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TEACHER INSTRUCTIONAL METHODS AND STUDENT ATTITUDES TOWARDS MATHEMATICS

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ABSTRACT. This study examined the effect of behavioral objective-based (BOBIS) and study question-based (SQBIS) instructional strategies on students' attitude towards Senior Secondary Mathematics. The three hypotheses for the study were tested at 0.05 level of significance. The issue of attitudinal changes of student in mathematics classroom is an evergreen topic which cannot be wished away. It is therefore important to search for more and simple methods/ways by which teachers could continually inspire positive attitude in mathematics classroom. The research adopted a pre-test, post-test, control group quasi experimental design. There were three treatment groups which are - two experimental groups (behavioral objective-based (group1, N=117) and study question-based (group II, N=95) instructional strategies) and a control group (group III, N=100). A total of 312 students were involved in the study. The classrooms were randomly selected in each school and all the students in the selected classroom constitute the sample (intact class). Students' Attitude Questionnaire (SAQ) has a reliability coefficient of r = 0.81. Findings revealed a significant effect of treatments (BOBIS & SQBIS) on students' attitude towards Mathematics. The result was ($F(2,311) = 72.95$, $P < 0.05$). There was a significant difference in attitude between behavioural objective-based instructional strategy group and the control group with the BOBIS group having far better attitude to mathematics than the control group. Similarly, significant difference was found between the attitude of SQBIS group and the control group but no significant difference in attitude was found between BOBIS group and SQBIS group. Behavioral objective-based and Study-question-based groups were found to have similar attitude towards. In other words, there was significant differences between the attitudes of subjects exposed to behavioural objectives and control group and between those exposed to study question and the control group and no significant difference in attitude between the behavioural objective and study question groups. Both experimental groups (BOBIS and SQBIS) proved to be superior to the control group. Based on the findings, behavioral objective-based and study question-based instructional strategies were found to be viable instructional strategies that could promote positive attitude towards mathematics. The implication of the result is that teachers' method of instruction in classroom is important in changing students' attitude and habits towards mathematics.

KEYWORDS. Instructional Methods, Behavioural Objectives, Study Questions, Attitudes towards Mathematics.

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INTRODUCTION

It is generally believed that students' attitude towards a subject determines their success in that subject. In other words, favorable attitude result to good achievement in a subject. A student's constant failure in a school subject and mathematics in particular can make him to believe that he can never do well on the subject thus accepting defeat. On the other hand, his successful experience can make him to develop a positive attitude towards learning the subject. This suggests that student's attitude towards mathematics could be enhanced through effective teaching strategies. It has in fact been confirmed that effective teaching strategies can create positive attitude on the students towards school subjects Bekee (1987), Balogun and Olarewaju (1992), Akinsola (1994), Akale (1997), Olowojaiye (1999), (2000).

Attitudes are psychological constructs theorized to be composed of emotional, cognitive, and behavioral components. Attitudes serve as functions including social expressions, value expressive, utilitarian, and defensive functions, for the people who hold them (Newbill, 2005). To change attitudes, the new attitudes must serve the same function as the old one. Instructional design can create instructional environments to effect attitude change. In the greater realm of social psychology, attitudes are typical classified with affective domain, and are part of the larger concept of motivation (Greenwald, 1989d). Attitudes are connected to Bandura's (1977) social cognitive learning theory as one of the personal factors that affect learning (Newbill, 2005).

The definition of attitude depends on the purpose of the definition. Most attitudes researchers include the concept of evaluation as the basis for the definition (e.g. Boliner & Wanke, 2002, Eagly & Chaiken, 1993). To Petty and Cacioppo (1986) attitude are general evaluations of people hold in regard for themselves, other people, object, and issues. To Greenwald (1989b), attitudes are pervasive, predict behaviors, are a force in perception and memory, and they serve various psychological functions. Though there is an ongoing debate about the structure of attitudes (Newbill, 2005), however instructional designers have long assumed that attitudes is made up of three components; a cognitive component, an emotional component, and a behavioral component (e.g., Bednar & Levie, 1993, Kamradt & Kamradt, 1991). The debate of the existence of the component structure of attitude may never be completely resolved because attitudes are constructs and are therefore not directly observable (Newbill, 2005). The measurement of attitudes is inextricably tangled with theoretical debate on the nature of attitudes.

