EFFECTS OF COOPERATIVE, COMPETITIVE AND INDIVIDUALISTIC INSTRUCTIONAL STRATEGIES ON SECONDARY SCHOOL STUDENTS' ATTITUDE TOWARDS MATHEMATICS IN ONDO STATE, NIGERIA

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ABSTRACT

The study investigated effects of cooperative, competitive and individualistic instructional strategies on senior school students' attitudes towards Mathematics in Ondo State, Nigeria. The study adopted the quasi-experimental research design of the pretest and posttest control group type. The sample consisted of 400 senior secondary school two students who were selected from eight secondary schools in Ondo State using purposive random sampling technique. Two research instruments were developed for the study. The instruments were Pre - Test Mathematics Attitude Scale (PMAS) and Post - test Mathematics Attitude Scale (MAS). The reliability coefficients of the instruments were 0.85 and 0.89 respectively. The two null hypotheses generated were tested at 0.05 level of significance using Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA). Post - Hoc analysis of the form Sheffe test was carried out to determine the point at significance existed. The result showed that there was a significant difference in the attitude of students when exposed to mathematical concepts using cooperative, competitive, individualistic and conventional instructional strategies. It was also found that individualistic, competitive, cooperative and conventional learning strategies (in that order) have the potency of effecting better attitude in students when exposed to mathematical concepts. Based on the findings of this study, it was recommended that teachers should make individualistic learning strategy a fundamental part of their instructions.
Keywords: *Mathematics, Senior Secondary Schools, cooperative, competitive, Individualistic, conventional, and Achievement.*

INTRODUCTION

Nigeria, like other developing countries of the world, seems to be eager to develop her scientific and technological potentials so as to attain a measure of self sufficiency in the production of goods and services. This is evident from the resolutions, communiques and workshops on Science, Mathematics and Technology (SMT) sponsored in the past decades by Governments and professional bodies and the general aims of mathematics education as contained in the National Policy on Education (NPE, 2007). In the National Policy on Education (2007), mathematics is

one of the leading core and compulsory subjects of the junior and senior secondary school curricular. This importance accorded mathematics in the school curriculum reflects accurately the recognitions of the vital roles it plays in contemporary society. In spite of the prominence given to mathematics as a school subject, students' achievement in the subject is not encouraging globally. In Nigeria, even though the difference governments have provided materials for the study of mathematics, it is disheartening to note that senior secondary school students still achieve poorly in the subject. This poor performance in school certificate examinations calls for serious concern by stakeholders. For example, the presidency ordered an investigation into the mass failure of year 2009 SSCE, NECO examination. According to the Nation of November 3, 2009, most secondary leavers failed the May-June examinations conducted by the WAEC, the NECO and the National Board for Technical Education (NBTE). According to the newspaper, of the candidates who sat for that year's May/ June Senior Secondary Examinations, 84% failed. The paper shows that out of 1,373,009 candidates who sat for WAEC in 2009, only 356, 981 or 25.99% got five credit passes and above in English, Mathematics and at least three other subjects. Of the 1,200,765 candidates who registered for NECO examinations of the same year, only 126,500 or 10.76% secured at least five credits, including English and Mathematics. The question then is Where are we heading for?.

Peskin (1975), Neale (1960) and Ohuche (1980) have identified attitude as a significant factor in mathematics learning and one of the major problems among students is their negative attitude towards the subject. There are many causes of negative attitude. For instance, the home and cultural background of the student may not encourage them to learn mathematics effectively. Some students attribute their negative attitude towards mathematics to their teachers and their methods of teaching. Some efforts have been made to improve the students' attitude towards mathematics. One of such strategies for combating the problem was launched by Mathematics association of Nigeria (MAN) tagged "War Against Poor Achievement in Mathematics" (WAPAM).

