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Original Research Article

Effect of Peer Tutoring Instructional Strategy on Achievement of Basic Science and Technology Students with Learning Disabilities in Nasarawa State, Nigeria

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Abstract: This study examined the effect of Peer Tutoring Instructional Strategy on Achievement of Basic Science and Technology Students with Learning Disabilities. Quasi experimental research design was employed for the study. The population of this study comprised all Upper Basic II basic Science and Technology students with learning disabilities in Nasarawa State, Nigeria. The sample of the study was sixty-seven Upper Basic II Basic Science and Technology students from two intact classes purposively selected from two special co-education schools in Nasarawa State, Nigeria. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. Basic Science and Technology Achievement Test (BSTEAT) was used as instrument for data collection. The test was validated by experts in Science and Technology Education and trial tested. The reliability of BSTET was determined using Kuder-Richardson formula 21 (K-R_{21}) and the reliability coefficient was found to be 0.77 implying that the instrument was reliable enough for the study. Descriptive statistics of mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance. The findings of this study among others revealed that peer tutoring instructional strategy has a significant effect on students' academic achievement in Basic Science and Technology. Also, the findings showed that a significant difference exist in the achievement of male and female Basic Science and Technology students exposed to peer tutoring instructional strategy. Based on the findings of this study, it was recommended that Basic Science and Technology teachers should incorporate peer tutoring instructional strategy into the teaching of Basic Science and Technology in Upper Basic schools having students with learning disabilities in Nasarawa State.
Keywords: Achievement, Basic Science and Technology, Learning Disability, Peer Tutoring, Instructional Strategy

Introduction

Science and Technology education is a veritable tool for scientific and technological advancement of any nation. This fact is enshrined in the National Policy on Education of the Federal Republic of Nigeria (FRN, 2014) which states that science and technology education should among other things equip students to live effectively in the modern age of science and technology. The policy also emphasized that science and technology teaching and learning are viable instruments for inculcating necessary scientific knowledge, skills and competencies. In order to inculcate the necessary scientific knowledge, skills competencies and attitudes in various developmental strategies such as World Declaration on Education for All (EFA) are put in place in Nigeria educational system. Other strategies like the NEEDS (National Economic Empowerment Development Strategies) and SDGs (Sustainable Development Goals) were put in place. In order to meet these goals, the Nigerian Government overhauled its existing science and technology curriculum to cater for the needs of the nation as it aspires to be among the 20 top economies in the globe by the year 2020 (FRN, 2012).

Basic Science and Technology education has become one of the best avenues to meet the global challenges facing the Nigerian nation. Despite the importance of Basic Science and Technology in the country's quest for technological advancement, there has been seeming ineffectiveness in the teaching and learning of the subject which in turn is strongly affecting the attainment of the country's laudable objectives and goals of developing a scientific and technologically literate citizenry. Researchers such as Bukunola and Idowu (2012), Osokoya (2013), Alabi (2014), Oni (2014) Kabutu, Oloyede and Bandele (2015) and Samuel (2017) attested that the poor

instructional strategies employed in the teaching of the subjects by teachers contribute to students under achievement. Students find it difficult to understand the basic concepts taught, hence a child that is not well grounded in Science and Technology at the basic level, will not show interest in offering core science and technology subjects at the Senior Secondary level.

The main purpose of teaching is to transfer knowledge to the learners. For effective teaching and learning to take place, the teacher needs to use different methods and approaches in teaching. Unfortunately, poor achievement in Basic Science and Technology has been attributed to poor approach to teaching employed by teachers (Samuel, 2017; Alabi, 2014; Osokoya, 2013). Unfortunately, the present Nigerian Basic Science and Technology classroom does not seem to provide hands-on-minds-on challenging, interactive and collaborative environment needed by new generation of students who have been exposed to internet, computer usage, hand-set and other sophisticated gadgets.

Disability is generally equated with incapacity. The impact is remarkably similar in different countries and across health conditions where the general public lacks an understanding of the abilities of people with physical impairments (Jordan, 2017 & Spicker, 2018). Negative attitudes and behaviours can have adverse effects on children and adults with disabilities, leading to negative consequences such as low self-esteem and reduced participation. Persons who feel harassed because of their disability sometimes avoid going to places, changing their routines, or even moving from their homes. Example of abuse of persons with disability abound: children bullying other children with disabilities in schools; taxi drivers failing to support access needs of passengers with disabilities; employers discriminating against people with disabilities and strangers mocking people with disabilities (Rohwerder, 2018; Etieyibo & Omiegbe, 2016; Idrees & Ilyas, 2012; Smith, 2011).

