EFFECTS OF EXPLICIT TEACHER INSTRUCTION ON AUTISM STUDENTS' ACADEMIC PERFORMANCE AND RETENTION ABILITY IN DIRECTED NUMBERS AMONG JUNIOR SECONDARY SCHOOLS IN DAURA EDUCATION ZONE, KATSINA STATE, NIGERIA

By

Dr U. A. Ginga & Dr. A. I. Kauru

Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria & Department of IJMB, Nuhu Bamalli Polytechnic, Zaria. uaginga2@yahoo.com,

Abstract

This study investigated the effect of Teacher explicit instruction on Autism students' academic performance and retention ability among junior secondary schools in directed numbers operations in Daura Education Zone, Katsina State. The population of the study was 1,400 Junior Secondary One (JSSI) Autism students in Daura Education Zone, Katsina State admitted in 2016/2017 academic session. A stratified random sample was employed where 400 students were selected as the sample size of the study. One instrument, Directed Numbers Multiple Choice Test (DNMCT) was used for the study. The study was a Quasi-experimental and used the Pre –test –Posttest control group design. Four research questions and null hypotheses were formulated and tested. A test-retest reliability and Pearson Product Moment Correlation Coefficient (PPMCC) were used to estimate the reliability which was found to be 0.86. The test items were subjected to content, construct and criterion related validity by experts in the area of Mathematics-Education. Means and standard deviations were used to answer the research questions while Inferential Statistic of One-way Anova was used to test the null hypotheses. The results obtained from the analyses indicated that there were significant differences between the mean performance and retention ability scores of students exposed to Teacher explicit instruction and those taught using lecture method at $p \leq 0.05$. It was recommended that primary school autism students be taught using Teacher explicit instruction at primary school level.

Introduction

Explicit or direct instruction involves teaching a specific skill or concept in a highly structured environment using clear, direct language. This type of instruction is focused on producing specific learning outcomes and sometimes involves the use of scripted lessons. During explicit instruction, the teacher clearly identifies the expectations for learning, highlights important details of the concept or skill, provides precise instructions, and connects new learning to previously learned material. The purpose of explicit teacher modeling is to provide students with a clear, multi-sensory model of a skill or concept. The teacher is the person best equipped to provide such a model. Below offers a step-by-step explanation of this instructional strategy:

(1) describes and models the math skill/concept.

(2) describes features of the math concept or steps in performing math skill.

(3) breaks math concept/skill into learnable parts.

(4) describes/models using multi-sensory techniques. (5) engages students in learning through demonstrating enthusiasm, through maintaining a lively pace, through periodically questioning students, and through checking for student understanding.

Explicit instruction is based on research studies relating to effective teaching practices. This research aimed to identify educational interventions that were the most effective in supporting the learning of students with learning disabilities (LDs) in the core subjects of reading, writing and mathematics. Explicit instruction involves using highly structured and sequenced steps to teach a specific skill. With this approach, the educator

intentionally aims to teach students with LDs using a series of actions in three main stages: preparing for the lesson, interacting with students over the course of the lesson, consolidating the lesson taught (Gauthier, Bissonnette & Richard, 2013). This study investigated the effects of explicit teacher instruction on autism students' retention ability and academic performance among junior secondary schools in directed numbers.

It is important that teacher educators prepare their lessons in advance before going to the class. During this stage, they should reflect on the anticipated learning outcomes, on the educational activities to be performed, in the execution of the various stages, on the required materials, on the estimated time required for each step, and how the anticipated learning outcomes will be evaluated. Ultimately, the teacher must specify the learning objectives they will pursue with their students with LDs: that which drives planning activities in reverse (Tomlinson & McTighe, 2010), which consists of determining: the anticipated results, what constitutes as evidence of learning and educational activities. It is thus apparent that the explicit determination of learning outcomes and evidence of learning in advance will help to facilitate the learning of students with LDs.

