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IMPROVING SECONDARY SCHOOL STUDENTS' ATTITUDE TOWARDS MATHEMATICS THROUGH METACOGNITIVE TEACHING STRATEGY IN NKANU WEST LOCAL GOVERNMENT AREA OF ENUGU STATE.

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Abstract

This study aimed at determining students' attitude towards mathematics when taught with metacognitive teaching strategy. Two research questions and three hypotheses guided the study. Pretest-posttest non randomized control group design was adopted for the study. The study was conducted in Nkanu West Local Government Area of Enugu State, where a sample of 235 senior secondary school two (SS 2) students was drawn from 6 intact SS2 classes in 3 secondary schools. Techniques adopted for sampling was purposive and stratified random sampling. Instrument used for data collection was Mathematics Attitude Scale (MAS). The instrument was constructed by the researchers and validated by three research experts. MAS was made up of 18 items scored on a four-point scale. It yielded a reliability coefficient of .86 obtained by Cronbach's Alpha Method. Research questions were answered using mean and standard deviation. Hypotheses were tested using Analysis of Covariance (ANCOVA). Major findings of the study showed that students taught mathematics with Metacognitive teaching strategy showed better attitude towards mathematics than their counterparts taught same topics with lecture method. Also, male and female students did not differ significantly in their attitude towards mathematics when taught with metacognitive teaching strategy. It was recommended that metacognitive teaching strategy be used in teaching secondary school mathematics in Nkanu west local government area particularly and Enugu State in general.

Keywords: Secondary Education, Improving Attitude, Metacognitive Teaching Strategy, Mathematics, Enugu State.

Introduction

Attitude is a person's predisposed state of mind regarding a value and it is precipitated through a responsive expression towards oneself, a person, place, thing, or event which in turn influences the individual's thought and action. According to Kofi (2012) attitude is a psychological construct, a mental and emotional entity that inheres in, or characterizes a person. They are complex and are an acquired state through experiences. Attitude can be formed from a person's past and present. Most contemporary perspectives on attitudes permit that people can also be conflicted or ambivalent toward an object by simultaneously holding both positive and negative attitudes toward the same object. This has led to some discussion of whether the individual can hold multiple attitudes toward the same object. Kofi asserted that an attitude can be a positive or negative evaluation of people, objects, events, activities, and ideas. It could be concrete, abstract or just about anything in your environment. Uyi (2012) defined attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor." Though it is sometimes common to define an attitude as affect toward an object, affect (i.e., discrete emotions or overall arousal) is generally understood as an evaluative structure used to form attitude object.

Attitude may influence the attention to attitude objects, the use of categories for encoding information and the interpretation, judgement and recall of attitude-relevant information, Eagly and Chaiken (2000) in Uyi (2012). These influences tend to be more powerful for strong attitudes which are accessible and based on elaborate supportive knowledge structure. The durability and impactfulness of influence depend upon the strength formed from consistency of heuristics.

Attitudes can guide encoding information, attention and behaviors, even if the individual is pursuing unrelated goals. According to Jung (2004) in Mbunda (2012) attitude is a readiness of the psyche to act or react in a certain way. Attitudes very often come in pairs, one conscious and the other unconscious. Within this broad definition Jung defines several attitudes such as;

- Consciousness and the unconscious. The presence of two attitudes is extremely frequent, one conscious and the other unconscious. This means that consciousness has a constellation of contents different from that of the unconscious, a duality particularly evident in neurosis.
- Extraversion and introversion. This pair is so elementary to Jung's theory of types that he labeled them the "attitude-types".
- Rational and irrational attitudes. The rational attitude subdivides into the thinking and feeling psychological functions, each with its attitude. The irrational attitude subdivides into the sensing and intuition psychological functions, each with its attitude. There is thus a typical thinking, feeling, sensation, and intuitive attitude.
- Individual and social attitudes. Many of the latter are “isms”. Abstraction is contrasted with concretism. Contcretism refers to a peculiarity of thinking and feeling which is the antithesis of abstraction.

