EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 3/ June 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Effect of Strategic Content Learning on Mathematics Achievement of Students with Learning Disability

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Abstract:

The study investigated the effect of strategic content learning on mathematics achievement of students with learning disability. It employed a quasi experimental non-equivalent control group, pretest-posttest research design. The population was all 864 senior secondary II students in the 14 public secondary schools and a sample of all 47 (males-23, females-24) senior secondary II students drawn from intact classes in four randomly sampled coeducation secondary schools in Uzo-uwani local government area of Nsukka education zone, Enugu State, Nigeria. Two instructional programmes were developed and used for the study; they are mathematics/strategic content learning instructional plan (MSCLIP) and Mathematics conventional teaching lesson plan (MCTLP). Two research questions and two null hypotheses guided the study. The findings revealed that intervention with strategic content learning significantly improved mathematics achievement of students with mathematics learning disability and that gender as a factor does not have a significant influence on the mathematics achievement of students with mathematics learning disability taught using strategic content learning.

Key words: Strategic Content Learning, Mathematics, Achievement, Gender and Learning Disability

Introduction

In recent time, life is engulfed in a fast growing technological age where education has become not preperation for future life but life itself with regards to being successful. This explains the fact that one needs to live by updating knowledge and acquiring new skills that are in pace with technological growth. Students develop an indepth understanding of various school subjects as well as high expectations for success which is the ultimate goal of schooling. In order to accomplish this, an up to date learning and continous hard work of students is required, this can only be successful with a good knowledge of mathematics. That is to say that in this technological age, knowledge of mathematics is not only important in scientific and technical fields but increasingly important in business, social sciences and even humanities.

Mathematics is an interdisciplinary language which explains the relationships, structures, quantities, properties and forms of objects, constructs time and space (Richard and Robbins, 2013). Similarly, Asikhia (2013) maintained that mathematics is a broad domain addressing the measurement, properties and relations of quantities as expressed in numbers or symbols. Mathematics as a subject cuts across all areas of human learning and endeavour. An effective learning of mathematics is therefore, imperative, for a society to cope and compete effectively in the present world of fast changing scientific and technological development. This explains the fact that knowledge gotten from mathematics is applicable to all areas of human activities and consequently, determines the level and rate of national development (Iji, 2010). Regrettably, in spite of the importance of mathematics in all spheres of life, it has been shown that there is a general unimpressive

achievement in the subject among learners especially the secondary school students (Awolola, 2010).

Achievement, however, is a measure of learner's level of knowledge, skill, or performances and goal accomplishment (Ugwu, 2008). Achievement therefore, is the extent of success or failure of goal accomplishment in a specified content which the learner has earlier been exposed to. The unimpressive mathematics achievement among secondary school students has been attributed to many factors among which are; poor teaching approach (Olunloye, 2010); learner's lack of confidence in the subject (Basturk and Yavuz, 2010); and heterogeneous classroom where students of different abilities are taught together (Abakpa and Iji, 2011). Learners exhibit diverse individual differences in the classroom such as different abilities ranging from high achievers, normal achievers, low achievers, and students with learning disability. Learning disability is a condition giving rise to difficulties in acquiring knowledge and skills to the normal level expected of those of the same age (Wikipedia Dictionary, (2012). Learning disability (LD) can also be defined as a group of learning disorders that affect the learners' ability to receive, process, store, respond to, and communicate information (Logsdon, 2013). Learning disability is a situation where the learner has an average or above average intelligence quotient (IQ) yet, experiences difficulties in learning one or more specific areas, reading, writing, or mathematics. It is a group of varying neurological differences in processing information that limits a person's ability to learn in one or more specific area such as listening, speaking, reading, writing, spelling, reasoning and mathematics (Ashami and Igwue, 2013).

Gina Kemp, Smith & Segal (2012) on the other hand explained that such learning disability could be in the form of learning disabilities in reading (dyslexia), in math (dyscalculia), in writing (dysgraphia), in motor skills (dyspraxia), in language and in reading comprehension (aphasia/dysphasia), Auditory

Processing Disorder- Difficulty hearing differences between sounds and problems, Visual Processing Disorder- Difficulty interpreting visual information. Furthermore, many children if not all, have learning difficulties or disabilities of one kind or another; and that poses academic problem. Learning disabilities such as dysphasia or aphasia, dyscalculia are oftentimes apparent in schools and it usually revolves around reading, writing, or mathematics **(**Kemp, Melinda, and Jeanne, 2012**)**.

