder*. The sample size of the present study was ten students with ASD who registered with THPI, Hyderabad and studying in the primary class in Special School. For the present study researchers develop a tool called checklist for subtraction skill', the purpose of the tool is to assess the level of knowledge on subtraction skills. The data analysis was done for the achievement scores obtained for learning single digit subtraction skills by the subjects belonging to the control group and experimental group, the achieved data were operated for independent sample *t*-test and pair *t*-test scores. Though both the control and experimental group score were at the same level in the pre-test after the exposure of Direct instruction and ordinary method on teaching same contents of single digit subtraction there was also a remarkable change in experimental group children.

KEYWORDS:- Autism, Direct Instruction

I. INTRODUCTION

Many children with ASD exhibit over selectivity the tendency to focus on a minute feature of an object or a person rather than the whole. For example, if shown a guitar for the first time a child might focus on the sound hole and not consider anything else about the instrument, such as its size, shape other parts or even the sound that it makes. This over selectivity interferes with the child's understanding of what a guitar is the totality of its parts, and functions. The tendency to over select hinders his learning of new concepts and interferes with his ability to interpret relevant meaning from the environment. Some children with ASD process a strong aptitude for rote memory for certain things. For example, a child with ASD may be able to name all of the film stars. Yet the same child may have difficulty recalling what he did during recess or remembering the sound that the letter k' makes.

Direct instruction is most effective for teaching basic or isolated skills it's a scripted program that is very systematic with a step-by-step format requiring student mastery at each step. Direct instruction involves continuous modelling by teachers so that children begin to master the material. Direct instruction is a general term for the explicit teaching of a skill-set using lectures or demonstrations of the material, rather than exploratory models such as inquiry-based learning. The method is often contrasted with tutorial participatory laboratory classes, discussion, recitation, seminars, workshop, observation, case study, active learning, practices or internships. Usually it involves some explications of the skill or subject participation or individual practise. The foundational pillars for performing any mathematically operations are addition, subtraction, multiplication and division. For an ASD child also it is mandatory that he/she acquires these skills effectively at the earliest possible age.

In comparison with more child-centred teaching methods, direct instruction commonly is characterized as teacher-directed. Consequently, the responsibility for student learning (or lack thereof) rests squarely with the teacher's design and delivery of instruction. This may present a philosophical challenge for the general education teachers, trained to work with typically developing groups of students, who see their role as a

facilitator of learning. On the other hand, special educators, generally trained to view themselves as interventionists, may have more knowledge of direct instruction, yet lack an understanding of how to integrate opportunities for individualized instruction into the framework of the general education classroom. In this topic we will identify and describe effective strategies for increasing opportunities for direct instruction in the least restrictive classroom setting. There are studies which are specifically based on research instructional strategies that can be integrated into general education settings to maximize opportunities for individualized instruction of children with disabilities, including ASD.

However, for many children, including students with ASD, more directive methods of instruction will be required. These strategies are represented by the base of the hierarchy and form the content of the lecture on direct instruction: reinforcement strategies, naturalistic procedures, and response-prompt strategies. Appropriate instructional strategy for a student has to be determined at the earliest stages so as to achieve optimum results. Thus, research suggests that increased generalization of learned skills is associated more with opportunity for child-initiated behaviour and less with adult-directed learning.

II. AUTISM AND RELATED DISORDERS

Current commonly used definitions of autism include those contained in the diagnostic Statistical Manual of Mental Disorders. Fourth Edition-Text Revision (DSM-IV-TR: American Psychiatric Association, 2000),the definition advanced by the Autism Society of America(2004),the definition of the International Classification of diseases (WHO,1993),and the educational definition of Autism adopted for use in the individuals with disabilities education act(IDEA)amendments of 1997.These definitions of autism are briefly presented here and are followed by definitions of the major diagnostic groups within ASD.

A widely used definition of autism is that of the DSM-IV-TR (APA,2000) which classifies autism as pervasive developmental disorder. Children and youth identified as having a pervasive development disorder are characterised by severe and pervasive impairment in several areas of development: reciprocal social interaction skills, communication skills, or the presence of stereotyped behaviour interest, and activities (p 69).These behaviour patterns are shown in the first few years of life and are significantly atypical for a child‘s mental age or development level.

