Global Scientific JOURNALS
GSJ: Volume 9, Issue 5, May 2021, Online: ISSN 2320-9186
www.globalscientificjournal.com

EFFECTS OF METACOGNITIVE TRAINING ON INTEREST AND SELF-EFFICACY OF SENIOR SECONDARY SCHOOL STUDENTS IN MATHEMATICS IN IFE CENTRAL LOCAL GOVERNMENT AREA, OSUN STATE, NIGERIA

Akinwumi Emmanuel Adefioye, Popoola Oluwasegun Oladipupo

Introduction

It is often believed that not so many secondary school students in Nigeria involved in the learning of Mathematics at any stage can attest to the fact that they enjoy the learning of the subject (Omobude, 2014). Even those who studies other science related subjects like Physics, Chemistry or other subjects which require the application of Mathematics often complain about the difficulties in the teaching and learning of the subject as they encounter them. The government, employers of labour, parents, students, teachers and other stakeholders have expressed great anxiety because large numbers of students, after secondary school course, are unable to solve most of the simple arithmetical and mathematical operations needed in their everyday life and work (Omobude, 2014).

Moreover, Olatunde (2009), sees the most pronounced factor that influences teaching and learning of Mathematics as attitude, which as a concept is concerned with an individual's way of thinking, acting and behaving. In addition, it has very serious implications for the learner, the teacher, the immediate social group with which the individual learner relates and the entire school system. Attitudes are formed as a result of some kind of learning experiences and may also be learned simply by following the examples or opinion of teachers, parents and learning situation (Adino, 2015). Also, the inability of students to change to a thinking mode suitable for a particular problem, for example, to alter between a numeric, graphic, or symbolic form of representing mathematical ideas deters them from solving a wide range of mathematical problems (Tall, 2005).

Another fact for the students' achievement in Mathematics has been in the area of their self-efficacy. Self-efficacy refers to an individual's belief in his or her capacity to execute behaviours necessary to produce specific performance attainments (Bandura, 1994, 1995, 1997). Self-efficacy reflects confidence in the ability to exert control over one's own motivation, behaviour, and social environment. These cognitive self-evaluations influence all manner of human experience, including the goals for which people strive, the amount of energy expended toward goal achievement, and likelihood of attaining particular levels of behavioural performance. Unlike traditional psychological constructs, self-efficacy beliefs are hypothesized to vary depending on the domain of functioning and circumstances surrounding the occurrence of behaviour. Perceived self-efficacy beliefs are hypothesized to predict learner motivation by affecting the choices the learner makes the effort he/she expends on learning tasks, the persistence he/she exhibits even in the face of obstacles, and the courage to seek help whenever necessary. Self-efficacy is also described as a mediator for the influence of other determinants of academic achievement, such as the learners' use of learning strategies and the formation of attribution patterns for failures and successes; and that when acting in concert with other common mechanisms of personal agency, it predicts academic outcomes (Martin 2004).S

Whatever one learns, 'interest' plays an overriding role in making him or her learn better. According to Schiefele (1991), when a student attributes high value to a particular subject area, then it is said that the student has interest in that area. This is why Gardener and Tamir (as cited by Sarmah & Hazarika, 2012) defined the term 'interest' as being involved in some types of activities rather than others. 'Interest' may be regarded as a highly specific type of attitude. When students are not interested in Mathematics, they are not favourably inclined to it and will not give time to it. The term 'interest' is used also to indicate a permanent mental disposition (Sarmah & Hazarika, 2012). According to McDougal (1994), 'taking interest' means the bearing of a condition or subject. If a person takes 'interest' in a subject, then he will centralise himself or herself in it despite being tired. But, studies by Scholars (Singh, Granville & Dika, 2002; Sarmah & Hazarika, 2012; and Amelink, 2012) have shown that interest is closely related to performance in mathematics-related achievement tests and grades in Mathematics.