However, due to the essential nature of mathematics to mankind, this study focuses on students with mathematics learning disabilities or dyscalculia. Dyscalculia is a disorder that affects the learners' ability to perform basic mathematics operations (Logsdon, 2013). People with dyscalculia do not understand the relationship between numbers and quantities they represent. Understanding mathematics applications and performing practical mathematics task are also difficult for such individuals. Ashami and Igwue (2013) state that these disorders are typically diagnosed through testing, history taking, and observation by a trained specialist in the first few years of elementary school, when formal teaching of numbers and basic mathematics concepts begin. Logsdon (2013) points out that such disorder have no medical remedy; rather such students need special intervention, and teaching approaches by the teachers to help them cope and compensate for their inadequacies in mathematics. However, instructional approaches have been found to be seemingly important to bring positive change in learners and close the gap created by other factors like gender, abilities and socio-economic background of the learners (Abakpa and Iji, 2011).

Consequently, Olunloye (2010) maintains that the use of conventional instructional approach by mathematics teachers is inapt. Agulanna (2010) suggested the adoption of innovations on improved instructional approaches by mathematics teachers in order to enhance better understanding and application of

mathematics among students, especially in heterogeneous classrooms like the ones in Nigeria. In line with the above assertion, Adimora (2012) reported a research priority established by the National Institute of Child Health and Human Development that suggests an effective interventions for content literacy with young low-achieving students, including those with disabilities. This is a remmediation strategy for students with learning disability. It is therefore relevant to explore approaches that can give uniform improvement in students' achievement as West African Examinations Council (WAEC, 2010) indicates that the conventional teaching method is deficient in meeting the needs of most learners. That could account for the fact that only a few of the students in each school get high scores in mathematics achievement tests in school exams and WAEC. In a quest to profer solution to this persistent existing phenomenon, the researchers decided to investigate the effectiveness of remedial instructional strategy, 'strategic content learning' in improving mathematics achievement of students with basic mathematics learning disabilities.

Strategic Content Learning (SCL) is an instructional model in which the learners are made to learn a given content and at the same time learn how to use the content (learning strategies) (Buttler in Michiko and Barbara, 2008). It involves the instructor or tutor using scaffolding techniques to help the learners develop their own specific strategies for learning a given task (Mickiko and Barabara, 2008). Buttler (1996) perceives strategic content learning as a process and a product which involves the teacher guiding the learner to choose a task (self-initiation) and guiding the learner through a self-regulated learning activities associated with successful learning. Strategic Content Learning (SCL) model seems to equip the students with learning strategies rather than focusing on direct content learning. The students and the tutor work collaboratively to strategize about the learning process while

working on the course specific content. Such activities include: Analyzing task requirement or demand, select, adapt, invent and implement strategies for learning the task, monitor progress, revise and evaluate goals and strategies. The key instructional goal of this model is that, together with learning the content, the learners construct metacognitive knowledge, motivational beliefs and resource management skills that enhance students' self-efficacy and task-persistence.

Thus, strategic content learning model is meant to shift the learning responsibility from the teacher to learner and make the students mastery learners. From the proceeding discourse, it could be seen that SCL has the potential of effective intervention for teaching students with learning disabilities, as Woolfolk (2011) suggests that a typical strategy for effective intervention should be hand-on-materials or task to develop awareness of mathematics. The focus of this study, therefore is to investigate the extent to which Strategic Content Learning will enhance mathematics achievements of students with mathematics LDs.

Another area of interest to the researcher is the issue of gender and achievement in mathematics. Gender refers to the socially constructed roles, behaviours, activities and attributes that a given society considers appropriate for men and women (World Health Organization, 2002). From the above definitions, it can be inferred that gender is a set of socially constructed values, attributes, roles, expectations and perceived capabilities which are distinctively associated with males and females in a given culture or society. Many researchers have maintained that differences exist between sexes in mathematics achievement (Osefehinti, 2002). It then becomes imperative to investigate the innovative strategies such as strategic content learning to find out whether they affect the students 'achievements on the basis of gender.

Statement of the Problem

Poor achievement in mathemetics indicates that secondary school students are scared of mathematics especially the students with dyscaculia learning disability. It would appear that the content of mathematics and the conventional method of teaching mathematics scares the students with learning disability the more. Mathematics as a subject matter has its contents very logically related to each other. It is not clear whether the mathematics components is so complex for these students, the teaching method applied by the teacher or whether the learning disability of these students prevents them from learning and understanding mathematics. The problem of the study therefore stated in question form is; what is the effect of strategic content learning on mathematics achievement of students with learning disability?

Research Questions

The following research questions guided the study:

1. What is the pretest-posttest mean mathematics achievement scores of students with dyscalculia learning disability exposed to SCL and those exposed to conventional method?
2. What is the influence of gender on the mean mathematics achievement scores of students with dyscalculia learning disability exposed to SCL and those exposed to conventional method?

Hypotheses

The following null hypotheses were tested at 0.05 level of probability.

$H0_1$: There is no significant effect of mean mathematics achievement scores of students with dyscalculia learning

disabilities exposed to strategic content learning and those exposed to conventional method.