Purpose of the Study

The purpose of this study was to examine the effect of peer tutoring instructional strategy and guided discovery method on achievement of Basic Science and Technology students with learning disabilities. Specifically, the study sought to:

1. determine the effect of peer tutoring instructional strategy and guided discovery method on achievement of Basic Science and Technology students with learning disabilities.
2. determine the variation in the achievement of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy.

Research Questions

The following research questions guided the study:

1. What is the mean achievement scores of Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy and guided discovery method?
2. What is the mean achievement scores of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy and guided discovery method?

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy.
2. There is no significant difference in the mean achievement scores of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy.

Scope of the Study

The study focused on the effect of peer tutoring instructional strategy on achievement of Basic Science and Technology students with learning disabilities in Nasarawa State, Nigeria. The study was delimited to the topics of Work, Energy, Power and Simple Machines.

Literature Review

Signs and Symptoms of Learning Disabilities

A range of environmental, biological, genetic, and Prenatal conditions may be associated with adverse developmental of learning disability. Symptoms do not necessarily predict later learning problems or indicate the existence of a disability, particularly when only a single indicator is present (Onukwufor, 2016). Similarly, protective factors do not rule out the presence of a disability. However, the presence of risk indicators warrants substantial and serious efforts to facilitate early learning success because many children at risk respond positively to high quality instruction and support. Therefore, children at risk, who may or may Not have Learning Disabilities (LD), need to receive carefully planned and responsive services and supports to enhance their opportunities for learning Systematic Observations - Systematic observations of a child's behavior and abilities over time are an important addition to examining the presence of risk indicators and protective factors.

Observations may be informal or may follow a standard observation protocol; in either case, they

should be conducted multiple times and in varying contexts (e.g., home, diagnostic preschool, Head Start classroom, playgroup) to increase the reliability and validity of the hypotheses made regarding a child's behavior. In many cases, an extended period of observations will be necessary. Observations should provide a description of the frequency, consistency, and severity of the behaviors causing concerns in relation to contextual demands. The child's family should be involved throughout the entire process. When professionals raise a question about the course of the child's development as a result of systematic observation, they should discuss the findings with the caregivers and family. When indicated, a referral should be made to appropriate professionals for further evaluation and, if warranted, provision of supports and services should be recommended.

Suspected Causes of Learning Disability

It is thought that learning disabilities may be caused by *hereditary*, alcohol or cocaine use during *pregnancy*, premature birth, *diabetes*, *meningitis* of mother or offspring, and/or environmental factors of *malnutrition and* poor prenatal healthcare (Shriver, 2018). A leading theory among scientists is that learning disabilities stem from subtle disturbances in the way brain structures are formed (Jordan, 2017**)**. Learning disabilities are not caused by economic disadvantage, environmental factors, or cultural differences. In fact, there is frequently no apparent cause for learning disabilities **(**Sheldon Horowitz, 2003**)**. More generally, there are multiple factors that cause learning disabilities, including a typical brain organization. Specifically, there may be differences in cells or in the basic "hard-wiring" of the brain. One patient explained that his brain "was wired by a non-union electrician." There also may be differences in brain development due to metabolic disorders such as maternal diabetes or thyroid disease. Parental alcohol abuse and maternal smoking are well-known agents contributing to childhood learning problems. In addition, there may be stress to the baby during birth when there is sudden lack of oxygen to the baby's brain **(**Weinstein, 2016).

Type of Learning Disabilities

There are many *types of learning disabilities* in school-aged children. Learning disabilities are an umbrella term for a wide variety of learning problems. A learning disability is not a problem with intelligence or motivation. Kids with learning disabilities are just as smart as everyone else. Their brains are simply wired differently. This difference affects how they receive and process information. Children with learning disabilities see, hear, and understand things differently. This can lead to trouble with learning new information and skills, and putting them to use. The most common types of learning disabilities involve problems with reading, writing, math, reasoning, listening, and speaking. Here are five of the most common learning disabilities in classrooms today:

a. **Dyslexia** (reading-based or print-based) is a most common form of all learning disabilities. It is a language-based disability in which a child has trouble understanding words, sentences, or paragraphs. The child may have difficulty identifying and comprehending words from a book or with spelling. They often have problems with processing or understanding what they read or hear. Because decoding printed words from a book becomes so much of a struggle, they often miss the meaning of what they have read. Many dyslexic people are notably talented in arts and music; visual perception; athletic and mechanical ability.
   Common signs include:
   i. Reading painfully and slowly;
   ii. Difficulty with basic letter sounds;
   iii. Trouble decoding, order of letters become mixed up;
   iv. Cannot recall known words;

b. **Dyscalculia:** Dyscalculia is a life-long learning disability that affects the ability to grasp and solve math concepts which results in a child having trouble recognizing numbers and symbols and understanding basic math concepts. There are many different types of math disability and these can affect people differently at different stages of a child's life. People with dyscalculia often have difficulty manipulating numbers in their head and remembering steps in formulas and equations. Just like dyslexia, people with dyscalculia can be taught to achieve success.
   Common signs include:
   i. Difficulty recalling number sequences;
   ii. May mistake numbers that look similar in shape;
   iii. Cannot retain patterns when adding, subtracting, multiplying, or dividing;
   iv. Difficulty with handling money or estimating cost.

c. **Dysgraphia:** Dysgraphia is a writing disability which means a child may not have the complex set of motor and information processing skills to be able to write his or her own thoughts down on a piece of paper. Children find it hard to form letters and write within a defined space. Many people with dysgraphia possess handwriting that is uneven and inconsistent. They struggle with writing complete and grammatically correct sentences,

and often have poor handwriting. Many are able to write legibly but do so very slowly or very small. Typically, people with dysgraphia are unable to visualize letters and do not possess the ability to remember the motor patterns of letters and writing requires a large amount of energy and time.

Common signs include:

i. Awkward pencil grip;
ii. Illegible handwriting;
iii. Frustration with writing thoughts on paper;
iv. Can talk about an idea, but cannot write it down on paper.

d. **Dyspraxia:** Dyspraxia is a disorder that affects the development of motor skills. People with dyspraxia have trouble planning and executing fine motor tasks, which can range from waving goodbye to getting dressed. Dyspraxia is a life-long disorder with no cure, but options are available for helping to improve a child's ability to function and be independent. Dyspraxia is not a learning disability, but it commonly coexists with other learning disabilities that can affect learning ability.

e. **Attention Deficiency Hyperactivity Disorder (ADHD):** ADHD is a disorder that causes people to lose focus on tasks very easily. ADHD has two main types, with a third being a combination of the two. Hyperactive-Impulsive ADHD is distinguished by the child's excessive amount of activity. This may include constant fidgeting, non-stop talking, problems with doing quiet activities, trouble controlling their temper, and more. Inattentive ADHD causes people to not put the needed attention into a required task. People with inattentive ADHD may struggle with paying attention to instruction, daydream a lot, process information slowly, become bored easily, and are very poorly organized. ADHD is not a learning disability, but can cause people to struggle with learning and is commonly linked to other learning disabilities.

Auditory Processing Disorders: Auditory processing disorders are disorders that may cause a person to struggle with distinguishing similar sounds, as well as other difficulties. Auditory processing disorders are not considered learning disabilities by the Canadian Government, but they might explain why someone would be having troubles with learning

Visual Processing Disorders: Visual processing disorders are disorders that cause people to struggle with seeing the differences between similar letters, number, objects, colors, shapes and patterns. Just like auditory processing disorders, visual processing disorders may not be considered learning disabilities, but could be an issue when it comes to learning.

Non-verbal Learning Disorders: Non-verbal learning disabilities (NLD), or non-verbal learning disorders, are neurological syndromes that develop in the right side of the brain. People with NLD have a very strong verbal ability, remarkable memory and spelling skills, and strong auditory retention; although they possess poor social skills and have difficulty understanding facial expression and body language. Many do not react well to change and some possess poor social judgement. Some people with NLD have poor co-ordination, balance problems and difficulty with fine motor skills.

Students with physical handicap need adequate building codes to accommodate their disabilities. In many of these cases the students are able to perform their work normally. After all, when all necessary provisions are met, most students can reach their optimum educational goal (Jordan, 2017).

Psychological Effects of Children with Learning Disability

The feeling of trauma appears vivid in children with disability. This trauma could be either social or psychological (Partanen, 2016). The victims are usually occupied with thoughts of anger, fear of death, guilt of having to pass it on to others, thoughts of how to fit into the society or cope with work.