All the more likewise, self-efficacy is defined by Pajare and Urdan (2006) as the belief that one is capable of performing in a certain manner or attaining certain goals. It is the belief (whether accurate or not) that one has the power to produce an effect. Most times, many students in the Nigerian educational system do not see themselves performing very well in Mathematics as a result of their unbelief in their ability to do well in the subject. For instance, a person with low self-efficacy would harbour feelings of hopelessness in Mathematics, whereas a person with high self-efficacy may engage in a more advanced level of study in Mathematics (Omroid, 2006).

Mathematics teaching is aimed at improving achievement, interest and good self-efficacy in the subject. Conventional teaching strategy has not really helped in this aspect as studies have been carried out on other teaching strategies. They include the use of advance organisers, concept mapping, and group activity strategies (Okebukola, 1994; and Idowu, 2002). According to Herbst (2006), teaching and learning in Mathematics is not just about a student completing a task in which they connect between problems and new ideas, but also an attempt to maintain the students' responses to always be involved in the learning process.

To improve students' metacognitive skills, metacognitive teaching process is required. This is why Kramarski, Mevarech and Aramaic (2002) opined that the main elements of metacognition is to teach students how to work together in small groups and to reason together mathematically or formulate and answer a series of questions. Metacognitive training covers thinking that can influence human psychology. The efficacy of such training to improve students' achievement in Mathematics is therefore worth investigating, hence this study.

OBJECTIVE OF THE STUDY

The specific objective of the study are to:

- determine the effects of metacognitive training on students' interest in Mathematics
- investigate the effects of the metacognitive training on students' self-efficacy in Mathematics

METHODOLOGY

A non-equivalent pretest-posttest control group design was employed for the study. A pretest-posttest design is usually a quasi-experiment where participants were studied before and after the experimental manipulation. The researcher tested the subject before the experiment, ran experimental manipulation, and then tested again to see if there were any changes. The variables and subjects in the study were observed and data were collected simultaneously to solve the essential elements and characteristics of the variables of interest.

(Experimental group)	O_1	X_1	O_2
(Control group)	O_3	X_2	O_4

where $O_{1,}$ and O_3 represent the pre-test

$O_{2,}$ and O_4 represent the post-test

X_1 –Metacognitive Training Strategy Treatment (MTST)

X_2 – Conventional Strategy (CS)

The variables in this study consisted of independent variables at two levels (Metacognitive Training and Teacher expository teaching strategies), the dependent variables were the students' learning outcomes at two levels (Self-efficacy and interest).

The population for this study comprised all the secondary school students in Ife Central Local Government Area of Osun State. The study sample comprised senior secondary school students' selected using random sampling technique. There was a random selection of two schools from Ife Central Local Government Area of Osun State. Also, an intact class of SS1 students from each school was randomly selected. Thereafter, students of the class selected from the first school were used for experimental group who were taught topics as: Indices; Standard form; Logarithms of numbers greater than one; using metacognitive training while students of the class selected from the other school were used for control group who were taught the same topics like of the first school using conventional strategy. Questionnaires were given to the students in the study area to assess their interest and self-efficacy. Two instruments were used to collect data for the study; these are Students' Interest in Mathematics Questionnaire (SIMQ) and Students' Self-Efficacy in Mathematics Questionnaire (SSMQ). Data collected were analysed using mean and t-test analysis, which were used to answer the research hypotheses.

Research Hypothesis One: There is no significant difference in the interest of students taught with metacognitive training and those taught without in Mathematics.

To test this research hypothesis, the responses were scored Very High Extent (VHE) = 4, High Extent (HE) = 3, Moderate Extent (ME) = 2, Low Extent (LE) = 1. However, the responses of the respondents were added and the result was presented in table 4.3.

Table 1:

t-test analysis of MTG and CTG on interest of students before treatment

Group	N	Mean	SD	df	t	p
Experimental	50	42.75	6.64			
Control	50	39.25	5.12	98	0.1234	> 0.05

Table 1 reveals that there was no significant difference in the interest of students exposed to metacognitive training and those taught with conventional strategy before treatment was administered. ($p > 0.05$). It shows that interest of students in both groups did not differ before treatment. Hence, the null hypothesis was not rejected based on the interest of the students before the treatment was administered.