Over the course of the lesson, the implementation of explicit instruction, when planning for educational activities should be adopted: the educator demonstrates to students with LDs what they must do (modeling the practice); then guides students through a group activity (guided or directed practice) so that students have the necessary skills to complete the task, and then the students practice the task independently (autonomous practice).

The term autism is derived from the Greek word autos meaning self, which refers to limited ability to communicate and lack of response to people. Autism is a neurobiological developmental disorder that typically starts before the age of three. It affects a child's social interaction, communication skills, play skills and behavior Prelock, 2006). The Autism Society of America (ASA) defines autism as "a complex developmental disability that typically appears during the first three years of life and affects a person's ability to communicate and interact with others. Based on the age of onset, there are two different types of autism: congenital and regressive autism. Congenital autism is generally apparent from the beginning; however, children with regressive autism develop normally in the beginning and then begin to show regression in language and other skills (McCoy, 2011).

Directed numbers are numbers which are either positive or negative. Directed numbers can be added and subtracted together just like normal positive integers - signs, however, become very important because each directed number has its own positive or negative sign. Many of the numbers we use represent situations which have directions as well as size. The numbers which have a direction and a size are called directed numbers. Once a direction is chosen as positive (+), the opposite direction is taken as negative (-).

In Nigeria, gender-achievement studies include that of Abiam and Odok (2006) who found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. They however found the existence of a weak significant relationship in Geometry and Trigonometry amongst secondary school students of different gender. Teacher gender has significant influence on students performance in mathematics.

Academic Performances; may be used to refer to an expression used to present student's scholastic standing within a short time (Ado, 2014). It is significant to consider retention ability when evaluating learning strategies. Retention is the ability to retain and later recall information or knowledge after learning. It can be categorized into two that are short-term and long-term. This study is concerned with the short-term that is how a student can recall

material immediately or after a very short time in examinations. It requires a student to reproduce correctly what has been previously learned (Ado, 2014). This study investigated the effects of explicit teacher instruction on autism students' retention ability and academic performance among junior secondary schools in directed numbers in Daura Education Zone, Katsina State with aim of making great contribution to mathematics education.

The Problem

The National Council of Teachers of Mathematics (NCTM, 2000) specifies that students should have an opportunity to develop understanding of mathematical concepts and procedures by engaging in meaningful mathematics instruction. Still, the findings of a review done on mathematics interventions for low-achieving students indicate that instruction for students with disabilities focuses on teaching computation skills and procedures rather than conceptual knowledge. Additionally, the achievement gap for mathematics between typically developing students and students with disabilities e.g. autisms continues to increase because students with disabilities progress at a much slower rate as compared to their typically developing peers. Therefore, this study investigated the effects of Teacher explicit instruction on autism students' retention ability and academic performance among junior secondary schools in directed numbers in Daura Education Zone, Katsina State.

Objectives of the Study

The following objectives were sought to be achieved

- Examine the effect of Teacher explicit instruction on JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.
- Investigate the effect of teacher explicit instruction on retention ability of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.
- Determine the effect of teacher gender and teacher explicit instruction on academic performance of JSSI autism students in directed numbers in Daura Education Zone, Katsina State.
- Analyse the effect of teacher explicit instruction on retention ability of JSSI autism students in directed numbers in Daura Education Zone, Katsina State.

Research Questions

The following research questions were raised and answered

- What is the difference between the mean academic performance scores of JSSI autism students taught directed numbers using teacher explicit instruction and those taught using lecture method in Daura Education Zone, Katsina State?
- What is the difference between the mean retention ability scores of JSSI autism students taught directed numbers using teacher explicit instruction and those taught using lecture method in Daura Education Zone, Katsina State?
- What is the difference between the mean academic performance scores of JSSI autism students taught directed numbers by male and female teacher using teacher explicit instruction in Daura Education Zone, Katsina State?
- What is the difference between the mean academic retention scores of JSSI Autism students taught directed numbers by male and female teacher using teacher explicit instruction in Daura Education Zone, Katsina State?