Based on a conceptualization and definition originally developed by Ritvo and Freeman(1978).the Autism society of America(2004) relies on the following definition of autism, which is closely aligned with the criteria used in the DSM-IV- TR(APA,2000) and Kanner‘s (1943)original observations of autism: Autism is a complex developmental disability that typically appears during the first three years of life. The result of a neurological disorder that affects the functioning of the brain. Autism and its associated behaviours have been estimated to occur in as many as 2 to 6 in 1,000 individuals. (centers for Disease Control and Prevention, 2001). Autism is four times more prevalent in boys than girls and knows no racial , ethnic, or social boundaries. Family income, lifestyle, and educational levels do not affect the chance of autism‘s occurrence. (Autism Society of America, 2004)

The International Classification of Diseases, Tenth Revision (ICD-10; World Health Organization, 1993) uses the term pervasive developmental disorders to refer to ASD. With few exceptions, the ICD-10 classification system conceptualizes and defines autism in a manner similar to the DSM-IV-TR (APA, 2000). Thus, the ICD-10 classification system includes and defines the following autism spectrum disorders: childhood autism, Rett syndrome, other childhood disintegrative disorder, Asperger syndrome, other pervasive developmental disorders, pervasive developmental disorders-unspecified, overactive disorders with mental retardation with stereotyped movements, and atypical autism. The term atypical autism is used to refer to age, symptoms, or other characteristics of autism along with behavioural excess, such as self-stimulatory responses and other non functional movements, and mental retardation.

Characteristics of Autistic spectrum disorder

The characteristics of autistic spectrum disorder (ASD) can vary both from person to person and across different environments. They can also be different for the same person at different times in their life. That is why autism is usually referred to as a spectrum disorder. The first characteristics of ASD can sometimes be seen in a child who is under the age of two. However, in other children, the condition may not be picked up until they are much older.

Many children with ASD react to sensory stimulation in atypical ways. This takes the form of over and under-responsiveness to sensory stimulation. An over-responsive (hypersensitive) individual may not be able to

stand certain sounds, dislike being touched or the feel of certain textures, and refuse to eat foods with certain smells or tastes. An under-responsive child appears oblivious to sensory stimulation to which most people react, some children with ASD do not seem to feel pain in a normal way. Some under-responsive children will spin round, rock back and forth, or rub and push things hard into their skin to create additional forms or higher intensities of stimulation. It is not uncommon for an individual with ASD to display a combination of both over and under responsiveness for example, being hypersensitive to tactile stimulation but unresponsive to many sounds.

Intellectual functioning

Children with ASD span the entire range of IQ. A diagnosis of Autism can e make in a child with sever or profound mental retardation as well as in a child who is intellectually gifted. Although ASD occur across the full range of intellectual abilities between 70% and 80% of individuals with ASD also have mental retardation (Romanczyk, Weinter, Lockshin, & Ekdahl, 1999). The terms l*ow functioning autism and high functioning autism* are sometimes used to differentiate individuals with and without mental retardation.

Uneven skill development is a common characteristic of ASD and about 10% to 15% of children exhibit ―splinter skills‖ areas of relatively superior performance that are unexpected compared to other domains of functioning. For example a child may draw very well or remember things that were said a week before but have no functional language and will not make eye contact with others. Some children with ASD process a strong aptitude for rote memory for certain things. For example, a child with ASD may be able to name all of the film stars. Yet the same child may have difficulty recalling what he did during recess or remembering the sound that the letter *'k'* makes.

Direct Instruction

Direct Instruction (DI) is an explicit, scientifically-based model of effective instruction developed by Siegfried Engelmann in the 1960s. DI can be distinguished from other models of explicit instruction (such as direct instruction-di) by its focus on curriculum design and effective instructional delivery. Commercial DI curricular programs are typically published by Science Research Associates (SRA).

Guiding principles of DI include every child can learn if we teach him or her carefully and all teachers can be successful when given effective program and instructional delivery techniques. Thus, ultimately it is the teacher who is responsible for student learning; students are not blamed for their failure of learn.

Components of DI

The goal of DI is to do more in less time accelerating student learning by carefully controlling the features of curriculum design and instructional delivery. There are three main components of the design and delivery of DI programs. These include:

1. programme design,
2. organization of instruction, and
3. Teacher/student interactions.

Direct Instruction has nothing to do with training meaningless bits of behavior or coercing students into docility. It is a sophisticated way of: 1) determining what students need to succeed with meaningful material; 2) arranging the learning environment (e.g., the physical setting, curriculum, student-teacher communication, and peer relationships) so students receive what they need; and 3) helping teachers and students keep track of progress and difficulties so curriculum and Instruction can be improved (accountability).