Social psychologists has notice that people respond to objects (ideas) with different degrees of positive to negative evaluations. Responses could be affective (e.g., frown or smiling);

cognitive (e.g., stating rational thoughts) or behavioral (clapping or running away). Social psychologists conceived of a driving force behind these responses, and name it –attitude. They proceeded to measure attitude by measuring what they conceived to be the effects of it. It is important to note that all responses are technically behaviors (Ajzen, 1989).

Definitions of attitude towards mathematics are numerous as researchers' and thinkers' conceptions, ideas and perspectives vary. According to a point of view, the attitude towards mathematics is just a positive or negative emotional disposition towards mathematics (Zan & Martino, 2007). Hart (1989), considering attitudes towards mathematics from a multidimensional point define an individual's attitude towards mathematics as a more complex way by the emotions that he/she associates with mathematics, his/her beliefs towards mathematics, which could be either positive or negative and how he/she behaves towards mathematics. Research on attitude in mathematics education has been motivated by the belief that 'something' called "attitude" plays a crucial role in learning mathematics but the goal of highlighting a connection between positive attitude and mathematics achievement has not been reached conclusively(Zan & Martino, 2007).It is therefore imperative to continue to search for linkages between instructional methods that could facilitate the development of more positive attitude towards the learning of mathematics. Hence this research.

Several studies in the area of mathematics have shown that instruction, especially at the secondary school level remains overwhelmingly teacher-centered, with greater emphasis being placed on lecturing and textbook than on helping students to think critical across subject area and applying their knowledge to read-worlds situation (Butty, 2001). There is a need to adopt some of the recent reform-based instructional strategies, along with some traditional practices that have been overlooked and underutilized in secondary mathematics (National Council of Teachers' of Mathematics, 2000). Such practices include individual exploration, peer interaction, and small group work each of which emphasizes the use of multiple approaches to problem solving, active student inquiry, and the importance of linking mathematics to students' daily life (Butty, 2001). A key component in reform is the movement from traditional to reform instructional practices in mathematics is the importance of examining the effects and relationship among types of instructional practices that student receives and their resulting achieving and attitudes towards mathematics. Studies related to instructional practices and academic achievement have suggested that the quality of teachers' instructional messages affects children's task involvement and subsequent learning in mathematics (Cornel, 1999, Butty, 2001). The National Council of Teacher of Mathematics (NCTM, 2000) has advocated for the development of inquiry- based

mathematics tradition. According to Fennema, Carpenter, and Peterson (1989), students who experience this reform tradition are encouraged to explore, develop conjectures, prove, and solve problem. The assumption is that student learns best by resolving problematic situations that challenge them through conceptual understanding. In the study by Stein, Grover, & Henninssen (1996), investigated the use of enhanced instructions as a means of building student capacity for mathematics thinking and reasoning concluded that students must first be provided with opportunities, encouragement, and assistance before they can engage in thinking, reasoning, and sense making in mathematics classroom. Consistent engagement in such thinking practices, they maintained, should lead students to a deeper understanding of mathematics as well as increased ability to demonstrate complex problem solving, reasoning, and communication skill upon assessment of learning outcomes. They concluded that the tasks used in mathematics classroom highly influence the kinds of thinking processes students employ, which in turn influence learning outcomes. Perhaps this is the reason why the mode of questioning in mathematics classroom becomes relevant.

It is therefore imperative for teachers to appreciate and inculcate in students positive attitude towards mathematics by using improved and appropriate instructional strategy. It is believed that the lack of specific directives has one way or the other hindered learning achievement among students.

However, behavioral objective when properly formulated and communicated to students could function to remedy the problem of effective teaching and learning of Mathematics. Since behavioral objective or related study question projects specific learning outcome, the knowledge of behavioral objective or a study question related to it can be useful in indicating to the learner what is actually required of them instead of wondering over the learning materials and as a result relevant learning achievement and attitude are promoted. Mager (1962) popularized the use of behavioral objectives in his classic on preparing instructional objectives. According to him if a learner is provided with a copy of behavioral objectives the teacher does less work. Melton (1978) had supported the use of behavioral objective by pointing out that behavioral objectives clearly indicate to students what is required of them and as a result relevant learning is enhanced. He argued that behavioral objectives and inserted questions are very much similar in that both show students what they should be able to do as a result of learning process.