The responses of the students were then analyzed after the treatment was administered and the result is presented in Table 1.

Table 2:

t-test analysis of MTG and CTG on interest of students after treatment

Group	N	Mean	SD	df	t	p
Experimental	50	54.42	6.85			
Control	50	50.56	6.51	98	2.887	< 0.05

It was shown from table 2 that there was a significant difference in the interest of students exposed to metacognitive training and those that were not exposed to metacognitive training. (t = 2.887, p < 0.05). The table also revealed that those exposed to metacognitive training had a better interest ($\bar{X} = 54.42$) than those that were not exposed to the training ($\bar{X} = 50.56$)

Research hypothesis Three: There is no significant difference in the self-efficacy of students taught with metacognitive training and students taught without in Mathematics.

To test this research hypothesis, the responses were scored Very High Extent (VHE) = 4, High Extent (HE) = 3, Moderate Extent (ME) = 2, Low Extent (LE) = 1. However, the responses of the respondents were added and the result was presented in Table 4.5.

Table 3:

t-test Analysis of MTG and CTG on Self-Efficacy of students before Treatment

Group	N	Mean	SD	df	t	p
Experimental	50	50.55	7.20			
Control	50	50.56	8.25	98	3.657	> 0.05

Table 3 shows that there was no significant difference in the self-efficacy of students exposed to metacognitive training and those taught with conventional strategy before treatment was administered. (p > 0.05). It shows that self-efficacy of students in both groups did not differ before treatment. Hence, the null hypothesis was not rejected based on the self-efficacy of the students before the treatment was administered.

The responses of the students were then analysed after the treatment was administered and the result is presented in Table 3.

Table 4:

t-test Analysis of MTG and CTG on Self-Efficacy of students after Treatment

Group	N	Mean	SD	df	t	p
Experimental	50	61.16	6.14			
				98	4.577	< 0.05
Control	50	54.48	8.29			

It was shown that there was a significant difference in the self-efficacy of students exposed to metacognitive training and those that were not exposed to metacognitive training. (t = 4.577, p < 0.05). The table also revealed that those exposed to metacognitive training had a better self-efficacy mean score ($\bar{X} = 61.16$) than those that were not exposed to the training ($\bar{X} = 54.48$). It was then concluded that metacognitive training had significant effect on self-efficacy of Mathematics learners.

Discussion

On the effects of the training on the interest of the students, the results showed that metacognitive training has effects on the interest of the students in Mathematics. George (2006) stated that the analysis of the data showed that a high proportion of students hold positive interest towards mathematics task when exposed to metacognitive training. Metacognitive training also has an effect on self-efficacy. It was revealed from the study that students exposed to metacognitive training had better performance than those that were not exposed to the training. This was also corroborated by the findings of Maria and George (2006) as they showed that most students feel quite efficacious in Mathematics. In addition, a total of 38.5% of the students have high effect of metacognitive training on self-efficacy, 32.5% have extremely high self-efficacy believe, 22.4% neutral believe, and only 6.6% rated themselves on the negative side of the scale. Comparison with their classmates' results shows that 16.8% are not good as majority of their class mates, 24.5% claim that they are excellent students, while 37.4% said they are very good students in Mathematics. The findings also agreed with those of Halon and Schneider (1999) as their study showed that students who participated in the self-efficacy intervention group (MTG) out-performed students who were involved in the regular remedial classes (CTG).

Conclusion and Recommendation

The study concluded that metacognitive training was more effective in enhancing students' self-efficacy in Mathematics than conventional strategy. Furthermore, the study concluded that metacognitive training was equally more effective in enhancing the interest of students in Mathematics. It is however recommended that seminars and workshops should be organized for teachers in secondary schools on procedure and use of metacognitive training.

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