Children with disabilities could be having physical disability. Such children will need help with self-care, mobility and decision making. They therefore, require special care. To ensure their safety, laws have been enacted by the Federal Government of Nigeria (Asiwe & Omiegba, 2015; Omede, 2016). The continuous negative perceptions of children with disabilities have made accountability difficult to achieve, especially when Federal, State and Local responsibilities are misappropriated. The deep misrepresentations of cultural beliefs about children with disabilities and their alleged maltreatment by society cannot be allowed down the drain without being challenged. The immediate impact of these negative societal perceptions is that teacher training and certification in special education are not maintained.

Ignorance, superstition and societal taboos have also contributed immensely to the lack of care of children with disabilities. Barriya, Buchana, Cerimovic and Sharma (2017) further found that cultural behaviours resulting from superstition and negative perception of these children have led to poor identification, evaluation, placement and instruction. Further, the absence of legal mandate indicates that parents of disabled students lack the legal rights to due process, and as a result, they cannot initiate litigation against any form of discrimination against their children in terms of admissions into schools, manpower placement and service delivery.

Moreneo and Duran (2002) described peer tutoring as a method of cooperative learning based on the creation of pairs of students with a lopsided relationship; that is, the tutor and tutee do not have equal academic ability but they share a common goal. This goal must be achieved through a relationship framework organised by the teacher. Peer tutoring is regarded as an excellent resource for facilitating the mastery of interpersonal competencies. Fuchs, Fuchs, Mathes, and Martinez (2002) assert that socialisation experiences that occur during peer tutoring can benefit both the tutor and the tutee by encouraging students to learn and increase their social standing among peers. Peer tutoring was found to be helpful in socialization experience as the level of interaction among students both inside and outside the classroom improved significantly. Peer tutoring is also important for the tutor; that is, learning is encouraged through teaching. Hartman (2010) conducted an evaluation study and reported that peer tutoring increased students' motivation to learn. This result is supported by Whitman (2012) and Annis (2013) who stated that peer tutoring can be the most intellectually rewarding experience of a student's career. They found peer tutoring helped students perform better on higher order conceptual understanding scales than students who read the material simply for study purposes. Oviawe (2008) also asserts that peer tutoring serves as an effective way to improve self-esteem in students. Peer tutoring aids interaction among peers not only academically but also socially.

One of the problems that attracts public concern in Nigeria today is the gender gap in academic achievement of students in schools. This observable disparity has been blamed on a number of factors, including social, economic, and cultural stereotyping. Gender is the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine (female and male) population (Adigun, Onihunwa, Irunokhai, Sada, & Adesina, 2015). The importance of examining achievement in relation to gender is based primarily on the socio-cultural differences between girls and boys. Some vocations and professions have been regarded as men's (e.g., engineering, arts and crafts, agriculture, etc.) while others have been regarded as women's (e.g., catering, typing or nursing.). In fact, parents assign tasks like car washing, grass cutting, and home repair to the boys.

In the past, attempts have been made to address major causes of poor academic achievement among students with learning disabilities. Such as the Lazarus (2014); however, students with learning disabilities still have difficulties in Science and Mathematics. Therefore, this study examined the effect of peer tutoring instructional strategy on achievement of Basic Science and Technology students with learning disabilities.

Methodology

Quasi experimental research design was employed for the study. The sample for study comprised sixty-seven Upper Basic II Basic Science and Technology students from two intact classes purposively selected from two special co-education schools in Nasarawa State, Nigeria. The schools were purposively sampled based on equivalence in students and manpower. The schools were randomly assigned to experimental groups (exposed to Peer Tutoring Instructional Strategy (n = 30)), and the control group (exposed to Guided Discovery (n = 35)).

Basic Science and Technology Achievement Test (BSTEAT) was used as instrument for data collection. BSTEAT was a 30-item instrument with options A – D adopted from past Basic Examination Certificate covering work, energy, power and simple machines. The test was validated by experts in Science and Technology Education and were trial tested. The reliability of BSTEAT was determined using Kuder-Richardson formula 21 ($K\text{-}R_{21}$) and the reliability coefficient was found to be 0.77 implying that the instrument was reliable enough for the study.

RESULT

Descriptive statistics of mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance.

Research Question One

What is the mean achievement scores of Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy and guided discovery method?

The data used to answer this research question is presented in Table 1.