Nzewi (1994) noted that teachers should no longer be satisfied with only having a statement of behavioral objectives in their lesson notes. They should also make it a point to let their students know these objectives, and if possible, the students should be given these objectives

in a written form. He also noted that teacher should refer to the objectives in the course of teaching. This seemed to be in line with Duchastel and Merril (1973) who opined that objectives would certainly make no difference if the student pays no attention to them in the learning situations. Presenting students therefore with behavioral objectives of a lesson topic or the study questions related to these objectives at the beginning of instruction can alert their sensitivity to the learning situation. Referring students to these objectives or related questions at every stage of information presentation can serve as an evaluating role for teachers teaching as well as students learning, thus, helping to promote learning and positive attitude.

In 1912, Stevens stated that approximately eighty percent of a teacher's school day was spent asking questions to students. More contemporary research on teacher questioning behaviors and patterns indicate that this has not changed. Teachers today ask between 300-400 questions each day (Leven and Long, 1981).

Teachers ask questions for several reasons (from Morgan and Saxton, 1991):

1. the act of asking questions helps teachers keep students actively involved in lessons;
2. while answering questions, students have the opportunity to openly express their ideas and thoughts;
3. questioning students enables other students to hear different explanations of the material by their peers;
4. asking questions helps teachers to pace their lessons and moderate student behavior;

and 5 questioning students helps teachers to evaluate student learning and revise their lessons as necessary.

Classroom questioning is an extensively researched topic. The high incidence of questioning as a teaching strategy, and its consequent potential for influencing student learning, have led many investigators to examine relationships between questioning methods and student achievement and behavior (Cotton, 2001)

Cotton (2001) suggested a variety of purposes for classroom questioning that include:

- To develop interest and motivate students to become actively involved in lessons
- To evaluate students' preparation and check on homework or seatwork completion
- To develop critical thinking skills and inquiring attitudes
- To review and summarize previous lessons
- To nurture insights by exposing new relationships

- To assess achievement of instructional goals and objectives
- To stimulate students to pursue knowledge on their own

As one may deduce, questioning is one of the most popular modes of teaching. For thousands of years, teachers have known that it is possible to transfer factual knowledge and conceptual understanding through the process of asking questions. Unfortunately, although the act of asking questions has the potential to greatly facilitate the learning process; it also has the capacity to turn a child off to learning if done incorrectly. (Brualdi, 1998).

Statement of the problem

Teachers often state behavioral objectives in their lesson notes when preparing to teach and give students questions to practice after teaching. They however, fail to realize that behavioral objective and study question could better be utilized to stimulate the learners for possible better learning outcomes. The study therefore, investigated the effect of behavioral objective-based and study question-based instructional strategies on students' attitude towards mathematics.

Hypothesis:

The hypotheses below were tested at 0.05 level of significance.

H1: There will be no significant difference in attitude scores on the behavioural objective-based group posttest between students who have been given knowledge of behavioural objectives prior to instruction and students who do not have prior knowledge of such objectives.

H2: There will be no significant difference in attitude scores on the study questions-based group posttest between students who have been given knowledge of the study questions prior to instruction and students who do not have prior knowledge of such study questions.

H3: There will be no significant difference in attitude scores on the behavioural objective-based group posttest between students who have been given knowledge of behavioural objectives prior to instruction and students who are given study question prior to instruction.

METHOD

Research Design: A pre-test post-test control group quasi experimental design was employed. Two experimental groups I (behavioural objective-based group, n =) and II (study

question-based group, n =) and a control group III (conventional method, n=) were used. Students in group I were exposed to behavioral objective treatment only, group II were exposed to study question treatment only while the control group students were exposed to the conventional teaching method.

Subjects: The subjects constituted a total of 312 (184 male & 128 female) senior secondary school two students from six co-education schools selected by using stratified random sampling technique from three Local Education District (LED) of Lagos State, that is, two schools from each LED.

The selected schools in each LED were assigned randomly to a treatment group so as to avoid interaction that may occur among the groups if two or more treatment groups are located in the same school. To avoid disrupting the school program or arrangement, intact classes (that is, students as find in the class) were used and the selection of the classes used was done in each school through simple random sampling technique (that is, a arm of the class is selected by random sampling in each school) .