$H0_2$: Gender has no significant influence on the mean mathematics achievement scores of students with dyscalculia learning disability exposed to strategic content learning and those exposed to conventional method?

Method

The study adopted a Quasi-experimental research design. Specifically, pretest-posttest non equivalent experimental and control group design. The population was all 500 senior secondary II students of the 12 public secondary schools in Uzo-uwani local government Area and the sample was all 47 senior secondary II students drawn from intact classes in four randomly selected coeducational secondary schools in Uzo-uwani local government of Nsukka education zone, Enugu State. Initially, the researchers sampled 4 coeducational secondary schools from the 12 secondary schools in Uzo-Uwani Local Government Area using simple random sampling technique (balloting without replacement). The researchers further sampled one intact class from each of the sampled schools through the same simple random technique. Then, using purposive sampling the researchers sampled all the mathematics learning disabled students in each of the sampled intact classes. These subjects (mathematics learning disabled students) were identified using previous school mathematics achievement records of members of the sampled intact classes; which the researchers collected from the schools. Instrument for data collection (pre-test and posttest) was mathematics achievement test (MAT) which comprised 25 multiple choice objective questions. The instrument was developed by the researcher based on the content of the instructions. The instrument was face-validated by three experts in measurement and evaluation and mathematics. The students'

responses from the trial-testing were subjected to internal consistency. An estimate of internal consistency was obtained using Kudder Richardson (K-R20) since the questions were scored dychotomously. Treatments were administered on only the experimental group for a period of three weeks after which a posttest was administered.

Experimental Procedure

A Mathematics and Strategic Content Learning Instructional Plan (MSCLIP) and Mathematics Conventional Teaching Lesson Plan (MCTLP) constituted the instructional programmes. These instructional programmes were developed by the researcher and were face validated by specialists in Mathematics, special education and Educational Psychology and were approved for teaching the experimental and control groups respectively. Both the experimental and control groups were taught using their normal class teachers, who received pre-training on the use the instructional programmes accordingly.

This was organised to equip the teachers of the sampled classes with the skill to teach both the control and the experimental groups. While the MCTLP was used to instruct teachers in the control group, MSCLIP was use to instruct teachers in the experimental group to equip them with the skills involved in Mathematics/SCL instruction. This training guide was prepared by the researcher by embedding the SCL strategies into a detailed Mathematics lesson plan. So, instead of the normal steps of the conventional method of teaching, the steps of Strategic Content Learning instruction were used; which include; Introduction of the content; Analysing task requirement/demand; Selecting, adapting, inventing and implementing strategies for learning the task; Monitoring progress and finally Revising and evaluating goal and strategies. The researchers therefore, built the above listed

strategies into the lesson topics which included Circle Geometry. They also modelled the process involved and observed the teachers try out the process and provided the necessary feedback for improvement.

Before the commencement of the treatment, students in the control group and the experimental group were given the pretest. Thus MAT was administered to the entire members of the intact classes. All the instruments administered were collected back but only that of the students with mathematics learning disability were made use of.

After the pretest, the relevant treatment for experimental groups and the control group commenced. Each intact stream received the appropriate instructional programme during the usual mathematics periods in the regular school time table of classes which lasted for three weeks comprising of 15 lessons of five sessions a week. Students in the experimental group were taught using SCL approach while those in the control group were taught using conventional procedure.

Method of Data Analysis

Means and standard deviations were used to answer the research questions. An Analyses of co-variance (ANCOVA) statistics was used to test the hypotheses at a significant level of 0.05.

Results

The results of this study are presented according to research questions and hypotheses**.**

Research question 1; What are the pre-test and post-test mean mathematics achievement scores of students with learning disabilities in mathematics, who are taught using

strategic content learning and those taught with conventional method?

Table 1: Pretest-Post Test Mean Mathematics Achievement Scores of Students with mathematics learning disabilities.

		Pre-Test	Post Test	Mean gain
Experimental group (SCL)	Mean	10.24	78.65	68.41
	N	25	25	
Control group (conventional method)	Mean	10.74	51.55	40.81
	N	22	22	

Data in Table I above show that the pretest mean mathematics achievement score of LD students exposed to strategic content learning strategies was 10.24 and their posttest mean score was 78.65, while those taught using conventional teaching method had pretest mean score of 10.74 and posttest score of 51.55. MLD students in the experimental group had mean gain score of 68.41, while those in control group had mean gain score of 40.81. the difference in the mean gain scores for the two groups which favours the treatment groups indicated that students who were exposed to strategic content learning strategies instruction manifested enhanced achievement in mathematics achievement as against their counterpart in the control group. The effect of strategic content learning strategies on mathematics achievement of students with LD was further tested using the corresponding hypothesis.

