EFFECT OF METACOGNITIVE STRATEGY ON MATHEMATICS LEARNED HELPLESSNESS AMONG UNDERGRADUATE STUDENTS OF AHMADU BELLO UNIVERSITY ZARIA, NIGERIA.

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Abstract
The study assessed the effects of metacognitive strategies (MCS) on mathematics learned helplessness among undergraduate students of Ahmadu Bello University Zaria, Nigeria. Four (4) Research Questions and Four (4) null hypotheses were formulated to guide this study. Quasi-experimental design involving pretest, post-test only without control group was used. The population is made of 320 undergraduate Maths education students. 45 students with high incidence of learned Helplessness in mathematics class was randomly selected through purposive sampling technique and were used for the study. Mathematics Achievement Test (MAT) and Metacognitive learning strategies (MLS) was used for data collection. Mean, standard Deviation, t-test and Analysis of Covariance (ANCOVA) statistics was used to analyze the data. Findings reveals that mathematics learned Helpless students exposed to metacognitive strategies of planning, monitoring and evaluation had a reduced motivational deficits (p=0.001), cognitive deficits (p=0.000) and emotional deficits (p=0.000) and that gender was not a significant factors in the interration of metacognitive strategies and mathematics achievement of undergraduate students (F=0.001). Based on the findings of this study it was recommended among others that mathematics learned helplessness students should be exposed to metacognitive strategies of planning, monitoring and evaluation so as to improve their performance in mathematics. Psychologists and mathematics teachers should be encouraged to adopt the use of MCS in handling mathematic learned helplessness students with motivational, emotional and cognitive deficits so as to improve in their academic tasks.

Key variables: metacognitive strategies, mathematics, and learned helplessed undergraduate students.

Introduction

Mathematics is a core and compulsory subject for all secondary school students in Nigeria. It is a body of knowledge that deals with quantity, structure, size and space. It has been described as the key that unlocks the mystery of the subjects that shape and enhance logical thinking with its calculative inference and deductions (Umaru, 2010). Umaru, Ngwoze and Eze (2015) observed that mathematics offers the experience needed to develop ways of dealing with problems, not only at school but in all aspects of life. Results from mathematics examinations and tests are used as a determining factor for writing report cards as well as promotion of students. Most universities in Nigeria insist on a pass in mathematics as a prerequisite for admission into any course of study or a credit pass for any science related course (Joint Admission and Matriculation Board, 2018). The emphasis on mathematics examination results and the abstract nature of the subject seems to make many students experience helplessness before, during even after the examinations.

Among many other school subjects, learned helplessness students were generally found in mathematics as mathematics is the area of curriculum where teachers generally encounter students who are discouraged disengaged and have lower achievement (Yates, 2009). Some students behave during mathematics lessons as if they believe they are powerless to influence the outcomes of their learning (Maier, & Seligman, 2016). They do not make much effort to learn, do not persist when mathematics tasks become difficult, and often refuse to try, avoid work wherever possible, engage in a variety of off-task behaviors, respond badly to failure, or simply give up (Cherry, 2017 & Lang,2012). When presented with new or different mathematics task or problems, disaffected students are likely to complain that they are too hard or they cannot do them, even before they have attempted to do so (Cherry 2017, Maier & Seligman, 2016). These students have learned to be helpless (Maier, & Seligman, 2016) and believe that the subject matter is beyond them, this belief is more commonly espoused by girls than boys (Monaco & Gentle, 1987).

In Western societies mathematics is often considered to be a subject only for the very able. Students often explain away their failure in mathematics by saying their parents were not good at math's when they were at school. In addition, many students think that mathematics is governed by rules and that problems should be able to be solved within a few minutes (Lang, 2012). These beliefs have negative effects on student's behaviors, particularly when they are confronted with problems which have no quick and easy solutions. The net result of these negative attitudes is that when students encounter difficulties in learning mathematics. Many attribute their failure to their lack of mathematical ability and consequently decrease their efforts, engaged in a variety of work avoidance strategies, or simply give up trying and opt out altogether. In response to repeated failure, students exhibit characteristically passive learned helplessness behaviors in the classroom (Maier & Seligman, 2016) and reduce their participation in the activities and lessons provided by the teachers. This

in turn interacts with their lower achievement (Cherry, 2017, Maier & Seligman, 2016), to create vicious cycle of failure resulting to learned helplessness.