Instrument: Basically, the instrument used for the study was Students' Attitude Questionnaire (SAQ).

A stimulus instrument (instructional guide) for the teachers was also used. The SAQ is made up of two sections, that is, section A which has to do with questions that seek for the background information about students like name of school, class, sex and age, and section B which consists of 22 items covering the students' cognitive, affective and behavioral attitude components. Students method of response to the items was the closed response mode of 4 points scale of strongly agree, agree, disagree and strongly disagree. Scoring was therefore from 4 to 1 mark, that is, 4 marks for strongly agree, 3 marks for agree, 2 marks for disagree and 1 mark for strongly disagree of the item if positively warded. Where the item is negatively warded, scoring was in reverse order. The reliability coefficient of the instrument was established using Cronbach coefficient alpha reliability method and was found to be 0.81.

Procedure: The Students' Attitude Questionnaire was administered as pre-test on students in the six schools. The senior secondary school two Mathematics teacher from each of the selected schools received training in the use of the strategy appropriate for his group for two weeks. Materials were then given to the teachers. Only the teachers for experimental group I (BOBIS) were provided with the list of behavioral objectives of the lesson topics while only the teachers for experimental group II (SQBIS) were provided with the list of study questions relating

to the behavioral objectives. The teachers for the control group were not provided with either behavioral objectives or study questions lists. Having administered the pre-test, training teachers and providing them with the necessary materials, teaching commenced and lasted for 8 weeks. For experimental group I, the teacher started lessons by presenting the list of behavioral objectives of the lesson topic to the students. While teaching, he makes use of the behavioral objectives by drawing the attention of the students to the relevant objectives where necessary.

For experimental group II (SQBIS), study questions were presented to students at the beginning of instruction and were used exactly the same way that behavioral objectives were used for group I (BOBIS). The control group III (CON) neither has the benefits of objectives nor study questions; instruction was purely the conventional type. At the end of instruction, the pre-test instrument, that is, SAQ, was used as post-test to all groups to measure the attitude that has taken place, thus marking the end of the experiment.

Data Analysis: The SAQ scores formed the basis of data analysis. The research hypothesis was tested by employing Analysis of Covariance (ANCOVA) with pre-test score as covariates. Multiple Classification Analysis (MCA) technique was used to detect the magnitude and direction of the difference among the groups. The Scheffe post hoc analysis procedure was also employed to determine the relationship between means of different pairs of groups and the direction of significant difference observed on the ANCOVA.

RESULTS AND DISCUSSION

Hypothesis: There is no significant effect of treatment on students' attitude towards mathematics.

Table 1: ANCOVA Summary Table for Post-test Attitude Scores by Treatment with Pre-test as Covariates

Source of Variation	Sum of Squares	DF	Mean Square	F	Sign of F
Covariates	15126.880	1	15126.880	606.110	.000
PREATT	15126.880	1	15126.880	606.110	.000
Main Effects	3622.192	2	1811.096	72.568	.000 *
TRT	3622.192	2	1811.096	72.568	.000 *
Explained	18749.072	3	6249.691	250.415	.000 *
Residual	7686.848	308	24.957		
Total	**26435.920**	**311**	**85.003**		

* = significant at $P < 0.05$

Table I present's the analysis of covariance of students' attitude toward mathematics by treatment. The table reveals a significant effect of treatment on students' attitude towards Mathematics ($F(2, 311 = 72.568, P < 0.05)$. Thus the null hypothesis is rejected.

Table 2: Multiple Classification Analysis (MCA) of Post-test Attitude Scores by Treatment with Pre-test as Covariates Grand Mean = 69.48

Variable + Category	N	Unadjusted Dev'n	Eta	Adjusted for Independent + Covariates Dev'n	Beta
Treatment					
Group I (BOBIS)	117	1.95		1.14	
Group II (SQBIS)	95	2.48		3.59	
Group III (CON)	100	-4.64		-4.74	
			.35		.37
Multiple R Square					.709
Multiple R					.942

Group I: Behavioral Objective-based Instructional Strategy (BOBIS)

Group II: Study Question-based Instructional Strategy (SQBIS)

Group III: Conventional Method (CON)

The related Multiple Classification Analysis (MCA) in table 2 shows that the Study Question-Based Instructional Strategy (SQBIS) group scored the highest adjusted mean score of 71.96, Behavioral Objective-Based Instructional Strategy (BOBIS) group came second with an adjusted mean score of 71.43 while the control (CON) group came last with an adjusted mean score of 64.84. The table also shows that treatment accounted for 13.64 (0.37)2 of variation in students' attitude towards mathematics. Since significant effect was observed, the Scheffe post-hoc analysis procedure was further carried out on the data in order to find out where the significant difference lies.