Hypothesis 1; There is no significant difference in the post-test mean mathematics achievement scores of LD students in the experimental and those in the control groups.

Table 2: Summary of the 2-Way Analysis of Covariance (ANCOVA) of students' mean scores on mathematics achievement test.

Source	Sum of Square	df	mean Square	f	Sig.	Decision at 0.05 level.
Corrected model	31756.519[a]	4	3175.519	34.895	.000	
Intercept	279453.636	1				
Pretest						
Treatment	30404.384	1	30404.384	133.638	.000	*S
Gender	119.179	1	119.179	.524	.470	*NS
Experiment x gender	350.412	1	350.412	1.540	.217	*NS
Error	26.125	1	26.126	.115	.735	
Total	66110.897	155				
Corrected total	798.650.000	156				

a. R Square = .450 (adjusted R Square = .467).

Data in the table above shows that treatment as a factor has significant effect on the mathematics achievement of secondary school students with mathematics learning disability. This is revealed by the F-calculated which is 133.638, was significant at .000 level of significance. It is therefore significant at .005 level of significance as postulated by the researchers. The hypothesis of no significant difference in the mathematics achievement of students with dyscalculia exposed to strategic content learning and conventional method was therefore rejected. The adjusted R square of .450 further suggested that 45% of total variance on the dependent measure was contributed by treatment using SCL. this evidence revealed that instruction in SCL was effective in enhancing the mathematics achievement of students with dyscalculia as compared to those in control group that were not exposed to SCL.

Research question 2: What is the influence of gender on the mean mathematics achievement scores of students with mathematics learning disabilities taught using strategic content learning?

Table 3: Pre-Test-Post Test Mean Mathematics Achievement Scores of the MLD Students in the experimental group by Gender.

Gender of subjects		Pre-test	Post-test	Mean gain score
Males	Mean	10.80	68.50	57.70
	N	23	23	
	SD	8.41	21.62	
Females	Mean	9.97	68.55	58.58
	N	24	24	
	SD	8.07	19.51	

Data in the table three above shows that male MLD students in the experimental group obtained a pretest mean score of 10.80 and a posttest mean score of 68.50 with mean gain score 57.70. On the other hand, the females in the same group had pretest of 9.97 and posttest of 68.55 yielding a gain score of 58.58. Males and females had a gain score difference of 0.88 in favour of the females. However the difference is very minimal.

A corresponding hypothesis to further address this research question is;

Hypothesis 2; Gender has no significant influence on the mean mathematics achievement scores of students with LD who are taught using SCL.

Data in table 2 show that gender as a factor has no significant influence on the mean mathematics achievement score of students with MLD who are taught using SCL. This is shown by F-cal of .115 which is significant at .735 and therefore, not significant at .005 level of significant. Consequently, the null hypothesis of no significant influence is accepted.

Discussion of Major Findings

Data in table 2 reveal that Mathematics Strategic Content Learning teaching strategies significantly improved the Mathematics achievement of mathematics learning disabled

students over their counterparts who were exposed to Mathematics conventional teaching method. The finding affirms that of Buttler (1994); Eze (2003) whose studies showed that SCL sigificantlly improved mathematics achievement of students with learning disabilities. This could be further explained by the fact that strategic content learning is a strictly learner-centered approach to learning. It is also problem solving oriented and places the learner with the responsibility of learning and monitoring their learning activities. According to Zimmerman (2001), such instructional techniques could improve academic achievement.

Data in table 2 further show that gender has no significant influence on the mean mathematics achievement score of students with maths LD who are taught using SCL. This shows that the mean achievement scores of males and females in the experimental group did not vary significantly. This finding agrees with that of Eze (2003) which revealed the same result. It will also propel one to believe the idea of Adeleke (2007), that if there exist differences in mathematics achievement between genders, it is as a result of differences in teaching methods which are stereotyped. The non significant gender difference in mathematics achievement MLD taught using SCL therefore proves the approach efficacious in uniform improvement of mathematics achievement of students with MLD.

Conclusion

The findings of the study revealed that students with mathematics learning disability taught using SCL achieved significantly better than those taught using conventional method. Also gender was found to have no significant influence on the achievement scores of MLD students when taught using SCL strategies.

Recommendation

Based on the findings of this study, the following recommendations are made:

- Mathematics teachers should expose their students with learning disabilities to SCL during mathematics instruction to enable them take up the challenge of learning mathematics. This will no doubt equip the students with necessary skills that help them overcome their problem of consistent failure in mathematics.
- Strategic content learning should be incorporated into teacher Education programmes in order to equip the potential teachers with the skills involved in SCL instruction bearing in mind that one cannot give what he does not have.
- The Government and stakeholders in mathematics education should organize workshops and seminars for the in-service teachers to educate them on the use of strategic content learning.

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