The attitude of a person according to Ayuba (2012) may be determined by psychological factors like ideas, values, beliefs, perception, etc. All these have a complex role in determining a person's attitude. Educators posit that some teaching strategies can elicit positive attitudes from the learners. Closely related to attitudes are values which are ideals, guiding principles in one's life, or overarching goals that people strive to obtain. Beliefs are cognitions about the world—subjective probabilities that an object has a particular attribute

or that an action will lead to a particular outcome. Beliefs can be patently and unequivocally false. Beliefs may be tenaciously held and highly resistant to change. Another important factor that affects attitude is symbolic interactionism. These are rife with powerful symbols and charged with affect which can lead to a selective perception. Family plays a significant role in the primary stage of attitudes held by individuals. Initially, a person develops certain attitudes from his parents, brothers, sister, and elders in the family. There is a high degree of relationship between parent and children in attitudes found in them. Societies play an important role in formatting the attitudes of an individual. The culture, the tradition, the language, etc., influence a person's attitudes. Society, tradition, and the culture teach individuals what is and what is not acceptable. A person's attitude also depends on issues such as his salary, status, work environment, work as such, etc. Mbunda (2012) narrated that the classic tripartite view offered by Rosenberg and Hovland is that an attitude contains cognitive, affective, and behavioral components. Empirical research, however, fails to support clear distinctions between thoughts, emotions, and behavioral intentions associated with a particular attitude.

A criticism of the tripartite view of attitudes is that it requires cognitive, affective, and behavioral associations of an attitude to be consistent, but this may be implausible. Thus some views of attitude structure see the cognitive and behavioral components as derivative of affect or affect and behavior as derivative of underlying beliefs. Despite debate about the particular structure of attitudes, there is considerable evidence that attitudes reflect more than evaluations of a particular object that vary from positive to negative. Among numerous attitudes, one example is people's money attitudes which may help people understand their affective love of money motive, stewardship behavior, and money cognition. These ABC components of attitudes formulate, define, and contribute to an overall construct of Monetary Intelligence which, in turn, may be related to many theoretical work-related constructs. There is also a considerable interest in intra-attitudinal and inter-attitudinal structure, which is how an attitude is made (expectancy and value) and how different attitudes relate to one another which connect different attitudes to one another and to more underlying psychological structures, such as values or ideology. Researchers have found conflicting result with regard to effect of metacognitive teaching strategy on students' attitude towards mathematics. This study therefore aimed at finding out ways to improve student's attitude in mathematics by bridging this gap.

Purpose of the Study

The purpose of this study was to determine the effects of metacognitive teaching strategy on secondary school students' attitude toward mathematics. Specifically, the study aimed at determining the effects of metacognitive teaching strategy on Senior Secondary School two (SS2) students';

i. attitude towards mathematics
ii. attitude towards mathematics with regard to their gender

Research Questions

The following research questions guided the study

1. What are the mean mathematics attitude scores of students in the experimental and control groups in both pretest and posttest?
2. What are the mean mathematics attitude scores of male and female SS 2 students' in the experimental and control groups in both pretest and posttest?

Hypotheses

The following hypotheses were formulated and tested at .05 level of significance

1. There is no significant difference between the mean mathematics attitude scores of the students in experimental and control groups.
2. There is no significant difference between the mean mathematics attitude scores of male and female students in the experimental and control groups.
3. There is no significant interaction between teaching method and students' genders on students' mean attitude scores in mathematics.

Theoretical Framework

The theory underlying the design and implementation of this study was Ausubel's Subsumption Theory.

Ausubel's Subsumption Theory

David Ausubel (1963) theory centers on the process of meaningful and Rote learning. Meaningful learning occurs when new knowledge is consciously linked to existing concepts (i.e subsumers) the learner already knows. Subsumers will optimize meaningful learning. But where the "subsume" does not exist he recommends the use of what he called "advance organizers". Advance organizer is in the form of introductory material presented in advance of the learning itself to link already known materials to the new materials to be learnt. He uses the term subsumption to suggest how the existing knowledge of the learner interacts with the new knowledge. In contrast to meaningful learning, rote learning occurs when one acquires new information without specific association with existing concepts in his cognitive structure (i.e knowledge store). Ausubel criticized Bruners discovery approach as being too time consuming and insufficient to be considered as a primary method of presenting subject matter. Rather he maintains that if the materials can be meaningfully organized by the instructor, the need for student's discovery is removed and the process of learning rendered efficient.