Table 3: Scheffe Post-Hoc Analysis on Post-test

Attitude Mean Score by Treatment Groups				
Mean	Groups	III (BOBIS)	II (SQBIS)	I (CON)
64.8400	III (BOBIS)			
71.9684	II (SQBIS)			*
71.4359	I (CON)	*		

* indicate significant difference between pair of groups at 0.05 level of significance.

Table 3 shows that there is no significant difference between BOBIS and SQBIS groups. However, the BOBIS and SQBIS groups are significantly different from CON group. That is BOBIS > SQBIS > CON for attitude measure.

Studies investigating the relationship between instructional practices and students' attitude toward mathematics report that classroom organization and instructional variables correlates more strongly with students achievement, while measures of teachers' personal qualities correlate higher with students' attitudes towards mathematics (Butty, 2001)

The result of this study indicates that the attitude of the experimental groups, that is, BOBIS and SQBIS groups are akin and significantly better than that of the control group. This implies that the two strategies have functioned to develop in students' positive attitude towards Mathematics. The result shows that instructional method employed in the mathematics classroom play a central role in developing students positive attitude towards mathematics learning The result gives an unequivocal support to Bekee (1987),Guat & Tel (1987), Balogun and Olarewaju (1992), Akinsola (1994), Akale (1997),Olowojaiye (1999), (2000). It however contradicts those of Ibegbulam (1980), Nzewi (1994).

By utilizing behavioral objective-based and study question-based instructional strategies on students learning outcome, the teacher has established a structural framework which helps students to organize their learning in a systematic way for more efficient study thus, reducing the time spent on irrelevances.

In this way, students were not bored with the lesson; there was that eagerness to study more. No wonder, the improvement in attitude. The knowledge of behavioral objectives or study questions may have helped the students to perceive learning as relevant and meaningful thus, fostering a positive attitude in them towards mathematics.

Since attitudes refers to those actions that results from and are influenced by emotion, consequently, the affective domain relates to emotion, attitudes, appreciations, and values. In the mathematics classroom the affective domain is thus concerned with students' perceptions of mathematics, their feelings towards solving problems, and their attitudes about school and education in general. Pleasant experience through innovative and clearly understood instructional methods employed by the teacher will surely facilitates positive attitude toward mathematics. Personal development, self- management and ability to focus on important aspect of classroom learning are key areas which instructional delivery pattern could be used to enhance, promote and facilitate mathematics learning. Attitude cannot be easily separated from learning because they are acquired through the process of learning. Learning is a process of acquiring and retaining attitudes, knowledge, understanding, skills and capabilities (Farrant, 1994). Since learners are not

born with attitudes but instead they acquire them when they got in contact with the new world thus attitude can be learn and teachers should strive hard to develop the right attitudes in their students through various means especially instruction strategy. If learners are not assisted or encouraged to perceive positively most of the things they learning in mathematics classes, their performance will be affected. It depends entirely on the teacher to help learners develop positive attitudes towards the learning of mathematics.

IMPLICATION AND RECOMMENDATION

Evidence abounds that the conventional teaching method which is the traditional method commonly used in schools, is inadequate for improved students attitude towards Mathematics. This suggested the need to shift from the conventional method of teaching and embrace some other instructional strategies that have been found to have facilitative effect in promoting students' positive attitude towards Mathematics. The results of this study reveals that BOBIS and SQBIS are potent to bring about the desirable attitude towards the subject, both strategies influence attitude in a similar manner and exhibited superiority over the conventional method. It is therefore suggested that the teacher can use either strategy or a combination of both to increase positive attitude towards mathematics especially as the study questions are questions related to the behavioral objectives of the lesson topics.

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