Learned helplessness is an act of giving up or stop trying a task by individual or organism which they fail to accomplish even due to previous repeated attempts. It is the result of the general belief that one has very little or no control over the environment. It occurs when individual attributes, the negative events in life to internal (it's me!), stable (it will last forever!) and global (it will affect everything I do!) factors. The learned helplessness phenomenon works in three interrelated areas that is; cognitive, affective and motivational (Cherry, 2017). In cognitive area an individual or organism fails to find association between new stimulus and response, in affective area organism shows depressed affect and in area of motivational functioning organism shows a retarded initiation of responses, that is, they learn that the entire attempt to solve a problem goes futile (Cherry, 2017).

Learned helplessness can be developed at any stage of one's life and affects his behavioral, cognitive and affective domain. When a learned helpless person is in habit of putting things off or give up he is affecting his behavioral domain (Seligman, 2016). When a person reduce confidence in him and increase the feeling of frustration in him his cognitive domain will be affected. The affective domain is affected when a person shows the sign of depression, blames, his lack of ability when failed and credit his luck when succeeds (Cherry, 2017). Metacognitive Strategies have been suggested to address these problems. (Umaru, Ngwoke, & Eze 2015, Flawell, 1999)

Meta-cognition is a high order thinking which involves an active control over the cognitive processes learners engaged in while studying (Umaru, Ngwoke and Eze 2015). It refers to learners' automatic awareness of their own knowledge and their ability to understand, control and manipulate their cognitive processes (Cornold, 2010; Monaco & Gentile 1987). Furthermore, Flavell, (1999) described meta-cognitive as one's knowledge concerning one's own cognitive processes and the active monitoring and regulation of the processes. Knowledge about cognitive refers to the level of the learners understanding of his/her own memories, cognitive system and the way he/she learns to regulate his/her own learning system, that is, goal setting, choosing, applying strategies and monitoring his/her action. These definitions emphasize the executive role of meta-cognition in overseeing and regulating cognitive processes. Executive control processes are those processes responsible for the processing of information, selection of actions, and the implementation and monitoring of task (Flavell, 1999 Cornoldi, 2010 & Efklides 2011 Samesare etal 2019). Meta-cognition has provided educators and insight into the cognitive processes involved in learning and what differentiates successful students from their less successful peers. Successful students have been suggested to apply meta-cognitive. Strategies in pursuing learning much more than less successful ones (Bryce, White Bread & Szues, 2015). Meta-cognitive skills involve activities such as planning how to approach a given learning task, monitoring comprehension and evaluating progress

towards the completion of a task (Umaru, Ngwoke and Aze 2015; Akpor 2017, Algharaibeh 2017, Alogleh Teh 2019).

Brown believed that metacognition is the kind of knowledge about cognitions executive processs of decision making that the human being must perform being must perform both in cognitive process and their development (Brown, 2008; Balzan & Galletly, 2015; Vitzthum, Veckenstedt & Moritz, 2014). The metacognitive approach empowers individuals to free themselves from the mechanisms that cause maladaptive processing of worry, threat monitoring and maladaptive self-control, and through flexible emotion processing training, it can guide thinking and behaviuor in the face of treats and harm in the future (Bryce, Whitebread & Szues, 2015). Research finding has shown that metacognition has a significant and strong relationship with cognitive decline (Cornoldi 2010; Hong, Hwang, Szeto, Tsai, Kuo & Hsu, 2016.