Learning Mathematics with Manipulative

Concepts are essential to understanding and performing mathematics. A popular approach to help students understand abstract concepts is the use of manipulative. Manipulative enable students and teachers to represent concretely the abstract concepts that they are learning in mathematics class. Research suggests that students may also develop more complex understandings of concepts when using manipulative(Mover, Niezgoda & Stasnely, 2005).

The goal of special education is to educate students so they can reach their full potential. In order to achieve this goal, effective instructional programs must be used. Such programs should be at least scientifically based (i.e., consistent with what is known scientifically to be effective in teaching reading). DI programs go beyond this scientifically-based requirement. DI programs such as DI should be used with students who have

special needs.

Needs and significance of the study

Recent reviews of literature related to mathematics instructions have focused on teaching students with learning disabilities (Maccini and Hughes, 1997; S. Miller,Butler, & Lee, 1998). Reviews related to teaching mathematics to student with Autism have been meagre. Hence the literature is reviewed for the present study to find the effect of direct instruction in learning single digit subtraction skills. The above mention studies support direct instruction. Much research is available on reading writing for Autistic children. Hence the researcher has opted to study the effect in learning single digit subtraction skills.

Statement of the problem

The problem of the study is to investigate the effects of direct instruction on single digit subtraction skills among primary level students with Autism Spectrum Disorder.

Operational Definitions

Learning is a relatively permanent change in behaviour that is attributed to practice experience and is inferred from improvement in performance of single digit subtraction skills.

Subtraction skills.

The competence to compute the single digit subtraction by comprehending numeral values meaningfully for purpose of the study.

Autism spectrum disorder

Characterized by severe and pervasive impairment in several areas of development: reciprocal social interaction skills, communication skills, or the presence of stereotyped behaviour interest, and activities.

Primary level

Primary level refers primary classrooms in Special Education Centre, THPI-Hyderabad, consisting of students with Autism Spectrum Disorder, between age ranges of 7-10years.

Ordinary method

Method which are using in ordinary special classroom.

III. OBJECTIVES

[1]. To study the effect of direct instruction in learning single digit subtraction skills among experimental group of primary level students with Autism Spectrum Disorder.

[2]. To study the effect of ordinary teaching method on single digit subtraction skills among control group of primary level students with Autism Spectrum Disorder.

[3]. To compare the single digit subtraction skills between experimental and control group of primary level students with Autism Spectrum Disorder before and after the intervention.

IV. REVIEW OF LITERATURE

The review of related literature has been conducted to establish the need for the present study in the light of the studies conducted in this area. The primary concern of the study is to investigate the effectiveness of Direct Instruction on learning single digit addition skills among students with Autism Spectrum Disorder. The efforts made using Direct Instruction previously needs to be reviewed to know the extent to which the experiment have been done and their implications in teaching the children with Autism.

In this view, an attempt was made to gain insight into the following areas studies related to teaching mathematics to children with Autism Spectrum Disorder using different approaches, Studies related to functional arithmetic, Various approaches and studies related to Direct instruction.

Podell, Tournaki-Rein, and Lin (1992) compared computer assisted instruction practice to paper and pencil practice to develop fluency in addition and subtraction facts. 28 elementary students with mild mental disabilities participated in the addition study and 22 students with mild disabilities participated in subtraction study. A group comparison study was used to assess accuracy and speed of the students. After pre-test, students were randomly assigned to paper pencil group or computer assisted instruction group. Students in the paper-pencil group completed worksheets with two columns of 10 items each. Students in the computer assisted instruction group used Math Blaster software.

Harper, Mallette, Mahedy, Bently, & Moor (1995) conducted a 10 week investigation to determine the effectiveness of class wide peer tutoring in children with mild disabilities. Three elementary students with mild mental retardation participated in the present study along with four students who had learning disabilities and one student with an emotional disturbance. A variation of the alternating-treatment design was used to assess five dependent variables: accuracy, short term retention, long term retention, rate of responding, and student satisfaction with peer tutoring. At the end of each of session, the teacher totalled the daily points and posted them in front of the class. The intervention proved to be effective on all five dependent variables. Students with disabilities consistently perform poorer on mathematics problem solving and reasoning tasks (Parmer, Cawley, & Frazita, 1996).