Null Hypotheses

The following null hypotheses were formulated and tested at $p \leq 0.05$.

H_{O1}: There is no significant difference between the academic performance scores of JSSI autism students taught directed numbers using teacher explicit instruction and those taught using lecture method in Daura Education Zone, Katsina State.

H_{O2}: There is no significant difference between the mean retention ability scores of JSSI autism students taught directed numbers using teacher explicit instruction and those taught using lecture method in Daura Education Zone, Katsina State.

H_{O3}: There is no significant difference between the mean academic performance scores of JSSI autism students taught directed numbers by male and female teacher using teacher explicit instruction in Daura Education Zone, Katsina State.

H_{O4}: There is no significant difference between the mean academic retention scores of JSSI autism students taught directed numbers by male and female teacher using teacher explicit instruction in Daura Education Zone, Katsina State.

Methodology

Design of the Study

The design for this study was a Quasi-experimental and used the Pre-test-Posttest Group Design. Two groups were used for the research. The first group was exposed to Teacher explicit instruction while the second was exposed to Lecture method. At the end of the treatment each group was subjected to posttest and post-posttest.

Population

The population of the study was 1,400 JSSI Autism students in Daura Education Zone, Katsina State admitted in 2016/17 academic session. The distribution of the population was 850 male and 550 female Autism students.

Sample and Sampling Technique

Purposive Sampling Technique was adopted in selecting the sample. Intact classes of the respective schools were involved in the study. A sample size of 200 SS.I students participated in the study based on 95% Confidence and 5.0 % Margin of Error in line with Research Advisors, (2006). The sample size is presented in Table 1.

Table 1: Sample Size of the Study

	Gender		
Group	**M**	**F**	**Total**
Experimental	50	50	100
Control	50	50	100
Total	**100**	**100**	**200**

Table 1 show the sample selected in each group, in both the experimental and control groups. Two hundred (100) male and two hundred (100) female students were randomly selected.

Instrumentation

One instrument known as Directed Numbers Multiple Choice Test (DNMCT) was used for the study. Before selecting and administering the test items, a list of learning objectives for the topics were prepared and from the pool of the questions, the study choose more than 50 questions by taking the list of learning objectives into consideration. Some questions were discarded by taking the item analysis into consideration. It was deduced that items with

discrimination index between 0.4 and 0.6 were considered. The test items used were within the ability level of the students. The DNMCT had 50 parallel questions divided into two sets and administered to the two groups. Each group was independently administered the 50 questions at the same time. Before administration of the performance and retention tests, a pre-test was administered to both the groups to confirm their homogeneity, which was found to be no significant difference. This has given room for further study and the experimental treatment. After three weeks treatment, *o*ne instrument known as DNMCT of 50 questions was administered to both groups as the posttest in order to ascertain their academic performance. After one week the DNMCT was reshuffled and administered as post-posttest to both the groups in order to ascertain the retention ability of the students. This is in line with (Akram, Sufiana & Malik, 2012). The scripts were marked by the researcher and the marks were properly recorded.

Validity and Reliability

The face and content validities of the test items were validated by junior lecturers in mathematics education section at Ahmadu Bello University, Zaria. In addition a pilot test was conducted to ascertain the effectiveness of the instrument. Test- retest reliability was observed and Pearson Product Moment was used to estimate the reliability coefficient and found to be 0.86.

Data Analysis

The data collected was analyzed using One Way ANOVA Statistics; this is because it is one of the statistical tools that measure the difference of means between two or more samples. The One Way ANOVA statistics was calculated at $p \leq 0.05$.

Results Analysis

In answering the research questions, the data collected were analysed using Descriptive Statistics of Means and Standard Deviations. While in analyzing the null hypotheses, the data collected were analysed using Inferential Statistics of One Way ANOVA at $p \leq 0.05$. The details of the analyses were in tables:

Research Question One

What is the difference between the mean academic performance scores of students taught using the Teacher explicit instruction and those taught using Lecture method in Directed numbers among JSSI autism students in Daura Education Zone, Katsina State?