Flavell (1999) states that meta-cognition includes both meta-cognitive knowledge and experiences. Meta-cognitive knowledge is the knowledge learner has gained about cognitive processes, knowledge that can be used to regulate cognitive processes. Meta-cognitive knowledge can be divided into three categories, one of which is knowledge of strategy variables, including knowledge about both cognitive and meta-cognitive strategies, and conditional knowledge about when and where it is proper to employ such strategies (Flavell, 1999, Samesare et al 2019, & Efklide, 2011). Meta-cognitive experiences refer to the use of meta-cognitive strategies or meta-cognitive regulation (Brown, 2008 & Vitzthum et al 2014). Meta-cognitive strategies are successive processes to manage or regulate cognitive activities, thus ensuring that a cognitive goal will be gained. These processes contribute to regulation and managing of learning, and include planning and monitoring cognitive activities, as well as evaluating the outcomes of those activities (Bryce, Whitebread & Szues, 2015). It was against this background that this study explored the effect of MCS on Mathematics Learned Helplessness among undergraduate students of Ahmadu Bello University, Zaria, Nigeria.

Research Question

- What is the effect of metacognitive strategy on Cognitive deficit among
- undergraduate mathematics students Ahmadu Bello University Zaria.?
- What is the effect of metacognitive strategy on Cognitive deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?
- What is the effect of metacognitive strategy on emotional deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?
- Is there interaction of meta-cognitive strategy and gender on learned Helplessness among undergraduate mathematics students Ahmadu Bello University Zaria.?

Research Hypotheses

- There is no significant effect of metacognitive strategy on motivational deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?
- There is no significant effect of metacognitive strategy on cognitive deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?
- There is no significant effect of metacognitive strategy on emotional deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?
- There is no significant effect of metacognitive strategy and gender on learned Helplessness among undergraduate mathematics students Ahmadu Bello University Zaria.

Methodology

The study adopted Quasi experimental design involves pretest/post test design in which participants are randomly assigned into each of the three experimental groups for intervention.1,2 and 3. pretest and post test are conducted to measure changes in learned helplessed undergraduate mathematics students in the three groups. The population of this study consist of three hundred level (300 L) undergraduate mathematics students in A. B. U Zaria. The choice was guided by the assumption that the students have attained the formal operational state of cognitive development. At this stage students can be taught new kinds of thinking, which are abstract, formal and logical. Thinking symbolically at this stage is necessary if one should be able to deal with the mathematical problems solved at their level of education.

The samples for this study consisted of thirty (30) 300L undergraduate mathematics students and were purposively selected based on their record of poor achievement in their semester mathematics examination. The Learned helpless mathematics students were identified based on lecturers nomination as well as their performance on previous semester assessment records in mathematics. All the students who consistently scored below 50 percent in their continuous assessment were randomly assigned into three groups in the treatment groups namely, motivational, cognitive and emotional deficit undergraduate students and used for the study.

Two instruments namely the mathematics achievement test and Metacognitive Learning Strategy (MLS) were used for data collection. 5-point scale designed to measure the MLS. The items of the instruments were developed based on relevant information gathered through review of literature. The items statements were written in a manner that can be comprehensible and easy to rate by the respondents. There were face validated by two specialists each in educational psychology, measurement and evaluation, and mathematics for their criticism and inputs. They were asked to check for the clarity of the language and also check if the

instruments were measuring what they were supposed to measure. The inputs of these specialists were used to modify and improve the instruments.

The instruments were trial testes using 200level students drawn from agricultural education students. The internal consistency reliability estimates of the instruments were determined based on the result of the trial tastings. The internal consistency reliability was determined using the Cronbach alpha method and the reliability estimates of 0.90 and 0.72 were obtained respectively. In order to determine the stability over time, a test retest analysis using Pearson correlation method was conducted and a Pearson r of 0.83 and 0.70 were obtained respectively for MAT and MLS. This was necessary since the items in the MAT and MLS were reshuffled and used for the post-test.

The face validated metacognitive instructional programme was trial tested by the researcher with the help of three trained research assistants. The instructional programmes were used in instructing the Learned helpless mathematics undergraduate students. The aim was to ensure that the programme will be adequate in achieving the objectives of the study. It was also done to ensure that the training programme was clear enough and well understood for easy implementation.