Hanrahan (2000) discussed research that succeeded teaching addition and subtraction to a small group of mild to moderately intellectual disabled children using an adaptation of the touch math approach (a multi sensory approach that makes a connection between the concrete and abstract of number values). The children liked this dot notation approach‖ because it allowed them to appear as if they were mentally computing as their non disabled peers were doing. This approach offered these subjects a positive attitude towards computation when it allowed them to be like their peers.

Hollands (1972) writes that creativity in mathematics is the most neglected aspect of teaching of the subject. Teaching mathematics requires more emphasis on the process aspect rather than the product. Good preparation and good delivery system can turn a child into a creative person.

Studies related to functional arithmetic

Arithmetic reasoning is arguably one of the most important cognitive skills a child must master. The elementary and essential component of arithmetic reasoning is addition and subtraction. There has been a long history of research on the development of this type of simple quantification, which generally suggests an initial reliance on procedural knowledge and methods, such as counting followed by a gradual shift to retrieval from a network representation of arithmetic facts

Ashcraft, 1982 Ashcraft and Battaglia (1978) proposed that adults retrieve from memory the answer to a simple number problem (e.g. 3 + 4) through the activation of associative links between number combinations and solutions (Ashcraft and Battaglia, 1978). Most of the research done on the topic has followed the assumption that adults retrieve the results of simple calculation problems from a mental network (e.g. Ashcraft, 1982; Geary *et al*., 1986; Miller *et al*., 1984; LeFevre *et al*., 1988; Rickard and Bourne, 1996).

Morin and Miller (1998) investigated the effects of the concrete representational abstract sequence on teaching multiplication facts and word problems to three middle school children with autism. The researcher used a single subject and multiple baselines across subjects design to evaluate the effectiveness of the intervention. After a pre-test each student was individually taught multiplication facts consisted of instruction in computation and word problems for 20 sessions. All three students showed significant progress from pre test to the post test, though their scores dropped slightly during the advanced problem solving phase of the intervention.

Fasko (1994) also employed a peer tutoring format to improve multiplication fact retention for two students with mild mental retardation and three students with autism and three students without disabilities. A multiple baseline across subjects design was used to access the effectiveness of the intervention in increasing recall of basic facts and improving students class works assignments. He noted that one student improved only slightly. Fasko noted that peer tutoring may be an effective intervention for students who need additional practice beyond teacher directed lessons.

Vacc and Cannon (1991) used a cross age tutoring program to improve basic skills, such as rote counting, counting objects, telling time and identifying and matching number words and numerals. Four elementary school students with moderate mental retardation participated n the AB design study. Four sixth grade students without disabilities served as tutors during 6-weeks intervention. Sessions were held 4days a week for 30 minutes each. All four students increased and maintained the skills they were taught through the intervention.

Adams & Engelmann, 1996; Kameenui & Carnine, 1998. Indeed, Direct Instruction provides complete K-6 curricula in reading and math. The teaching methods and materials have been rigorously tested in numerous

experiments and field trials. This distinguishes Direct Instruction from other curricula and textbooks, which typically receive no testing before they are sold to schools and "tested" on children.

Hypothesis

- There will be a significant difference in the achievement of single digit subtraction skills among experimental group of primary level students with Autism spectrum Disorder who receive training through Direct Instruction.
- There might not be a significant difference in the achievement of single digit subtraction skills among control group of primary level students with Autism spectrum Disorder who receive training through ordinary method of teaching.
- There will be a significant difference in the single digit subtraction skills between experimental and control group of primary level students with Autism Spectrum Disorder who receive training through direct instruction and who receive training through ordinary method of teaching respectively.

Methodology

The major purpose of the study was to find the effectiveness of To study the effects of Direct Instruction on single digit subtraction skills among primary level students with Autism Spectrum Disorder.

Research method

The primary objective of the study is to investigate the effect of treatment condition on the experimental group. To serve the objective the Experimental Research design Pre-post with control group design was engaged.

Sample

The Non-probability sampling involves the selection of elements based on assumptions regarding the population of interest, which forms the criteria for selection and owing to these reasons Non-probability sampling was engaged. The sample size of the present study was ten students with ASD who registered with THPI and studying in the primary class in Special School (THPI, Hyderabad). Total of 23 students were selected from primary class between the age ranges of 7-9 years. A screening test was done to check the fulfilment of the criteria for inclusion. After the screening only 10 students were selected who fulfilled the criteria. Among these students made two group assigned as control and experimental group by using randomization method, each group consist of 5(five) students. The details are given in table 1&2.

