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Effects of Behavioural Objectives-based Instructional Strategy on Senior School Students' Academic Performance in Mathematics in Omu-Aran, Nigeria

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Abstract

This study sought for the effect of the use of behavioural objectives on Senior Secondary students' academic performance in Mathematics in Omu-Aran, Kwara South Senatorial District Area of Kwara State, Nigeria. The target population for the study comprised Senior Secondary Two (SS II) students in Omu-Aran town. Purposive sampling technique was employed to select 179 students for the study. A quasi-experimental, non-randomized, non-equivalent, pre-test, post-test control group involving a 2 x 3 factorial design was employed as research design. The dependent variable was the Mathematics Academic Performance Test (MAPT) administered. The independent variables were the instructional strategy and the scoring levels. The test scores were analyzed using mean scores, standard deviations, t-test and Analysis of Covariance on the two null hypotheses formulated. An alpha level of 0.05 was used to determine the significant level. Findings from the study showed that the experimental group significantly performed better in Mathematics Academic Performance Test than the control group. Based on this finding, it was recommended among others that teachers of Mathematics should always present the set behavioural objectives to the students prior to the lesson in order to enhance students' full participation in the lesson. Mathematics students should also be provided with academic counselling.

Keywords: behavioural objective, instructional strategy, academic performance

1. Introduction

Behavioural objective usually form the starting point of the lesson plan for effective teaching. The planning of the lesson involves primarily, the setting of objectives while every other component involves how to achieve the set objectives and how to know that the objectives have been achieved. Abdullahi (1981) defined behavioural objective as a means of conceiving instructional strategy in a form that requires a specification of what tasks the students are expected to be able to perform under what conditions and how such tasks will be evaluated. Students in the contemporary society have different objectives for education when compared with students of a generation ago. The nature of education and training has also changed, and the tendency today is towards a more direct and straight forward emphasis on learning in the sense that the appropriateness and effectiveness of teaching is been more and more questionable. For this reason, writing precise behavioural objectives are capable of observation and measurement is becoming increasingly important (Omosewo, 1999). A behavioural objective is a statement of proposed change expected from learners after they have been exposed to learning for specified period of time. This change desired and valued by the teacher is expected to occur in thoughts, actions and feelings of the students. These are the cognitive, psychomotor and affective domains (Omosewo, 1999).

Aiken (2000) refered to objectives as statements that predict what learners will have gained as a result of learning. But others describe learning objectives as what learners will be able to do after learning. Also, Ramsden (2003) stress that the statements must be specific, and clear, indicating what learners are expected to learn and able to demonstrate at the completion of their program of study. In addition to view of Ramsden (2003), Marsh (2007) and Kennedy et al (2006) believe that the statements should describe the competencies that students should possess upon completion of a course because the expressions direct attention more on the types of behavior that students should exhibit and that is why they are sometimes refered to as "behavioural objectives" or "intended learning outcomes". Behavioural objectives act as destinations, specifying where one

intends to go. Thus, Denga (1987) asserted that a lesson without objective is like a journey without destination. Inyang-Abia (1988) also emphasizes that if one knows what he or she wants, he or she can always tell when getting it; and can also reject those ones not wanted. These destinations referred to as objectives are usually prepared or determined by the teacher, and in most cases reserved for teachers, principals and school inspectors, but never for the students. Draper (2001) however, stated that a clearly defined objective provides students with a means to organize their own efforts towards the accomplishment of those objectives. Uche and Uromen (1998) also pointed out that when a list of behavioural objectives is made available to students, students will be able to focus their energies by working through the list of objectives, and will have more accurate idea of what is expected of them. However, behavioural objectives when properly formulated and communicated to students could function to remedy the problem of effective teaching and learning of Mathematics. Since behavioural objective specify learning outcomes. The knowledge of behavioural objective can also 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 could be promoted. Nzewi (1994) noted that the teacher should no longer be satisfied with only having the statements of behavioural objectives in their lesson notes. But should make it a point of duty to let their students know these objectives, and if possible, the students should be given these objectives in a written form. Further, the 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 students pay no attention to them in the learning situations. Presenting students therefore with the behavioural objectives of the lesson topic at the beginning of instruction can alert their sensitivity to the learning situation. Referring students to the stated objectives 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 students positive attitude towards the subject. Therefore, this study examined the effect of behavioural objective-based instructional strategy on students' academic performance in Mathematics.

1.1 Purpose of the Study

The main purpose of this study is to examine the effect of behavioural objective-based instructional strategy on students' academic performance in Set theory in Mathematics.

Specifically, study aims to determine whether there would be:

1) Difference in the performance of students exposed to behavioural objective based instructional strategy and those in the control group.

2) An improvement in the academic performance of the weak students when exposed to behavioural objective-based instruction al strategy.

1.2 Research Hypotheses

The following null research hypotheses were formulated and tested based on the research questions raised:

H_O: There is no significant difference between the academic performances of students exposed to behavioural objective-based instructional strategy and the control group.

H_O: There is no significant difference between the academic performances of high, average and low scoring students exposed to behavioural objective-based instructional strategy.