A valuable practical application of Ausubel's theory is for the teacher to tie the new material to what the learner already knows. The teacher can either use such subsumers or empty appropriate ones for the learner in the form of carefully developed advance organizer. The organizer can be a question, a demonstration, a definition, an analogy or even a film. Teachers should also employ the practice of alerting their students in advance of what topic that will be treated next and furnish them with the relevant references, bearing in mind its relevant to what the student already know. Teachers should refrain from the unsound pedagogical practice of withholding information about certain books or other sources of information because they do not want the learners to access them. Ausubel maintained that meaningful learning's occurs when new knowledge is consciously i.e knowingly linked to existing concepts (i.e subsumers) the learner already knows. Meaningful learning therefore, is a cognitive activity and in line with metacognitive strategy. Similarly, meaningful learning is likely to influence students' attitude.

Methodology

Pretest-posttest non randomized control group design was adopted for this study. Two research questions and three hypotheses guided the study. The study was conducted in Nkanu West Local Government Area of Enugu State, where a sample of 235 senior secondary

school two (SS 2) students was drawn from 6 intact SS2 classes in 3 secondary schools. Techniques adopted for sampling was purposive and stratified random sampling. Instrument used for data collection was Mathematics Attitude Scale (MAS). The instrument was constructed by the researchers and validated by three research experts. MAS was made up of 18 items scored on a fourpoint scale. It yielded a reliability coefficient of .86 obtained by Cronbach's Alpha Method. Research questions were answered using mean and standard deviation. Hypotheses were tested using Analysis of Covariance (ANCOVA).

Experimental Procedures

The researchers trained the (3) regular mathematics teachers in the (3) secondary schools used for the study for a period of two weeks on the use of metacognitive teaching strategy. Fore-most, the MAS was administered to all the subjects of the study as pretest. Thereafter, the treatment was administered for a period of six weeks. The experimental group in each school was taught the selected mathematics topics using metacognitive teaching strategy while the control group in each school was taught the same topics using lecture method. All topics were drawn from SS2 mathematics scheme of work. At the expiration of the treatment period, the MAS was re- administered to all the participants as posttest. Research Questions were answered using mean and standard deviation. Test of hypotheses were done with Analysis of Covariance (ANCOVA) at .05 level of significance.

Results

Research Question 1: What are the mean mathematics attitude scores of students in the experimental and control groups in both pretest and posttest?

Table 1: Mean attitude scores of experimental and control groups in pretest and posttest.

Group	n	Pretest		Posttest	
		Mean	SD	Mean	SD
Experimental	121	39.00	0.11	65.01	0.14
Control	114	38.51	0.30	46.22	0.40

In table 1, the pretests mean attitude score and standard deviation of the experimental group were 39.00 and 0.11 respectively and the posttests were 65.01 and 0.14 respectively. For the control group, the pretest mean attitude score and standard deviation were 38.51 and 0.30 respectively while the posttest mean attitude scores and standard deviation were 46.22 and 0.40 for respectively. There was not much difference between the two groups in the pretest but there was an appreciable difference in the posttest. The experimental group scored much higher with a lower standard deviation than the control group.

Research Question 2: What is the mean mathematics attitude scores of male and female SS 2 students' in the experimental and control groups in both pretest and posttest?

Table 2: Mean attitude scores of Male and Female students in pretest and posttest.

Group	n	Pretest		Posttest	
		Mean	SD	Mean	SD
Male	99	31.50	0.27	60.50	0.33
Female	136	36.00	0.59	61.01	0.21

In table 2, the pretests mean attitude score and standard deviation of male students were 31.50 and 0.27 for mean and standard deviation respectively while those of the female were 36.00 and 0.59 for mean and standard deviation also. Similarly, in the posttest, male students had 61.01 and 0.33 for mean and standard deviation respectively while the female had 60.01 and 0.21 for mean and standard deviation also. Evidently, there was no much difference in the attitude of the students from different genders.

Hypothesis 1: There is no significant difference between the mean mathematics attitude scores of the students in experimental and control groups.
Hypothesis 2: There is no significant difference between the mean mathematics attitude scores of male and female students in the experimental group.
Hypothesis 3: There is no significant interaction between teaching method and students' genders on students' mean attitude scores in mathematics.

Table 3: ANCOVA Analyses of the Students' attitude Scores.