In order to improve students' attitude, certain slogans were introduced in the WAPAM programme. For example "mathematics is a must", "you cannot do without mathematics", "mathematics is for doctors", mathematics is for lawyers, etc. were used as slogans. These slogans were made into stickers and wall posters. It was hoped that students seeing them will develop a positive attitude towards mathematics. It must be the responsibility of all mathematics educators that students develop positive attitude towards the subject. The current efforts by Governments at various levels to solve the myriad problems besetting Nigerian education are noteworthy. However, despite governments' efforts at all levels to promote the teaching and learning of science and mathematics, the yearly performance of students in both local and national examinations is far from being satisfactory. This situation if not corrected, will jeopardize the country's aspiration of becoming a technological giant country in the year 2020. It is of note that most of the identified factors or variables that contribute

to poor performance in mathematics were those of teachers. Of interest however, is also to find out the efforts students are making to learn the subject. The poor attitude of learners towards the study of mathematics should call for serious concern. From experience, the researcher has discovered that students of these days do not want to learn, mostly when it comes to mathematics. No doubt teachers and parents contribute to the poor attitude of students towards studying mathematics. In most class periods however, experience has shown that when teachers are going with their lessons many students are busy copying notes, sleeping, reading love novels, playing video games or doing other things. The study then sought to answer these questions Would the use of learning strategies introduce in this study help to improve students' attitude in mathematics? Would these strategies help students to be more active in mathematics lessons?

The issue of students' concentration in mathematics cannot be over - emphasized. The students are supposed to make up their minds to be attentive in mathematics classes. In addition, they are supposed to ask questions on areas they do not understand. They must make out time to solve the problems they have copied in the class and also try similar problems from textbooks. But these are hardly seen from our students. Besides, they are hardly seen contacting teachers or brilliant ones in their class to help explain difficult problem they have come across in the course of learning privately. How can they solve problems at home? The only time you see most of them making contact are when take - home assignments are given to them. Much as we attribute poor attitude of students in learning mathematics to other factors, a greater percentage of it could be attributed to the learner because attitude towards a subject will definitely increase or decrease the concentration of other factors that will determine students' achievement in the subject.

In a traditional classroom setting, when a teacher calls upon a student to answer any question, the student becomes the focus of attention of the entire class. Any mistakes or incorrect answers from the student make him/her a subject of scrutiny by the whole class. Such experience produces embarrassment and anxiety in many students. Such students become shy and unwilling to make any further contribution in the class. They hesitate to speak out and offer opinion publicly in a traditional classroom situation, for fear of making another mistake. This ugly situation leads to poor classroom participation by students, and of course poor students' achievement. Therefore, there is the need to develop learning strategies that would improve students' participation in classroom and consequently increase their achievement in mathematics.

In order to change this paradigm, classroom interaction needs to be improved upon. Appropriate teaching/learning strategies may be employed as teaching /learning situation may demand. Psychologists and educationists agree that most young children acquire mathematical concepts much easier by interacting with one another in the company of more matured or expert users of mathematical language and concepts. Young children acquire problem solving skills and hence think more mathematically about a mathematical concept in the company of more advanced users of the concepts

even when there in little or no reference to the society in which they live. The search for improved strategies for teaching and learning mathematics has been on the increase. Ifamuyiwa and Akinsola (2008), Peskin (1975), Johnson D. and Johnson R. (1990) have shown that there are various teaching strategies that teachers use to explain specific concepts and solve abstract mathematical problems. Teachers use several approaches to influence effective teaching and learning processes. In typical classroom situations, students are given lectures and completing assignments outside of class and take examinations to demonstrate their knowledge and retention of the subject matter. The examination papers are returned and new materials are covered, repeating the process over and over. There is little time for reflection and dissection of students' error or misconceptions. Understanding the diversity that exists among students of different learning styles and abilities, the teacher plays a very active role in facilitating the learning processes.

For efficient classroom interactions, a classroom teacher has the choice of structuring his lessons either cooperatively, competitively or individualistically. The present educational system in Nigeria is based upon competition among students for grades, social recognition, scholarships and admission to top schools. In the society and within the present educational framework, competition is valued over cooperation. In a traditional competitive classroom situation, students are concerned with individual grade and where they fit into grade curve. Emphasis is placed on doing better than everyone else. Competition fosters a win-loss situation where superior students reap all rewards and recognition while mediocre or low-achieving students reap none. Typical teaching paradigms consist of individual students efforts' characterized by competitive testing, assess students' competence and create an evaluation hierarchy based on grades. This approach is based on the premise of "winners take all while the looser takes nothing". It leads to performance goal as the desired outcome of the educational experience. Competitive learning is most appropriate when students need to view learned materials. It can be interpersonal or inter group. In a competitively structured classroom, students are working against one another. This is because one student can only "win" if another "loses".