Criteria for inclusion:

- Students who belonged to the group of primary level.
- Students who can comprehend simple instructions and have the capability to read and write numbers.
- Students who have pre-computational skill for subtraction of numbers i.e. yet tosingle digit subtraction.

V. CRITERIA FOR EXCLUSION

- Students who have impairments in vision or hearing or any other type of disability which might hinder with the learning process.
- Students having unyielding and intense ASD.

Profile of samples:

Table - 1: Profile of the Experimental group.

Sl.No.	Codes of the Students	Age	Gender
1	E1	8	M
2	E2	9	F
3	E3	9	M
4	E4	8	M
5	E5	7	F

Table - 2: Profile of the Control group

Sl.No.	Codes of the Students	Age	Gender
1	C1	9	M
2	C2	7	M
3	C3	8	M

4	**C4**	**9**	**M**
5	**C5**	**8**	**F**

Tool used

For the present study researcher develop a tool called checklist for subtraction skill‘ , the purpose of the tool is to assess the level of knowledge on subtraction skills.

Check list for Subtraction Skill

To assess the level of knowledge on addition skills a checklist was developed by reviewing the literature and listing the areas in a checklist pattern.

Content: Checklist consist of 20 items which covers the skills from the identification of sign, shorting the similar and different colored objects, computation of single digit subtraction with pictures, abacus, line, etc. upto independent solving of single subtraction.

Scoring system: The tool consists of six rating scale according to the mode of performance of the students these are as follows

5 = can perform the task without help i.e. independently.
4 = can perform the task with the help of cues.
3 = can perform the task with the help of verbal prompt.
2 = can perform the task with the help of gestural support.
1 = can perform the task with a model.
0 = totally dependent.

Validity establishment

To establish the validity it was circulated to 15 professionals in the field of special education consisting of all special teachers to get valuable suggestion on the areas with a 5 point scale to mark from most appropriate to most inappropriate of each area. The suggestions of the professionals were analyzed and areas were modified depending upon the responses by way of scores.

The final tool was prepared with 20 areas which comprises the areas mentioned above. Sample checklist is enclosed in the appendix. The checklist has provision for recording daily performance could be recorded on the list according to the level of independence or prompting in 6 different levels. Codes are used to describe the student‘s present level of performance in each task.

This tool was used to know the level of knowledge on single digit subtraction skills at the initial stage and to see the learned skills on single digit addition skills at final stage.

Data collection procedure

Seeking approval: Before starting the program a written consent were obtained with a request letter and a consent form from their parent and classroom teacher.

Place: The experiment was conducted in the premise of Special Education Centre - THPI, Hyd. prior to the study written permission was obtained from administer of the institution.

Tests and evaluation: With the help of single addition checklist developed by the researcher a pre-test was conducted before the implementation of program and time series tests also conducted to study the changes in their achievement, and post-test was conducted on the last day of the program. All the tests are conducted individually and, same day and gape of days were maintained for both the groups i.e. control and experimental group. All the observed data were entered onto a Performa.

Instructional kit: The researcher developed a kit for implementation and named it as direct instruction kit which consists of different items, they are

1) Flash cards
2) Abacus
3) Spoons
4) Real objects
5) Miniatures
6) Plastic leafs etc.

VI. IMPLEMENTATION

Duration: A total of continuous 30 sessions were carried out in working days only. It could conduct within six weeks i.e. 5 sessions in a week, and each session was of 60 minutes duration. The program was given to the

experimental group only and not given to the control group.

For Experimental Group: The subjects in the experimental group were taught single digit subtraction skills through direct instruction approach by using the prepared kits and the activities. The activities were followed in a sequence which is promote from

1. Simple to complex, and
2. Concrete to semi concrete and
3. Semi concrete to abstract level

The activities involved shorting & grouping, counting and reducing relating objects with numbers to subtracting the single digits. During the intervention social reinforcement were used. Primary reinforcement was provided at the end of the session.

For Control group: The training through direct instruction method was not imparted to the subjects in the control group instead placed them in their regular classroom. They were taught through the same content with ordinary method of teaching of 60 minutes for 30 sessions.

Data Analysis

Data Analysis was done by using *Statistical Package for Social Sciences* (SPSS). The objective of the study was to find the effect of Direct Instruction in learning Single Digit subtraction skills among primary students with Autism Spectrum Disorder (ASD).

