Influence of Metacognitive Evaluation Strategy in Reducing Test Anxiety among Low Achieving Secondary School Students in Mathematics in Katsina Metropolis, Nigeria

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ABSTRACT

This study investigates the influence of metacognitive evaluation strategy in reducing the level of test anxiety among low achieving secondary school students in mathematics. A quasi experimental design involving pretest posttest control group is adopted for the study. Simple random sampling technique is used in selecting two schools out of ten schools in the study area. Samples of twenty students out of those identified with low achievement in mathematics are used to serve as treatment and control groups. The treatment group is exposed to six weeks training of metacognitive evaluation strategy while the control group did not receive any treatment. The instrument used is Westside Test Anxiety Scale. The hypothesis formulated for the study is tested using independent t-test. The findings of the study reveal that significant difference exist between the treatment group that received metacognitive evaluation strategy training and the control group that received no treatment, the difference is in favour of the treatment group. Significant difference also exist in the effect of metacognitive evaluation strategy in reducing test anxiety among male and female low achieving secondary school students in mathematics. It is recommended that school counselors and teachers should be exposed to metacognitive evaluation strategy in order to enhance the test anxiety of secondary school students in mathematics.

Keywords: *Metacognition, evaluation strategy, low achieving, test anxiety, mathematics*

INTRODUCTION

Helping students learn by themselves is among the main objectives of education. Students who are able to learn independently have the ability to learn in several different ways. Thus, it is important to put into consideration the levels of students' self control. Students who show a high level of metacognitive skills performs better in exams and complete work more efficiently. They are self regulated learners who modify learning strategies and skills based on their awareness of effectiveness. Students with a high level of metacognitive knowledge and skill identify blocks to learning as early as possible and changes strategies to ensure goal attainment (Swanson, 1990). Metacognitive strategies are designed to monitor cognitive progress. Metacognitive strategies are ordered processes used to control

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one's own cognitive activities and to ensure that a cognitive goal (for example, solving a math problem, writing an effective sentence, understanding reading material) have been met. A person with good metacognitive skills and awareness uses these processes to oversee his own learning process, plan and monitor ongoing cognitive activities, and to compare cognitive outcomes with internal or external standards. Flavell (1979) indicates that a single strategy can be invoked for either cognitive or metacognitive purposes and to move toward goals in the cognitive or metacognitive domains. He gave the example of asking oneself questions at the end of a learning unit with the aim of improving knowledge of the content, or to monitor comprehension and assessment of the new knowledge.

Strategy variables are interlocked with one's goals or objectives in the learning process (Flavell, 1987). It is important to distinguish between cognitive strategies, such as summing a column of numbers, and metacognitive strategies, such as evaluating whether the correct answer has been obtained. Flavell (1987) also proposes numerous questions and possible explanations relating to the development of metacognition. He proposes that the emergence in the child, awareness of the flow of time, and specifically awareness of future time could support the ability to form metacognitive goals. Another change that occurs during childhood development is the sense of the self as an active agent in one's own experiences. As early as 1987, Flavell was actively encouraging the development of metacognition in school children; in schools there are abundant opportunities to develop metacognitive knowledge about persons, tasks, and strategies.

Evaluation strategy involves a learner's evaluation of learning process as a whole. The individual, through using evaluation strategies, assesses efficiency during learning process and the product that is attained (Flavell 1987). Evaluation also refers to appraising the products and a regulatory process of one's learning (Schraw and Moshman, 1995). Typical examples include reevaluating one's goals and conclusions. A number of studies indicate that metacognitive knowledge and regulatory skills such as planning are related to evaluation. With respect to text revisions, for example, Bereiter and Scardamalia (1987, cited in Schraw and Moshman, 1995) found that poor writers were less able than good writers to adopt the reader's perspective and had more difficulty "diagnosing" text problems and correcting them. These differences were attributed to the use of different mental models of writing. Good writers use what Bereiter and Scardamalia (1987) refer to as the "knowledge transforming" model. In contrast, poor writers used a "knowledge-telling" model.