Treatment Procedure

Before the actual implementation of the programme, the undergraduate Learned Helplessness students selected were assigned randomly assigned to treatment I, ii and iii. Thereafter in each treatment group selected, one class of 300L was randomly selected for study. The researcher was not involved in the teaching rather three qualified mathematics teachers were trained as research assistants. each taught in three treatment groups.

Meta-cognitive strategies was used in training the subjects in the treatment groups. Those in the treatment group received instruction in meta-cognitive strategies of monitoring, regulating/revising and evaluation using examples from mathematics contents. All these were done through the following methods; Modeling by a trained teacher, Coaching through offering such help as hints, feedback, reminders while the students were at work, Scaffolding by offering support in the form of suggestion and Reflections in which students compare their process with those of an expert. The control groups were only exposed to the normal mathematics lesson based on the selected mathematics content for the study. After the teaching the reshuffled MAT and MLS which served as a post test were administered to the students two weeks after.

The data collected were analyzed descriptively using mean scores and standard deviations and Analysis of Covariance was (ANCOVA) used to test the null hypotheses at 0.05 levels of significance.

Results

The research question was answered in line with the corresponding hypotheses.

Hypothesis one: Null hypothesis state that there is no significant effect of metacognitive strategy on motivational deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?

Table 1: Paried sample t test on effect of metacognitive strategy on motivational deficit among undergraduate students of mathematics education students Ahmadu Bello University, Zaria

Variables	Tests	N	Mean	Std.dev	Std.Err	Df	T	T	P
Motivational	Pretest	15	14.0000	2.42015	.62488	14	4.021	1.96	0.001
Deficit	Posttest	15	17.93331	3.51460	.90746				

Result of the above paired sample t test statistics showed that there is significant of metacognitive strategy on motivational deficit among undergraduate mathematics education students of Ahamadu Bello University Zaria. Reasons being that the calculated p value of 0.001 is lower than the 0.05 alpha level of significance and the computed t value of 4.021 is higher than the 1.961 t critical value of df 14. Their computed awareness level are14.0000 and 17.9333 in their pretest and posttest respectively with a mean difference of 3.9333 in favor of the post test. This shows that their motivational deficit has significantly increased as a result of exposure to metacognitive strategy. Therefore, the null hypothesis which state that the there is significant effect of metacognitive strategy on motivational deficit among undergraduate mathematics education students of Ahamadu Bello University Zaria.

Hypothesis Two: Null hypothesis state that there is no significant effect of metacognitive strategy on cognitive deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?

Table 2: Paired sample t test on effect of metacognitive strategy on cognitive deficit among undergraduate students of mathematics students Ahmadu Bello University, Zaria

Variables	Tests	N	Mean	Std.dev	Std.Err	Df	T	T	P
Cognitiv	Pretest	1	14.000	2.5317	.6536	1	6.12	1.9	0.00
e	Posttes	5	0	0	8	4	2	6	0
Deficit	t	1	18.266	1.3870	.3581				
		5	7	1	3				

Result in the above paired sample t test statistics showed that there is significant of metacognitive strategy on cognitive deficit among undergraduate mathematics students of Ahamadu Bello University Zaria. Reasons being that the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the computed t value of 6.122 is higher than the 1.961 t critical value of df 14. Their computed cognitive deficit are14.1333 and 18.26667 in their pretest and posttest respectively with a mean difference of 4.1333 in favor of the post test. This shows that their cognitive deficit has significantly improved as a result of exposure to metacognitive strategy. Therefore, the null hypothesis which state that the there is significant effect of metacognitive strategy on motivational deficit among undergraduate mathematics students of Ahamadu Bello University Zaria, is hereby rejected.

Hypothesis Three: Null hypothesis state that there is no significant effect of metacognitive strategy on emotional deficit among undergraduate mathematics students Ahmadu Bello University Zaria.?