The data Analysis was done for the achievement scores obtained for learning single digit subtraction skills by the subjects belonging to the control group and experimental group, the achieved data were operated for independent sample *t*-test and pair *t*-test scores. The recorded data were analysed and discussed as followings.

Objective 1: To study the effect of direct instruction in learning single digit subtraction skills among experimental group of primary level students with Autism Spectrum Disorder.

Hypothesis: There will be a significant difference in the achievement of single digit subtraction skills among experimental group of primary level students with Autism spectrum Disorder who receive training through Direct Instruction.

Table - 3: Comparison of Mean scores of Experimental group at pre and post test

Test	N	M	SD	*df*		t – value		Significant	
					.		.	.	
Pre-test	**5**	**5**	**0.82**	**4**		**6.122**		**P<0.01**	
								HS	
Post-test	**5**	**54**	**5.87**						
					P<0.01 at *df* 4		**= Highly Significant**		

From the above table 3 it is evident that the mean score of experimental group at pre-test is 5 and at post-tests are 54 where standard deviations are 0.82 and 5.87 respectively. There has been an big changes in the mean scores between pre & post-test i.e. about 48.8 units. Whereas, standard deviation is increased from 0.84 to 5.87, this variation is due to the achievement between more brighter and less bright skill students.

Using Direct Instruction helps brighter student to grasp the concept faster and they could performed the task which means it can gives the basics and logics for computation. Further, Paired *t*-test was carried out to find out the level of significance between pre and post test score. The computed ‗*t*' value is 6.122 which is bigger than the table value of *'t'* at 0.01 at 4 *df*. It shows that the differences between the pre and post test score of experimental group were found to be highly significant. Since the result shows that using Direct Instruction give effect on learning single digit subtraction the assumption of the researcher is correct. Therefore, the set hypothesis is correct and it served the objective ‗To study the effect of direct instruction in learning single digit subtraction skills among experimental group of primary level students with Autism Spectrum Disorder' and proved the hypothesis ‗There will be a significant difference in the achievement of single digit subtraction skills among experimental group of primary level students with Autism spectrum Disorder who receive training through Direct Instruction'. These results indicated that the intervention of direct instruction has a positive influence on learning single digit subtraction skills among children with ASD.

The differences in the performance in single digit subtraction skill among experimental group receiving intervention programme with Direct Instruction are shown in the figure 1. The average performance on checklist for single digit subtraction about single digit subtraction skill before the programme was 8.66% but after using the Direct Instruction method the performance was drastically changed from 8.56% to 90%. It shows that within 6 weeks of intervention with Direct Instruction their performance was improved more than 9 times from that of before. Result shows that Direct Instruction is an effective method for teaching single digit subtraction skill among primary children with Autism Spectrum Disorder.

Objective 2: To study the effect of ordinary teaching method on single digit subtraction skills among control group of primary level students with Autism Spectrum Disorder.

Hypothesis: There might not be a significant difference in the achievement of single digit subtraction skills among control group of primary level students with Autism spectrum Disorder who receive training through ordinary method of teaching.

Table - 4: Comparison of Mean scores of Control ``group at pre and post test

Test	**N**	**M**	**SD**	***df***	**t – value**	**Significant level**
Pre-test	5	5.2	0.84	4	2.852	P<0.05 Significant
Post-test	5	25.6	3.29			

P<0.01 at *df* 4 = Significant

The differences in the mean scores of control group at pre and post test scorese are shown in table 4. It is evident that the mean score of experimental group at pre-test is 5.2 and at post-tests are 25.6 where standard deviations are 0.84 and 3.29 respectively. There has been a change in the mean scores between pre & post-test i.e. about 20.4 units. Whereas, standard deviation is increased from 0.84 to 3.29, this variation is due to the achievement between more brighter and less bright skill students. Like Direct Instruction using Ordinary method also helps brighter student to grasp the concept faster and they could performed. Further, Paired *t*-test was carried out to find out the level of significance between pre and post test score. The computed ‗*t*' value is -2.852 which is bigger than the table value of *'t'* at 0.05 at 4 *df*. It shows that the differences between the pre and post test score of control group were found to be significant. Since the result shows that teaching with ordinary method give effect on learning single digit subtraction as the assumption of the researcher is correct. Therefore, the set hypothesis is correct and it served the objective ‗To study the effect of ordinary teaching method on single digit subtraction skills among control group of primary level students with Autism Spectrum Disorder' and proved the hypothesis ‗There might not be a significant difference in the achievement of single digit subtraction skills among control group of primary level students with Autism spectrum Disorder who receive training through ordinary method of teaching'. These results indicated that teaching with ordinary method also has a positive influence on learning single digit subtraction skills among children with ASD but not as influence given by direct instruction. In short it can be assumed that, direct instruction influences on primary children with ASD learn single digit subtraction skill than that of ordinary instruction.