To answer this question, a descriptive statistics using means and standard deviations were carried out. The result is presented in Table 2.

Table 2: Mean and Standard Deviations between the Teacher explicit instruction and Lecture Method Performances of JSSI Autism Students in Directed numbers

		Pretest			**Posttest**		
Group	**N**	**Mean**	**SD**	**Mean difference**	**Mean**	**SD**	**Mean difference**
Experimental	100	67.01	18.42	-0.2	74.26	15.88	5.96
Control	100	67.21	17.82		68.30	15.67	
Total	**200**						

The result in Table 2 indicated that the mean performance score of the experimental group was 74.26 (SD = 15.88) and that of the control group was 68.30 (SD = 15.67). The mean performance score difference between the groups was 5.96 in favour of the experimental group. The initial (pretest) performance scores were 67.01 (SD=18.42) and 67.21 (SD=17.82)

for the experimental and control groups, respectively. The mean pretest score difference was -0.2 in favor of the control group. This showed that there was a difference between the mean performance score of Autism students taught with Teacher explicit instruction and those exposed to Lecture method in Directed numbers operation after treatment.

Null Hypothesis One

There is no significant difference between the academic performance scores of students taught using the Teacher explicit instruction and those using Lecture method in Directed numbers among JSSI Autism students in Daura Education Zone, Katsina State.

To test this hypothesis an Inferential Statistics of One Way ANOVA was carried out and Table 3 presented the result.

Table 3: One-Way ANOVA Analysis between the Teacher explicit instruction and Lecture Method Performances of JSSI Autism Students in Directed numbers

Source of variance	Sum of squares	df	Mean Square	F	P
Between groups	2262.00	1	2263.00	5.33	0.02
Within groups	84138.23	98	404.84		
Total	**86400.23**	**99**			

The result in Table 3 indicated that F(1,98) = 5.33, P=0.02; the null hypothesis which stated no significant difference was rejected. Therefore, there was a significant difference between the academic performance scores of students taught using the Teacher explicit instruction and those using Lecture method in Directed numbers among JSSI Autism students in Daura Education Zone, Katsina State.

Research Question Two

What is the difference between the mean retention ability scores of students taught using Teacher explicit instruction and those using Lecture method in Directed numbers among JSSI Autism students in Daura Education Zone, Katsina State?

To answer this question, a Descriptive Statistics using means and standard deviations were carried out. The result was presented in Table 4.

Table 4: Mean and Standard Deviations between the Teacher explicit instruction and Lecture Method Retention Ability of JSSI Autism Students in Directed numbers

		Pretest			Posttest		
Group	**N**	**Mean**	**SD**	**Mean difference**	**Mean**	**SD**	**Mean Difference**
Experimental	100	67.01	18.42	-0.2	78.27	17.61	13.87
Control	100	67.21	17.82		64.40	14.22	
Total	**200**						

The result in Table 4 indicated that the mean score of the experimental group was 78.27 (SD = 17.61) and the mean of the control group was 64.40 (SD = 14.22). The mean difference score of both groups was 13.87 in favour of the experimental group. The initial (pretest) performance scores were 67.01 (SD=18.42) and 67.21 (SD=17.82) for the experimental and control groups, respectively. The mean pretest score difference was -0.2 in favor of the control group. This showed that there was a difference between the mean performance score of Autism students taught with Teacher explicit instruction and those exposed to Lecture method in Directed numbers operation.

Null Hypothesis Two

There is no significant difference between the mean retention ability scores of students taught using Teacher explicit instruction and those using Lecture method in Directed numbers among JSSI Autism students in Daura Education Zone, Katsina State.

To test this hypothesis an Inferential Statistics of One Way ANOVA was carried out and Table 5 presented the result.