Test anxiety is worry, restless or agitated distress that results from tests of performance or academic ability. It affects everyone; from athletes, to students, to executives whether it is triggered by an upcoming speech, an impending athletic competition, a test of curriculum mastery, a college entrance exam, or a critical business decision. Test anxiety can either enhance performance or hinder it, depending on whether the triggering event requires physical or intellectual performance (Salkind, 2008). Unlike trait anxiety, which causes worry and distress over an extended period of time, test anxiety is a kind of state anxiety that happens only when one is in a specific situation requiring performance or evaluation (Salkind, 2008). Another way of explaining test anxiety is to consider it as an interactional or transactional process. Bandura (1982) cited in Salkind (2008) say that

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test anxiety develops in a social context. He describes reciprocal determinism as the constant interaction of factors that are personal characteristics, behaviours that happen in reaction to the behaviours of others, and behaviours that happen in reaction to situations. This interaction of people with different personalities, the different ways people react, and the different situations in which they find themselves causes what they think, feel, or do in reaction. Therefore, individual behaviours are seen as not being so much individual as being determined within, and in part by, the environment. In other words, one way to consider test anxiety might be to see it as an interactive process that takes place during the test situation (Salkind, 2008). One must understand how personality, behavioural characteristics, situations, and backgrounds interact during a test situation to understand the problems that test anxiety causes for individuals in test performance. Behaviour patterns that develop in the interactions that occur in a family play a role in the formation, growth, and continuation of an individual's anxiety. Likewise, behaviour patterns that develop in school affect the development, growth, and continuation of test anxiety for students; and so, it follows that behaviour patterns that develop in workplaces affect the perpetuation of test anxiety in adults (Salkind, 2008).

Several authors use several teaching methods to improve students' level of test anxiety in several subjects. Maryam, Ali and Akbar (2012) investigate the effect of instruction of metacognitive knowledge on academic stress. They used quasi experimental with pretest and post test. 37 female first grade students (19 subjects in experimental group and 18 subjects in control group) were randomly selected using multi-stage cluster sampling. Measurement device used was academic stress questionnaire and metacognitive knowledge strategies were instructed to subjects during 8 sessions. The data were analyzed by descriptive statistics and multi-covariance and covariance. The results show that instruction of metacognitive knowledge have significant effect on reduce of academic stress.

Furthermore, in a study by Takallou (2010), two tests (Test of English as a Foreign Languge (TOEFL) and a reading comprehension test) and Strategy Inventory for Language Learning (SILL) were administered to 93 male and female EFL learners in four phases. At the first phase, TOEFL was administered to all the students both to homogenize students regarding language proficiency and to validate the reading comprehension test. At the second phase, SILL was administered to two experimental and one control groups before strategy instruction. SILL assesses the frequency with which the subjects use a variety of techniques for foreign language learning. At the third phase, two experimental groups received five sessions of instruction on metacognitive strategies, one on planning and the other on self-monitoring strategy based on the Cognitive Academic Language Learning Approach (CALLA). Both experimental and control groups worked on authentic and inauthentic texts (some articles from *Readers' Digest* and *Reading Skillfully III*). At the fourth phase, after completion of instruction, the reading comprehension test and SILL questionnaire were administered to all groups. Data analysis revealed that two experimental groups which received instruction on 'planning' and 'self-monitoring' outperformed the control group on the reading comprehension test. Ngwoke, Ossai and Obikwelu (2013) investigate the influence of study skills on test anxiety levels of senior secondary school students. Two

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research questions and two null hypotheses guided the study. A structured study skills inventory (SSI) consisting of 29 items, a test anxiety scale (TAS) consisting of 32 items developed by the researchers and validated were administered to 400 senior secondary school class III students (200 boys and 200 girls) in Nsukka Education Zone of Enugu State, Nigeria. The data collected were presented using mean scores and standard deviations. The t-test statistics was used to test the null hypotheses at 0.05 probability level. Findings indicated that study skills had no significant influence on students' test-anxiety levels; students' test-anxiety levels were significantly influenced by gender; the female students showed higher test-anxiety than their male counterparts.