The differences in the performance in single digit subtraction skill among control group receiving intervention programme with ordinary method are shown in the figure 2. The average performance on ‗checklist for single digit subtraction' about single digit subtraction skill before the programme was 8.66% but after using the ordinary method the performance was changed from 8.66% to 42.66%. It shows that within 6 weeks of intervention with ordinary method their performance was improved more than 4 times whereas 9 times after direct instruction from that of before. Result shows that ordinary method is also helps in learning single digit subtraction skill among primary children with Autism Spectrum Disorder.

Objective 3: To compare the single digit subtraction skills between experimental and control group of primary level students with Autism Spectrum Disorder before and after the intervention.

Hypothesis: There will be a significant difference in the single digit subtraction skills between experimental and

control group of primary level students with Autism Spectrum Disorder who receive training through direct instruction and who receive training through ordinary method of teaching respectively.

Table 5: Comparison of Mean scores between Experimental & Control group at pretest

Group	N	M	SD	*df*	t – value	Significant level
Experimental	5	5	0.82	8	0.416	P>0.05 NS
Control	5	5.2	0.84			

P>0.05 at *df* 8 = Not Significant

From the above table 5 it is evident that the mean score of experimental and control group at pre-test are 5 and 5.2 where standard deviations are 0.82 and 0.84 respectively. Almost the two groups were at the same level of skill performance on single digit subtraction. Further, Independent samples *t*-test was carried out to find out the level of significance between experimental and control group at pretest scores. The computed ‗*t*' value is 0.416 which is very smaller than the table value of *'t'* at 0.05 at 8 *df*. It shows that before the programme there were no differences between the control and experimental group on single digit subtraction skill.

The differences in the performance in single digit subtraction skill among experimental and control group before intervention are shown in the figure 3. The average performance of experimental and control group on ‗checklist for single digit subtraction' about single digit subtraction skill before the programme were 8.56% and 8.66%. It shows that before the programme started the performance on single digit subtraction between experimental and control group were at the same level, means there were no differences in the said skill.

Table - 6: Comparison of Mean scores of between Experimental and Control groups at post test

Group	N	M	SD	*df*	t – value	Significant level
Experimental	5	54	5.87	8	3.742	P<0.01 HS
Control	5	25.6	3.29			

P<0.01 at *df* 8 = Highly Significant

From the above table 6 it is evident that the mean score at post test of experimental group is 54 and for control group is 25.6 where standard deviations are 5.87 and 3.29 respectively. There has been a difference in the mean scores between post-test scores of experimental and control group i.e. about 28.4 units. Before the program both the groups were at same level i.e. at same mean scores. After the programme mean score of experimental group is increase from 5 to 54 whereas control group increase from 5.2 to 25.6. Standard deviation also differed as 5.87 and 3.29 for experimental and control after the programme. Further, Independent Sample *t*-test was carried out to find out the level of significance between experimental and control group at post-test score. The computed ‗*t*' value is 3.742 which is bigger than the table value of *'t'* at 0.01 at *df* of 8. It shows that the differences between the posttest scores between experimental and control group is highly significant. Since the result shows that using Direct Instruction give effect on learning single digit subtraction the assumption of the researcher is correct.

After the analysis as above two table it can answer to the third objective of the present study to compare the single digit subtraction skills between experimental and control group of primary level students with Autism Spectrum Disorder before and after the intervention.' As assumed as ‗There will be a significant difference in the single digit subtraction skills between experimental and control group of primary level students with Autism Spectrum Disorder who receive training through direct instruction and who receive training

through ordinary method of teaching respectively.‘

These results indicated that the intervention with direct instruction and ordinary method of teaching single digit subtraction leads to give difference in performing single digit subtraction. From the above evidences it can concluded that direction instruction is an effective teaching method for teaching single digit subtraction among primary student with Autism Spectrum Disorder.