Table 5: One-Way ANOVA Analysis between the Teacher explicit instruction and Lecture Method Retention Ability of JSSI Autism Students in Directed numbers

Source of variance	Sum of squares	df	Mean square	F	p
Between groups	5545.21	1	5545.21	17.22	0.01
Within groups	57744.61	98	291.34		
Total	**63289.82**	**99**			

The result in Table 5 indicated that F(1,98) = 17.22, P=0.01; the null hypothesis which stated no significant difference was rejected. Therefore, there was a significant difference between the mean retention ability scores of students taught using Teacher explicit instruction and those using Lecture method in Directed numbers among JSSI Autism students in Daura Education Zone, Katsina State.

Research Question Three

What is the difference between the mean academic performance scores of male and female Teacher explicit instruction of JSSI Autism students in directed numbers in Daura Education Zone, Katsina State?

To answer this question, a descriptive statistics using means and standard deviations were carried out. The result is presented in Table 6.

Table 6: Mean and Standard Deviations between the Male and Female Teacher explicit instruction Performance of JSSI Autism Students in Directed numbers

		Pretest			Posttest		
Gender	**N**	**Mean**	**SD**	**Mean difference**	**Mean**	**SD**	**Mean difference**
Male	50	67.01	18.42	-0.2	75.04	14.85	10.74
Female	50	67.21	17.82		64.30	13.39	
Total	**100**						

The result in Table 6 indicated that the mean score of the male experimental group was 75.04 (SD = 14.85) and the mean of the female experimental group was 64.30 (SD = 13.39). The mean difference score of both groups was 10.74 in favour of the experimental group. The initial (pretest) performance scores were 67.01 (SD=18.42) and 67.21 (SD=17.82) for the experimental and control groups, respectively. The mean pretest score difference was -0.2 in favor of the control group. This showed that there was a difference between the mean performance score of the male and female experimental Autism students taught with Teacher explicit instruction in Directed numbers operation after treatment.

Null Hypothesis Three

There is no significant difference between the mean academic performance scores of male and female Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.

To test this hypothesis an Inferential Statistics of One Way ANOVA was carried out and Table 7 presented the result.

Table 7: One-Way ANOVA Analysis of Male and Female Teacher explicit instruction Performance of JSSI Autism Students in Directed numbers

Source of variance	Sum of squares	df	Mean square	F	p
Between groups	2455.33	1	2455.33	9.91	0.01
Within groups	48444.34	48	238.82		
Total	**50899.67**	**49**			

Result in Table 7 showed that F(1,48) = 9.91, P=0.01; the null hypothesis that stated no significant difference was rejected. Therefore, there was a significant difference between the mean academic performance scores of male and female Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.

Research Question Four

What is the difference between the mean retention ability scores of male and female Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State?

To answer this question, a Descriptive Statistics using means and standard deviations were carried out. The result is presented in Table 8.

Table 8: Mean and Standard Deviations between the Male and Female Teacher explicit instruction Retention ability of JSSI Autism Students in Directed numbers

		Pretest			Posttest		
Group	**N**	**Mean**	**SD**	**Mean difference**	**Mean**	**SD**	**Mean Difference**
Male	50	67.01	18.42	-0.2	75.44	14.87	8.09
Female	50	67.21	17.82		67.35	12.31	
Total	**100**						

The result in Table 8 indicated that the mean score of the male experimental group was 75.44 (SD = 14.87) and the mean of the female experimental group was 67.35 (SD = 12.31). The mean difference score of both groups was 8.09 in favour of the male experimental group. The initial (pretest) performance scores were 67.01 (SD=18.42) and 67.21 (SD=17.82) for the experimental and control groups, respectively. The mean pretest score difference was -0.2 in favor of the control group. This showed that there was a difference between the mean retention score of male experimental autism students taught with Teacher explicit instruction in Directed numbers operation.