Table 3: Paired sample t test on effect of metacognitive strategy on emotional deficit among undergraduate students of mathematics students Ahmadu Bello University, Zaria

Variables	Tests	N	Mean	Std.dev	Std.Err	Df	T	T	P
Cognitiv	Pretest	1	13.533	2.6149	.6751	1	5.67	1.9	0.00
e	Posttes	5	3	8	8	4	7	6	0
Deficit	t	1	18.666	1.2344	.3187				
		5	7	3	3				

Result in the above paired sample t test statistics showed that there is significant of metacognitive strategy on emotional deficit among undergraduate mathematics students of Ahamadu Bello University Zaria. Reasons being that the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the computed t value of 5.667 is higher than the 1.961 t critical value of df 14. Their computed cognitive deficit are13.5333 and 18.26667 in their pretest and posttest respectively with a mean difference of 5.13333 in favor of the post test. This shows that their emotional deficit has significantly improved as a result of exposure to metacognitive strategy. Therefore, the null hypothesis which state that the there is significant effect of metacognitive strategy on emotional deficit among undergraduate mathematics students of Ahamadu Bello University Zaria, is hereby rejected.

Hypothesis Four: Null hypothesis state that there is no significant effect of metacognitive strategy and gender on learned Helplessness among undergraduate mathematics students Ahmadu Bello University Zaria.

Table 8: ANCOVA analysis on the interaction of metacognitive strategy and gender on learned Helplessness among undergraduate students of mathematics students Ahmadu Bello University, Zaria

Tests of Between-subjects Effects

Dependent Variable: METACOGNITIVE SCORES

Source	Type III Sum of Squares	Df	Mean Square	F	Sig
Corrected	244.196[a]	3	815.732	16.990	.000
Intercept	120819.648	1	120819.649	2516.464	.000
Gender	70.848	1	70.848	1.476	.235
TESTS	2364.315	1	2364.315	49.245	.000
Gender*TESTS	.048	1	.048	.001	.975
Error	1264.304	26	48.012		
Total	124663.000	30			
Corrected total	3695.500	29			

a. R Squared = .662 (Adjusted R Squared = .623)

The Analysis of covariance ANCOVA showed that there is no interaction of metacognitive strategy and gender on learned Helplessness among undergraduate students of mathematics, of Ahamadu Bello University Zaria. This is because on the gender versus test, the calculated p value of 0.975 is higher than the 0.05 alpha level of significant and its corresponding F value of 0.001 is lower than the F critical value. The descriptive statistics showed that the pretest scores of male and female students are 56.287 and 55.125 respectively. Their post test metacognitive scores for male and female students are increased to 74.0000 and 73.0000 respectively. This shows that both male and female had a reduced learned Helplessness as a result of metacognitive strategy and gender on learned Helplessness among undergraduate mathematics students of Ahamadu Bello University Zaria, is hereby accepted and retained.

Discussion

Findings reveals that mathematics learned Helpless students exposed to metacognitive strategies of planning, monitoring and evaluation had a reduced motivational deficits, cognitive deficits and emotional deficits. The finding collaborate with the early findings of Umaru, Ngwoke & Aze, 2015; Flavell,1999; Umaru 2010, Cornoldi, 2010, Hong et al, 2016 & Lang, 2012). When presented with new or different mathematics task using metacognitive strategies. Meta-cognitive strategies were

used in training the subjects in the treatment groups. Those in the treatment group received instruction in meta-cognitive strategies of monitoring, regulating/revising and evaluation using examples from mathematics contents such as; Modeling by a trained teacher, Coaching through offering such help as hints, feedback, reminders while the students were at work, Scaffolding by offering support in the form of suggestion and Reflections in which students compare their process with those of an expert out weight those who were not exposed to treatment and performed better in mathematics task(Umaru, Ngwoke & Aze, 2015 & Bryce et al, 2015).