Form the figure 4 we can see the differences in the performance in single digit subtraction skill among experimental and control group after programme. The average performance after the programme of experimental and control group on checklist for single digit subtraction‘about single digit subtraction skill before the programme were 90% and 42.66%. It shows that after the programme implemented the performance on single digit subtraction between experimental and control group were showing a big gap. It shows that group who received programme with direct instruction much improved than those who received programme with ordinary method on single digit subtraction skill.

Major findings

- It can be derived from the above finding that Direct instructions can become an effective strategy in learning single digit subtraction skills the children with ASD.
- Using Direct Instruction helps brighter student to grasp the concept faster and they could performed the task which means it can gives the basics and logics for computation.
- Teaching with ordinary method also has a positive influence on learning single digit subtraction skills among children with ASD but not as influence given by direct instruction
- The intervention with direct instruction and ordinary method of teaching single digit subtraction leads to give difference in performing single digit subtraction.
- Direction instruction is an effective teaching method for teaching single digit subtraction among primary student with Autism Spectrum Disorder.
- The results of the present study showed that the experimental group achieved higher score in compare to control group.

VII. DISCUSSION

An attempt has been made in the present study to ―the effects of Direct Instruction on single digit subtraction skills among primary level students with Autism Spectrum Disorder‖. Results indicated that the children in experimental group had improvement in single digit subtraction skills. This finding is supported by the researcher like Thaut M, found that playing instrument has an impact on the neurological patients. In other study researcher like Watkins and Slocum, (2004),

Carnina , silbert ,kame _ enui , & tarver,2004) found that Direct instruction has an impact on children with ASD . They revealed that more than any other commercially available instructional programmes, direct instructions were supported by the above researchers. Though both the control and experimental group score were at the same level in the pre-test after the exposure of Direct instruction and ordinary method on teaching same contents of single digit subtraction there was also a remarkable change in experimental group children.

Educational implications

The achievement of the experimental group in learning subtraction skills was found much better than the control group. The following findings of the study favour the use of direct instruction.

1) Meaningful and the relevant TLMs helped for better clarity of the concept and subject matter.
2) Performing skill of the students was increased through an active participation through a variety of learning activities.
3) Student‘s participation was enhanced and strengthened as they could handle the TLM with their being an opportunity for using.
4) The attention, motivation, concentration and involvement improved through the direct instruction.
5) As the primary school students have a special fascination for Models which can produce instruction, the teachers should use of the same in appropriate situations.
6) Teachers can use the existing body of the knowledge to plan mathematics instructions incorporating direct instruction approach to teach arithmetic concepts higher level skills in subtraction, additions, subtractions, multiplication etc.
7) Students should be allowed to handle the aids during class room transactions.

Limitations of the study

- The present study was conducted for very short period of time i.e. 30 sessions, therefore all subtraction skills were not achieved at 100% accuracy.
- The present size was only 10 therefore the size of sample can be increased for generalisation of the results.
- The present study assessed only the immediate effect of Direct instruction on various subtraction skills .It is necessary to find out the long term effect of such methods.
- The present study targeted only on primary students with ASD, which can be extended to other categories like, secondary, pre-vocational, etc.

Suggestions for future research

1. The present study was done with small sample size, so for the purpose of generalization of the findings further studies need to be carried out with large sample.
2. Similar studies can be carried out taking children belonging to other level of severity of ASD
3. Research need to be conducted to find out the effect of Direct Instructions various methods in a proper and systematic manner on the development of mathematics skills.

Summary and conclusion

The aim of the study was to investigate the effect of direct instructions in learning single digit subtraction skills among primary level students with ASD. Pre and post experimental control design was used for the present study. The total sample was 10 with the diagnosis of mild and moderate level of retardation belonging to the age group seven to nine years were taken from the primary section of Thakur Hari Prasad Institute, Hyderabad. Only those students were taken who do not have any other type of disability condition. All of them were screened on subtraction skills based on the scores obtained by the five pairs of students (total of 10 students) were selected. Both the students in each of these four pairs scored all most the same score in subtraction skills. After the selection of the five pair of students one from each pair is randomly assigned to control and experimental group. Hence there were 10 subjects for final study , divided into control and experimental group. The experimental group received exposure to systematic direct instructions on subtraction skills where as no such intervention was given to control group. This results revealed that direct instructions on subtraction skills can be effective for primary children ASD in learning single digit subtraction skills. The intervention with direct instruction and ordinary method of teaching single digit subtraction leads to give difference in performing single digit subtraction. From the findings it was concluded that direction instruction is an effective teaching method for teaching single digit subtraction among primary student with Autism Spectrum Disorder.

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