Cooperative learning on the other hand is a mode of learning in which students of different abilities work together in small group to achieve a purpose. It involves the use of variety of learning activities to improve their understanding of a subject. Students in a group interact with one another, share ideas and information, seek additional information, make decisions about the results of their deliberations and present their findings to the entire class. It encourages teachers to use alternative assessment techniques, further reducing the emphasis on competitive examinations. In cooperative learning group, students are concerned about performance of all the group members. At the same time, students are held individually accountable for their learning and given feedback on their performance. This helps other group members to know who to help and encourage. Cooperative learning helps to improve students' achievement and retention, increase self-esteem and intrinsic motivation

and develop more positive attitude towards learning and social skills. However, cooperative learning is not merely students working in groups. The essential feature of cooperative learning is that the success of one student helps other students to be successful. Each member of a team is therefore responsible not only for learning what is taught, but also for helping teammates learn, thus creating an atmosphere of achievement. Student work through the assignment until all group members successfully understand and complete it, hence the term "sink or swim together". In cooperative learning, the group work is an integral part of and not an adjunct to the achievement of the learning goals of the class. Cooperative learning, therefore fosters individual accountability in a context of group interdependence in which students discover information and teach that materials to their group and perhaps to the class as a whole. Although they learn in groups, the students are evaluated individually on the learning they have achieved.

The individually structured classroom features students working by themselves independent of what happen to their classmates. Considering therefore, the persistent decline over the years in students' attitude towards mathematics and the potential which these strategies (cooperative, competitive, and individualistic) have for improving students' attitude, this study sought to explore the extent to which each of these strategies could affect students' attitude towards learning of mathematics in secondary schools. The interactive learning strategies to be provided in this study is a mechanism for adopting lessons to an individual space. It is strongly believed that these methods can circumvent the large group barrier. It also ensures that students would constantly be kept actively at work, thereby enhancing frequent and correct responses on the part of students. Since the current educational system is based upon competition among students for grades, social recognition, scholarship and admission to schools. In most of the educational institutions in Nigeria, the dominant instructional strategy is the lecture method in which the dominant factor is the teacher. This method has failed to promote genuine mathematical understanding and consequently failed to induce in the students, positive attitude towards mathematics.

The resultant effect of this practice therefore is the poor learning outcomes. Researches support the use of learning strategies which increase retention, fostering team building and developing higher-order thinking skills. The main problem this study investigated is which of the cooperative, competitive, and individualistic instructional strategies will bring about better attitude of students towards learning mathematics and to what extent do these learning strategies affect gender in learning outcomes. The main aim of this study is to examine the effects of cooperative, competitive, and individualistic instructional strategies on Senior Secondary School Students' Attitudes towards Mathematics in Ondo State, Nigeria. To achieve this objective, the following research questions were raised:

1 Is there any difference in the attitude of students exposed to mathematical concepts using cooperative, competitive, individualistic and conventional instructional strategies?

2 Is there any interaction effect of gender and treatment on students' attitude when exposed to mathematical concepts?

The following hypotheses were generated in null forms for the study:

1 There is no significant difference in the attitude of students exposed to mathematical concepts using cooperative, competitive, individualistic and conventional instructional strategies.

2 There is no significant interaction effect of gender and treatment on students' attitude when exposed to mathematical concepts using cooperative, competitive, individualistic and conventional instructional strategies.

METHODOLOGY

The research design adopted for this study is quasi experiment. In other words, the design is a one short experimental design. The population of this study comprises all Senior Secondary School Two (SSSII) Mathematics Students in all the Secondary Schools in Ondo State, Nigeria. The sample consisted of 400 senior secondary school two (SSII) students, comprising of 189 male and 211 female, who were selected from eight secondary schools in Ondo state using purposive random sampling technique. Fifty students were randomly selected from each of the schools for pre-test. Two schools were thereafter randomly assigned to each of the groups. Thus, one hundred (100) students were randomly assigned to each of the three experimental and one control groups.