The subject mathematics creates an unusual fear in the minds of students due to the preconceived idea that it is difficult, coupled with the failures their predecessors continuously experience in assignments, tests and exams. Now, this fear and failure in mathematics has to do with test anxiety. Test anxiety is a combination of cognitive, emotional and physiological components which may interfere with a person's concentration, planning, and academic performance. Test anxiety is one of the crucial issues that affect students at all levels of education, thereby hindering their performance in all aspects of their academic activities. Student at a state of test anxiety finds it difficult to concentrate, retrieve, recall, or think over what he has learned, and therefore become internally disturbed, which is likely to be the cause of his failure. It is in light of this that the researcher investigated the effects of metacognitive evaluation strategy in reducing test anxiety among low achieving secondary school students in mathematics in Katsina metropolis. The following research hypotheses were formulated to guide the study, thus:

1. There is no significant difference in the level of test anxiety between the treatment and control group after the treatment of metacognitive evaluation strategy.
2. There is no significant difference in the effect of metacognitive evaluation strategy in reducing test anxiety among male and female secondary school students in mathematics.

METHOD

This study employs pre-test, post-test quasi experimental design in investigating the effectiveness of metacognitive evaluation strategy in reducing test anxiety among low achieving secondary school students in mathematics in Katsina metropolis. The design involve one (1) treatment group and one (1) control group, in which both groups received a pre-test of Westside Test Anxiety Scale, where t-test results shows that the two groups are homogenous at the beginning of the research. Later, the treatment group received a treatment of metacognitive evaluation strategy. After the experimental sessions, both groups received a post-test in order to determine the effect of metacognitive evaluation strategy training that the treatment groups received on their levels of test anxiety. The mean scores of the post-test of the treatment group and the control group were compared. The population of this study comprised 2374 students of Government Day Secondary School Kofar Yandaka and Katsina College, Katsina (KCK Senior), as obtained from Katsina State

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Ministry of Education. Out of this number 20 students were selected and assigned to the treatment group and control group. The selection was through simple random sampling techniques. Westside Test Anxiety Scale was used for this study. It is a standardized instrument adopted from Richard (2004). The instrument has ten (10) items which are designed to identify students with anxiety impairments who could benefit from an anxiety reduction intervention. The scale items cover self-assessed anxiety impairment and cognitions which can impair performance. The instrument has a five point scale, from *extremely or always true* to *not at all or never true*. To ascertain the validity of the instrument, professionals in the field of Educational Psychology in Ahmadu Bello University, Zaria validated the instrument and found it appropriate for use in this type of study. In order to establish the reliability for Westside Test Anxiety Scale, a pilot testing was conducted at Gobarau Academy, Katsina, where fifty (50) respondents fill the instrument. Standard Cronbach Alpha was used to establish the reliability of the instrument. A retest after two weeks interval was conducted in the same school with the same students in order to ascertain the internal consistency of the instruments. The result of the analysis shows Cronbach's Alpha value of .761 and a re-test value of .756. The six weeks training sessions that was given to the treatment group is as follows

Session 1: The researchers explain the importance of this study and its efficiency, as well as the application of various metacognitive strategies, and then a general discussion about the metacognition was conducted. As general discussions were going on, training sessions began, in which the researcher discusses about cognition and metacognition, their strategies and also some strategies about studying. This session serves as an introduction.

Session 2: During this session the samples in the group receives explanations about the importance and definition of metacognitive evaluation strategy.

Session 3: During this session, the researchers discuss the features of evaluation strategy to group, thereby explaining in details the way of implementation of the strategy.