Source of Variance	Sum of squares	DF	Mean squares	F-calc.	Sig	Remark
Method	104.29	1	104.29	2.552	0.001	Significant
Gender	63.04	1	63.04	1.542	2.12	Not Significant
Gender*Method	78.03	1	78.03	1.909	3.00	Not Significant
Error	9480.01	232	40.862			
Total	**9725.37**	**235**				

From Table 3, teaching method, (Experimental and control) as main effect gave an f value of 2.552 and this is greater than the critical value of 0.001. Hence teaching method affected the students' attitude towards mathematics significantly and so hypothesis one is rejected as stated. Gender as main effect gave an f value of 1.542which is less than the critical value (2.12). Hence gender had no significant effect. Therefore, hypothesis two is not rejected as stated. The interaction effect (Gender*Method) gave an f value of 1.909 which is less than the critical value (3.00). This indicates no significant interaction. Thus, hypothesis three is not rejected as stated.

Discussion of Findings

It was found in this study that the mean pretest attitude scores of both groups did not differ significantly. This suggests that both groups had similar entry behavior with regard to their attitude towards mathematics. Also, the wide gap between the mean pretest attitude scores and the mean posttest attitude scores showed that learning took place in both groups. However, the result indicates that there was significant difference between the mean attitude scores of the groups in the posttest. Hence, the experimental group showed better attitude than the control group. Also male and female students had equal attitude towards mathematics as shown by their posttest attitude. This shows that metacognitive teaching strategy is gender friendly. Going by this record, we can say, with certainty, that the attitude of the students towards mathematics was as a result of the treatment administered to them. More so, extraneous variables were properly controlled. This implies therefore, that metacognitive teaching strategy promoted positive attitude towards mathematics than lecture method. Also metacognitive teaching strategy is not gender bias. The findings of this study support those of Adejumo (2012) and Algazir (2013). But the findings disagree with those of

Ohanusi (2011) and Uyi (2012) who in their separated studies, reported that metacognitive teaching strategy inhibited students' attitude towards mathematics. The disagreement in the findings of these two sets of studies may likely be traced to experimenter's ability in controlling extraneous variables.

In fact, studies on metacognitive teaching strategy have been based on problem solving. Metacognition in problem solving is the basis for the use of appropriate knowledge and strategies. Metacognition knowledge is described as what we know about our own cognitive process. It is knowledge about what factors act and interact in what way to affect the course and outcome of cognitive enterprises (Adejumo, 2012). Three categories of metacognitive knowledge are persons, task and strategy. The metacognitive knowledge person refers to the individual involved in the cognitive process. Task metacognitive knowledge refers to information, skills, and competencies, abilities available to a person. Strategy metacognitive knowledge category includes knowledge of effective strategies that can be acquired in achieving various goals and in various sort in cognitive undertaking (Tenty and Awe, 2011). Metacognitive regulation involves setting goals and planning; monitoring and controlling learning; and evaluating one's own regulation (assessing result and strategies used).

The findings of this study have supported the assertion of Mbunda (2012) who posited that metacognitive teaching strategy are strategies that empower the learners to take charge of his/her own learning in a highly meaningfully fashion. When this happens, the learners are likely to develop positive attitude towards the subject they are learning. The learner uses metacognitive teaching strategies to regulate his cognitive processes. In other words, metacognitive strategies help the student to understand the way they learn that is means, processes designed for students to think' about their 'thinking'. Teachers who use metacognitive teaching strategy can positively impact students who have learning disability by helping them to develop an appropriate plan for learning. As students become aware of how they learn, they will use those processes to effectively acquire new information, and consequently, become more of an independent thinker.

Conclusion

Based on the findings of this study, the following conclusions were made; Metacognitive teaching strategy elicited better positive attitude towards mathematics than the lecture method. Students' gender did not significantly affect their attitude towards mathematics when taught with metacognitive teaching strategy. Interaction effect between teaching method and students' gender was insignificant in this study.

Recommendations

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

1. Use of metacognitive teaching strategy for teaching secondary school mathematics should be adopted by teachers in all secondary schools in Enugu State.
2. Periodic workshops, conferences and seminars should be organized for mathematics teachers on use of Metacognition Approach for teaching mathematics.

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