The instruments used for the study were Pre-Test Mathematics Attitude Scale (PMAS) and Post-test Mathematics Attitude Scale (MAS). The instruments were adapted from the mathematics attitude scale developed by Aborisade (2007). Pre - Test Mathematics Attitude Scale was designed to test for the homogeneity of the three groups (cooperative, competitive and individualistic instructional groups) and it was administered to all the students before the treatment. Post-test Mathematics Attitude Scale was administered to the three groups after the treatment, (teaching them with the mathematical package). Any difference between the pre-test and the post-test might have been due to the treatment given to the three groups. Pre-Test Mathematics Attitude Scale and Post-Test Mathematics Attitude Scale were two equivalent tests.

The validity of the instruments was ensured by giving them to test and measurement experts in the Faculty of Education, Ekiti State University, Ado-Ekiti for scrutiny. The reliabilities of the instruments were ensured by determining their internal consistencies using Cronbach Alpha formula. PMAS and MAS yielded reliability coefficient of 0.85 and 0.89 respectively. A random sampling technique was used to assign the sample into groups (cooperative, competitive, individualistic and conventional groups). The Pre-Test Mathematics Attitude Scale (PMAS) was administered to all treatment as Pre-Test in order to ascertain the homogeneity of the treatment groups. The Post-test Mathematics Attitude Scale (MAS) was administered

to the treatment groups after teaching the groups for a term (13 weeks) using the same scheme of work.

Mathematics teachers in each school were employed as research assistants. All the teachers used in this study were professional teachers as well as WAEC markers. They were given detailed instructions with lesson packages on how to teach each group on all the topics under consideration. After the treatment, the scores in Post - Test Mathematics Attitude Scale (MAS) in all the groups were collated and subjected to appropriate statistical analysis using Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA). Each hypothesis was tested at α = 0.05 level of significance.

RESULTS AND DISCUSSION

Table 1: Analysis of Covariance (ANCOVA) summary of treatment and students' Attitude Towards learning of mathematics.

Source	SS	df	MS	Fcal	Ftable
Corrected Model	4159.545	4	1039.886	2.635	2.37
Covariate (pre-test)	594.075	1	594.075	1.505	3.84
Group	3742.419	3	1247.473	3.161*	2.60
Error	15589.205	395	394.679		
Corrected Total	160057.750	399			
Total	7533998.000	400			

*P < 0.05

Table 1 shows that the F_{cal} (3.161) is greater than the F_{tab} (2.60) at 0.05 level of significance. The null hypothesis that there is no significant difference in the attitude of students exposed to mathematical concepts using cooperative, competitive, individualistic and conventional instructional strategies was therefore rejected. This implies that there was a significant difference in the attitude of students who were exposed to mathematical concepts using cooperative, competitive, individualistic and conventional learning strategies. In order to determine the effect of the treatment (cooperative and individualistic) on the attitudinal mean scores in Mathematics, Multiple Classification Analysis (MCA) was used. The results are presented on Table 2.

Table 2: Multiple Classification Analysis (MCA) of Treatment and Students' Achievement towards Mathematics.

Grand Mean = 135.78

Variable + Category		N	Unadjusted Deviation	Eta	Adjusted for Independent Covariate	Beta
Cooperative	100	-0.39		31.78	-0.48	0.05
Competitive	100	1.71	1.71			
Individualistic	100	3.31	3.45			
Conventional	100	-4.65	-4.70			
Multiple R^2		0.003				
Multiple R		0.051				

Table 2 presents the Multiple Classification Analysis (MCA) of treatment and

students' attitude towards mathematics. The results clearly show that students exposed to individualistic learning strategy had the highest adjusted post-test mean score of 139.23. Next to this are competitive learning strategy with an adjusted post-test mean score of 137.49, cooperative learning strategy with an adjusted post-test mean score of 135.30, while the conventional learning group had the least adjusted post-test mean score of 131.08. This implies that individualistic, competitive, cooperative and conventional learning strategies (in that order) have the potency of effecting better attitude in students when exposed to mathematical concepts. The results also show that the coefficient of multiple correlations was 0.051 which indicated that the relationship between treatment and SMAS was low and positive. The coefficient of determination, R^2 was 0.003. This implies that only about 0.3% variation in post-test scores (SMAS) was accounted for by the variation in pre-test (SMAS). This implies that the remaining 99.7% in post-test SMAS were due to the treatment given.