Session 4: During this session, the researchers presented adopted standardized model for evaluation strategy. This has helped the samples in having a guide towards designing their own models. Thereafter, the researchers gave an assignment to the groups to design a model and bring back next session.

Session 5: During this session, the researchers fixed a test and then ask the group members to design a model base on their experience of the strategy training they received in order to prepare for the test that is scheduled to hold next session.

Session 6: During this session, mathematics teacher from the school assist in given a test question based on what the students were taught during the term, the test was conducted to the group. Thereafter, the session ends.

The null hypothesis for the study was tested at 0.05 level of significance using the mean, standard deviation and t-test statistics.

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RESULTS AND DISCUSSION

The analysis on table 1 shows that the p-value of 0.007 is less than the alpha value of 0.05, while calculated t-value is 3.036 at df = 18. This means that there is a significant difference between the low achieving secondary school students in mathematics in the treatment group and that of the control group. It also implies that the metacognitive evaluation strategy is effective in reducing test anxiety among low achieving secondary school students in mathematics. Therefore the null hypothesis which states that there is no significant difference in the mean Test Anxiety between students exposed to Metacognitive Evaluation strategy and those in control group is hereby rejected. The analysis on table 2 shows that the p-value of 0.001 is less than the alpha value of 0.05, while calculated t-value is 4.025 at df = 18. This means that there is a significant difference in the level of test anxiety between male and female low achieving secondary school students in mathematics. It also implies that female students have more test anxiety than male students. Therefore the null hypothesis which states that there is no significant difference in the effect of metacognitive evaluation strategy in reducing test anxiety among male and female secondary school students in mathematics is hereby rejected.

The findings of this study show that there is a significant difference between the levels of test anxiety of students in the treatment group of evaluation strategy and that of the control group. The finding reveal that the calculated p-value (0.007) is lower than 0.05 level of significance and their calculated t-values (3.036) is also higher than the critical t (1.96). Hence, the result made us to reject the null hypothesis. This means that there is significant difference between the experimental group of evaluation and that of the control group in their levels of test anxiety, after the treatment of metacognitive strategies to the group of evaluation strategy. Therefore, metacognitive evaluation strategy have effect on test anxiety among low achieving secondary school students in mathematics in the sense that it has reduced the levels of test anxiety of the students that were in the treatment group, thereby leaving the control group with high level of test anxiety. The finding of this study agrees with the findings of Maryam, Ali and Akbar (2012) who investigate the effect of instruction of metacognitive knowledge on academic stress. They found that metacognitive strategy training has a significant effect on the listening performance of students. Furthermore, the findings of this study are also supported by the findings of Takallou (2010) where two experimental groups received five sessions of instruction on metacognitive strategies, one on planning and the other on self-monitoring strategy based on the Cognitive Academic Language Learning Approach (CALLA). His findings were that two experimental groups which received instruction on 'planning' and 'self-monitoring' outperformed the control group on the reading comprehension test.

The finding on the test of hypothesis two showed that there is a significant difference in the level of test anxiety among male and female low achieving secondary school students in mathematics. The finding reveals that the calculated p-value (0.001) is lower than 0.05 level of significance and their calculated t-value (4.025) is also higher than critical t (1.96). Hence, the null hypothesis was rejected. This means that metacognitive evaluation strategy

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is more effective in reducing male students' level of test anxiety than that of the female student thereby leaving the female students with high level of test anxiety. This finding conforms to that of Ngwoke, Ossai and Obikwelu (2013) who investigate the influence of study skills on test anxiety levels of senior secondary school students. Their findings indicated that study skills had no significant influence on students' test-anxiety levels; students' test-anxiety levels were significantly influenced by gender; the female students showed higher test-anxiety than their male counterparts.