Table 1
Means and Standard Deviation of Basic Science and Technology Students' Achievement Exposed to Peer Tutoring Instructional Strategy and Guided Discovery Method

Group	Type of Test	N	Mean	SD	Mean gain
Peer Tutoring Instructional Strategy	Pretest	30	13.08	3.09	17.83
	Posttest	30	30.91	2.72	
Guided Discovery Method	Pretest	35	10.09	3.81	14.02
	Posttest	35	24.11	2.08	

Table 1 shows that mean gain of the achievement scores of Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy is higher than those exposed to guided discovery method. This implies that students exposed to peer tutoring instructional strategy achieved higher than those exposed to guided discovery method.

Research Question Two

What is the mean achievement scores of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy and guided discovery method?

The data used to answer this research question is presented in Table 2.

Table 2
Means and Standard Deviation of Basic Science and Technology Students' Achievement Exposed to Peer Tutoring Instructional Strategy and Guided Discovery Method

		Male			Female		
Group	Type of Test	X	SD	N	X	SD	N
Peer Tutoring	Pretest	13.71	2.52	18	11.99	2.67	12
	Posttest	35.98	3.08	18	30.16	2.89	12
Guided Discovery	Pretest	11.56	2.08	22	10.09	2.17	13
	Posttest	25.06	2.47	22	22.58	2.41	13

Table 2 shows that mean achievement scores of male Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy and guided discovery method is higher than their female counterparts. This implies that male students with learning disabilities achieved higher than their female counterparts when exposed to peer tutoring instructional strategy and guided discovery method.

Hypothesis One

There is no significant difference in the mean achievement scores of Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy.

Table 3
Result of Analysis of Covariance of Basic Science and Technology Students' Achievement Exposed to Peer Tutoring Instructional Strategy

Source of Variation	Sum of Square	Df	Mean Square	F	Sig
Corrected Model	5813.009	2	1030.010	41.109	.000
Intercept	9560.031	1	9560.031	123.132	.000
Pretest	2207.102	1	2207.102	55.173	.000
Group	724.321	1	724.321	28.131	.000
Error	2061.021	60			
Total	20365.484	65			

Table 3 shows that the ANCOVA test is $F = 28.131$, $p < 0.05$. This implies that there is a significant difference in the achievement of Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy. Therefore, the hypothesis was rejected.

Hypothesis Two

There is no significant difference in the mean achievement scores of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy.

Table 4
Result of Analysis of Covariance of Male and Female Basic Science and Technology Students' Achievement Exposed to Peer Tutoring Instructional Strategy

Source of Variation	Sum of Square	Df	Mean Square	F	Sig
Corrected Model	3589.121	2	1710.210	50.009	.000
Intercept	5310.090	1	5310.090	97.107	.000
Pretest	3201.002	1	3201.002	69.083	.000
Group*Gender	697.341	1	697.341	41.011	.000
Error	2411.001	60			
Total	20365.484	65			

Table 4 shows that the ANCOVA test is $F = 41.011$, $p < 0.05$. This implies that there is a significant difference in the achievement of male and female Basic Science and Technology students exposed to peer tutoring instructional strategy. Therefore, the hypothesis was rejected.

Discussion

This study among others revealed that peer tutoring instructional strategy has a significant effect on students' academic achievement in Basic Science and Technology. This finding concurs with Whitman (2012) and Annis (2013) who observed that peer tutoring instructional strategy has an effect on students' achievement. It can be deduced from the result reported that peer tutoring transformed the classroom from a place for the dispensation of knowledge into a place where knowledge is created, thereby allowing students to learn from one another. Invariably, peer tutoring depends on the process of mutual help between classmates, allowing the transfer of control to the students in the classroom. Peer tutoring instructional strategy allowed the teacher to accommodate a classroom of diverse students, including students with learning disabilities.

Also, the findings revealed a significant difference in the achievement of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy. This finding is in contrast with the findings of Abdulraheem, Yusuf and Odutayo (2017) whose study revealed that Peer tutoring instructional strategy had no gender bias in terms to improving students' academic achievement.

Conclusion

The findings of this study revealed that peer tutoring instructional strategy has a significant effect on students' academic achievement in Basic Science and Technology. Also, the findings revealed a significant difference in the achievement of male and female Basic Science and Technology students with learning disabilities exposed to peer tutoring instructional strategy with the male students achieving better than their female counterparts.

Recommendation

Based on the findings of this study, it was recommended that; Basic Science and Technology teachers should incorporate peer tutoring instructional strategy into the teaching of Basic Science and Technology in Upper Basic schools having students with learning disabilities in Nasarawa State.

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