Learned helplessness can be developed at any stage of one's life and affects his behavioral, cognitive and affective domain. When a learned helpless person is in habit of putting things off or give up he is affecting his behavioral domain. When a person reduce confidence in him and increase the feeling of frustration in him his cognitive domain will be affected. The affective domain is affected when a person shows the sign of depression, blames, his lack of ability when failed and credit his luck when succeeds (Cherry, 2017). Meta-cognitive strategies have been suggested to address the Meta-cognition is a high order thinking which involves an active control over the cognitive processes learners engage in while studying (Martin et al. 2016; Akpor, 2017, & Alogleh et al; 2019). It refers to learners' automatic awareness of their own knowledge and their ability to understand, control and manipulate their cognitive processes (Algharaibeh 2017). Cornoldi (2010) further, described meta-cognitive as one's knowledge concerning one's own cognitive processes and the active monitoring and regulation of the processes. Knowledge about cognitive refers to the level of the learners understanding of his/her own memories, cognitive system and the way he/she learns to regulate his/her own learning system, that is, goal setting, choosing, applying strategies and monitoring his/her action. These definitions emphasize the executive role of meta-cognition in overseeing and regulating cognitive processes. Executive control processes are those processes responsible for the processing of information, selection of actions, and the implementation and monitoring of task (Flavell, 1999, Cornoldi, 2010 & Efklides 2011). Meta-cognition has provided educators and insight into the cognitive processes involved in learning and what differentiates successful students from their less successful peers. Successful students have been suggested to apply meta-cognitive. strategies in pursuing learning much more than less successful ones. Meta-cognitive skills involve activities such as planning how to approach a given learning task, monitoring comprehension and evaluating progress towards the completion of a task.

Finding also revealed that gender was not a significant factor in the interaction of metacognitive strategies and mathematics achievement of undergraduate learned helpless students. Hence both male and female students exposed to instruction in metacognitive strategies had a reduced motivational deficits, cognitive deficits and emotional deficits. The finding collaborate with the early findings of Umaru, Ngwoke & Aze, (2015), Flavell, (1999); Vitzthum et al (2014)

and Lang, (2012); Efklides, (2011), and Bryce, Whitebreaod and Szues (2015) they maintained that gender was not a significant factor in using instruction in metacognitive strategies to enhance mathematics achievement among low achieving and test anxiety and education achievement on 5 and 7 years children as well as secondary school students.

Among many other school subjects, learned helpless students were generally found in mathematics as mathematics is the area of curriculum where teachers generally encounter students who are discouraged disengaged and have lower achievement (Yates, 2009). Some students behave during mathematics lessons as if they believe they are powerless to influence the outcomes of their learning (Maier, & Seligman, 2016). They do not make much effort to learn, do not persist when mathematics tasks become difficult, and often refuse to try, avoid work wherever possible, engage in a variety of off-task behaviors, respond badly to failure, or simply give up (Cherry 2017 and Lang, 2012). When presented with new or different mathematics task or problems, disaffected students are likely to complain that they are too hard or they cannot do them, even before they have attempted to do so (Cherry 2017 & Seligman, 2016). These students have learned to be helpless (Maier, & Seligman, 2016) and believe that the subject matter is beyond them, this belief is more commonly espoused by girls than boys (Monaco & Gentle, 1987; Cherry, 2017). Thus, the finding of this study has served as a missing link thereby making these students to learned independently, improved in problem solving skills and become metacognitively active recipient of information when given any tasks in their classroom.

Conclusion

From the findings of this study it was revealed that, mathematics learned Helpless students exposed to metacognitive strategies of planning, monitoring and evaluation had a reduced motivational deficits, cognitive deficits and emotional deficits and that gender was a significant factors in the interaction of metacognitive strategies and mathematics achievement of undergraduate students this was attributed as a result of being exposed to metacognitive strategies of planning , monitoring and evaluation, hence mathematics learned Helpless students become more active and learned independently when involved in problem solving skills in the classroom.

Recommendations

Based on the findings of this study it was recommended among others that:

1. Mathematics learned helplessness students should be exposed to metacognitive strategies of planning, monitoring and evaluation so as to improve their performance in mathematics.

2. Psychologists and Mathematics Teachers should be encouraged to adopt the use of MCS in handling mathematic learned helplessness students with motivational, emotional and cognitive deficits so as to improve in their academic tasks.

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