Table 1: Independent t-test statistics difference in the mean Test Anxiety between students exposed to Metacognitive Evaluation strategy and those in control group

Variable	Group	N	Mean	std. dev	std. err	df	t-cal	P Sign	
Test Anxiety	Treatment	10	26.8000	3.99444	1.26315	18	3.036	0.007	
	Control	10	31.3000	2.45176	.77531				

P ≤ 0.05

Table 2: Independent t-test statistics difference in the level of test anxiety between male and female low achieving secondary school students in mathematics

Variable	Gender	N	Mean	std. dev	std. err	df	t-cal	P Sign	
Test Anxiety	Male	10	27.9000	2.76687	.87496	18	4.025	0.001	
	Female	10	31.8000	1.31657	.41633				

P ≤ 0.05

CONCLUSION AND RECOMMENDATIONS

This study was carried out with the main objective of evaluating influence of metacognitive evaluation strategy in reducing test anxiety among low achieving secondary school students in mathematics in Katsina Metropolis, Nigeria. The findings of the study reveal that the metacognitive evaluation strategy is effective in reducing test anxiety among low achieving secondary school students in mathematics. The study concludes that metacognitive evaluation strategy training is effective in reducing the level of test anxiety among secondary school students in Katsina metropolis. The study also concludes that female students have more test anxiety than male students. In view of the above discovery, this work recommends that school counselors and teacher should be exposed to metacognitive evaluation strategy training in order to enhance and reduce the level of test anxiety of low achieving secondary school students in mathematics and other subjects. Male and female students should be given equal opportunity to participate in the training of metacognitive monitoring strategy so as to enhance their level of test anxiety in mathematics.

Appendix I
Westside Test Anxiety Scale

School name: _____

Student name: _____

Serial No: _____ Date: _____

Direction: Rate how true each of the following is of you, from extremely or always true, to not at all or never true. Use the following 5 point scale. After reading each statement, circle the number (1, 2, 3, 4, or 5) that applies to you using the scale provided. Please note that there are no right or wrong answers to the statements in this inventory.

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- 5 **means** extremely highly or always true
- 4 **means** high or usually true
- 3 **means** moderately or sometimes true
- 2 **means** slightly or seldom true
- 1 **means** not at all or never true

1.	The closer I am to a major exam, the harder it is for me to concentrate on the material	1	2	3	4	5
2.	When I study, I worry that I will not remember the material on the exam.	1	2	3	4	5
3.	During important exams, I think that I am doing awful or that I may fail.	1	2	3	4	5
4.	I lose focus on important exams, and I cannot remember material that I knew before the exam	1	2	3	4	5
5.	I finally remember the answer to exam questions after the exam is already over.	1	2	3	4	5
6.	I worry so much before a major exam that I am too worn out to do my best on the exam	1	2	3	4	5
7.	I feel out of sorts or not really myself when I take important exams.	1	2	3	4	5
8.	I find that my mind sometimes wanders when I am taking important exams.	1	2	3	4	5
9.	After an exam, I worry about whether I did well enough.	1	2	3	4	5
10.	I struggle with writing assignments, or avoid them as long as I can. I feel that whatever I do will not be good enough.	1	2	3	4	5

Source: Adopted from Richard (2004).

Output showing the Test of Hypotheses

Hypothesis one

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Post-test of Test Anxiety	Evaluation	10	26.8000	3.99444	1.26315
	Control	10	31.3000	2.45176	.77531

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Post-test of Test Anxiety	Equal variances assumed	1.040	.321	3.036	18	.007	-4.50000	1.48212	-7.61381	-1.38619
	Equal variances not assumed			-3.036	14.938	.008	-4.50000	1.48212	-7.66019	-1.33981

Hypothesis two

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Post-test of Test Anxiety	Male	10	27.9000	2.76687	.87496
	Female	10	31.8000	1.31656	.41633

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Post-test of Test Anxiety	Equal variances assumed	3.905	.064	4.025	18	.001	-3.90000	.96896	-5.93572	-1.86428
	Equal variances not assumed			-4.025	12.877	.001	-3.90000	.96896	-5.99536	-1.80464

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