Table 3: 2 X 4 Analysis of Covariance (ANCOVA) summary of Gender and Treatment on students' Attitude towards Mathematics. * P<0.05

Source	SS	df	MS	Fcal	Ftable
Corrected model	4493.452	8	561.682	1.412	1.94
Covariate (pretest)	515.396	1	515.376	1.295	3.84
Gender	37.716	1	37.716	0.095	3.84
Group	3619.450	3	1206.483	3.032*	2.60
Gender* Group	297.783	3	99.261	0.249	2.60
Error	155564.298	391	397.863		
Corrected Total	160057.750	399			
Total	7533998.00	400			

Table 3 shows that F_{cal} (0.249) was less than F_{tab} (2.60) at 0.05 level of significance. The null hypothesis that there is no significant interaction effect of gender and treatment on students' attitude when exposed to mathematical concepts using cooperative, competitive, individualistic and conventional instructional strategies was accepted. This implies that there was no significant interaction effect of gender and treatment on students' attitude when exposed to mathematical concepts. Also, the main effect of gender on attitude was not significant at 0.05 level of significance while the main effect of treatment on students' attitude was significant at 0.05 level of significance. The results reveal that there was a significant difference in the attitude of the students towards mathematics. This means that there is substantial improvement in the attitude of the students towards mathematics. This result collaborates with the findings of Seweje and Idiga (2003) who reported that achievement of students in science depends on students' personal efforts. This is probably because when students work in groups they feel that they can depend on others for help and therefore increase their confidence in solving mathematical problems. This may indirectly change their attitudes towards mathematics. This finding is also consistent with the findings of Ifamuyiwa and Akinsola (2008). A further analysis reveals that individualistic, competitive and cooperative learning groups (in that order) have the potency to better the attitude of students towards mathematics. This finding is however at variance

with those of Johnson D. and Johnson R. (1990), Wheeler and Ryan (1996), Ifamuyiwa and Akinsola (2008) and Slavin (1991) who found that students in cooperative groups tend to have better attitude, more positive feeling about themselves, develop better collaborative skills and are more motivated with better attitude towards a subject than students in other types of classroom. The result also revealed that there was no significant interaction effect of gender and treatment. This however, implies that male and female students exposed to the same treatment would not differ significantly in their attitude in mathematics.

CONCLUSION AND RECOMMENDATIONS

This study examined the effects of cooperative, competitive, and individualistic instructional strategies on Senior Secondary School Students' Attitudes towards Mathematics in Ondo State, Nigeria using the quasi-experimental research design. Based on the findings of this study, it is therefore, concluded that there is an improvement in students' attitude towards Mathematics when exposed to the treatment. And that male and female students exposed to the same treatment did not differ significantly in their attitude towards learning Mathematics. However, it is hereby recommended that Mathematics teachers should adopt individualistic learning strategy as an alternative and effective learning strategy in order to improve students' performance, social interaction skills and foster Meta-cognition in students. Individualistic learning should be emphasized in the teaching of students in Secondary School Mathematics.

REFERENCES

Federal Republic of Nigeria (2007). National Policy on Education. Abuja: Federal Ministry of Science and Technology.

Ifamuyiwa, S. A. and **Akinsola, M. K.** (2008). Improving senior secondary School Students' altitude towards mathematics through self and cooperative - instructional strategies. *International Journal of mathematics Educational Science Technology,* 39, 569 - 585.

Johnson D. W. and **Johnson R. T.** (1990). The Integration of the Handicapped into the Neglected classroom: Effects of Cooperative, Completive and individualistic Instruction. *Contemporary Educational Psychology,* 2(3), 41-49.

Neale, K. (1960). The role of attitude in learning mathematics. Arithmetic Teacher 16, 413-417.

Ohuche R. O. (1980). Perceived competency in elementary mathematics of primary school teachers. A paper presented to the conference of teachers' effectiveness.

Peskin, R. (1975). *Children Arithmetic: The Learning Process.* New York: D. Van Nostrand.

Seweje R. O. and **Idiga D.** (2003). An investigation into the readability of the Integrated science textbooks. *Journal of the Curriculum Studies,* 2 (10), 205 - 210.

Slavin, R. (1991). Synthesis of Research on Cooperative Learning. *Educational Leadership,* 48(1), 82 - 89.

Wheeler, M. and **Ryan, J.** (1996). *Development of Children's problem- solving Ability in Arithmetic.* In Ginburg H. P. (Ed) *The Developmental Mathematics thinking.* New York Academic Press. pp. 22-26.