Null Hypothesis Four

There is no significant difference between the mean retention ability scores of male Teacher explicit instruction and female Lecture method of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.

To test this null hypothesis, One-Way ANOVA Analysis of variance was conducted. Result of the analysis is presented in Table 9.

Table 9: One-Way ANOVA Analysis between the Male Teacher explicit instruction and Female Lecture Method Retention Ability of JSSI Autism Students in Directed numbers

Source of variance	Sum of squares	df	Mean square	F	p
Between groups	3444.61	1	3444.61	7.33	0.21
Within groups	48377.33	48	238.82		
Total	**51821.94**	**49**			

Result in Table 9 showed that F(1,48) = 7.33, P=0.21; the null hypothesis which stated no significant difference was rejected. Therefore, there was a significant difference between the mean retention ability scores of male Teacher explicit instruction and female Lecture method of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.

Summary of the Major Findings

1. A significant difference was found between the mean academic performance scores of Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.
2. A significant difference was found between the mean retention ability scores of Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State.
3. There was a significant difference between the mean academic performance scores of male and female JSSI Autism students exposed to Teacher explicit instruction in Directed numbers in Daura Education Zone, Katsina State.
4. There was significant difference between the male and female mean retention ability scores of JSSI Autism students exposed to Teacher explicit instruction in Directed numbers in Daura Education Zone, Katsina State.

Discussion

Discussion was carried out according to the major findings of the study.

There was significant difference between the mean academic performance scores of Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State. This shows that there was significant difference between the mean performance scores among junior secondary school students in Directed numbers. This finding confirmed the study of Van de Pol, Volman, Oort & Beishuizen (2014) who observed the speed and performance differences between Teacher explicit instructions.

There was significant difference between the mean retention ability scores of Teacher explicit instruction of JSSI Autism students in Directed numbers in Daura Education Zone, Katsina State. Therefore, this showed that there was significant difference between the mean retention ability scores of Autism students in Directed numbers. This confirmed the finding of Van de Pol, & Elbers (2013) and Askell-Williams, Lawson & Skrzypiec (2012).

There was significant difference between the mean performance of male and female autism students taught using Teacher explicit instruction in Directed numbers in Daura Education Zone, Katsina State. Therefore, this showed that there was significant difference between male and female mean performance scores among junior secondary schools Autism students in Directed numbers. The finding also showed that the Teacher explicit instruction has more effect than the Lecture method. This confirmed the work of (Praetorius, Lenske, & Helmke, 2012; Kim & Hannafin 2011; Van de Pol et al. 2010). However, there was no significant difference between the mean retention ability scores of male and female students in Directed numbers. This confirmed the study of Askell-Williams, Lawson & Skrzypiec (2012).

Conclusion

The study compared the effects of Teacher explicit instruction on junior secondary schools Autism students' retention ability and academic performance in Directed numbers in Daura Education Zone, Katsina State with aim of making great contribution to mathematics education. Based on the empirical evidences presented, Teacher explicit instruction has enhanced the performance and retention ability of Autism students in Directed numbers operations. However, it was gender friendly. Despite the treatment given some problems were identified and measures that would further improve the teaching of Autism students by the use of Teacher explicit instruction in Directed numbers were recommended to students, teachers, government and prospective researchers. A further study is hereby recommended to ascertain the effects of Teacher explicit instruction on Autism students' retention ability, academic performance and some related areas.

Recommendations

1. Students should take advantage of Teacher explicit instruction opportunities by adopting it in their learning processes, this will enhance their knowledge of application; retention ability, develop skills of reasoning within and outside Directed numbers. This will create the much needed attention and interest among students.
2. Teachers should ensure that students are given the opportunity to develop their meta-cognitive abilities in teaching and learning through the use of Teacher explicit instruction appropriately in the classroom as a tool rather than as a toy.
4. The curriculum designers should design the curriculum in such way that there are options to activity based learning through Teacher explicit instructions that will help the Autism students.

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