2. Literature Review

Behavioural objective became known to educators through a book entitled, preparing instructional objectives, written by Robert F. Mager that was published in 1962. It was during the 60's and early 70's that public schools teachers were required to write behavioural objectives as a critical component of their daily lesson plan. Many workshops for teachers were conducted and the Mager model for writing behavioural objective was taught. The Mager model recommended that objective should be specific and measurable. The Magerian model recommended three specific features of an objective as follows:

1) It should have a measurable verb (an action verb)

2) It should include a specification of what is given the leaner, and

3) It should contain a specification of criteria for success or competency.

Formulation of behavioural objectives usually forms the starting point of the lesson plan for effective teaching. The planning of the lesson involves primarily, the setting of objectives while every other component involves how to achieve the set objectives and how to know the objectives have been achieved. Onogwere (2000) summarized the lesson plan as processes to answer the following questions: "Where am I going?" "How will I

get there?" "How will I know when I arrive?" In the opinion of Yusuf (2010), properly constructed learning objectives are about the evidence of learning; they specify what behavior a student must demonstrate or perform in order for a teacher to infer that learning took place. Since learning cannot be seen directly, teachers must make inferences about learning from evidence they can see and measure. Learning objectives, if constructed properly, provide an ideal vehicle for making those inferences.

Behavioural objectives can be summed up using the mnemonic device ABCD as presented by Schwier (1998), for instant, after having completed the unit, the students will be able to answer correctly 90% of the question on the posttest

A – audience – the student

B – Behaviour – Answer correctly

C – Condition – after having completed the unit on a posttest

D – degree – 90% correct.

To write a behavioural objective, a learning task has to be analyzed to determine into specific measurable tasks. The learning success may be measured by tests developed to measure each objective. According to Gilbert (1984), the qualities of specific learning objectives are: Relevant, unequivocal, feasible, logical, observable, measurable and so on.

Westberg and Jason (1993) described the characteristics of an effective objective in collaborative clinical education as follows:

- Consistence with overall goals of the school
- Clearly stated
- Realistic and do able
- Appropriately comprehensive
- Worthy, complex outcomes
- Not treated as if they were etched in stone
- Not regarded as the only valuable outcome, etc.

In educational psychology, learning is defined as a change in behavior. This is a little confusing but if a student could not answer a particular question on a pretest, then received instruction, and then answered the question correctly in the post-test, a change in behavior is illustrated and learning is considered to have occurred. In his own contribution, Harron (1972) explained the three domains of behavioural objectives as follows:

Cognitive domain: refers to intellectual learning and problem solving. Cognitive levels of the learning include: knowledge, comprehension, application analysis, synthesis, and evaluation.

Affective domain: refers to the emotion and value system of a person. Affective levels of learning include: receiving, responding, valuing, organizing and characterizing by a value.

Psychomotor domain: refers to physical movement characteristics and motor skill capabilities that involve behavior requiring certain levels of physical dexterity and coordination. These skills are developed through repetitive practice and measured in terms of speed, precision, distance, procedures, or execution techniques. Psychomotor levels include: perception, set, guided response, mechanism, complex overt response, adaptation and origination.

Omosewo (1999) in a study on the impact of behavioural objectives on students' academic achievement in physics carried out within Ilorin metropolis concluded that students taught with behaviuoral objectives performed better than those taught without behavioural objectives, and the students taught with the use of behavioural objective retained what they were taught one month after they had been exposed to the treatment. The researcher therefore concluded that physics teachers should endeavour from time to time to let the students be aware of what is expected of them at the end of the lesson. Umoren and Ogong (2007) carried out a research on the prior presentation of behavioural objectives and students' achievement in Biology concluded that the principle and effortless process of letting learners know the behavioural objectives of a lesson before the lesson significantly enhances achievement of students. It also shows that the best time to show learners the objectives is immediately before the lesson in order to have maximum enhancement of objective. To Bozimo and Okam (1998) in their own research work on behavioural objectives strategy for a more functional instruction in History concluded that students were more intelligent, enthusiasm and students participated in the class instruction when

they were aware of the objectives of their History lesson. The study further stated that teaching by behavioural objectives is of child-centered learning strategy, which in turn makes History learning exciting, interesting and fulfilling. Thus, the researchers concluded that behavioural objectives are important learning aids which contribute greatly to improved class performance among History students. Beskeni et al (2011) determined how effective prior knowledge of behavioural objective can assist secondary school students' understanding of difficulty chemistry concepts using a sample of 557 chemistry students selected from six target zones. The researcher from their findings reported that prior knowledge of the behavioual objective have tremendous implications on the teaching of chemistry. Yusuf (2010) observed the statement of learning objectives performs the following functions among others, namely, guiding the teacher relative to the design of instruction, and for evaluation/test design (e.g., written tests, school examinations, etc). Further, it was opined that the statement of behavioral objectives serves as a guide for the learner relative to learning focus and self-assessment. It is also believed that the statement of behavioural objectives brings about careful thinking of what is to be accomplished through instruction and enhances the relationship between teacher and learner because with explicit objectives the teacher is viewed less in an adversarial role because students are not forced to guess what is to be learned.

3. Methodology

3.1 Research Design

The research work is a quasi-experimental of the type pre-test, post-test, non-randomize non equivalent, Control group design involving a 2 x3 factorial. The Instructional Strategy is at two levels (experimental and the control groups), while the scoring level is at three levels (High, medium and low). The illustration is given below:

O_1 X O_2 Experimental group

O_3 O_4 Control group (no presentation of objectives)

Where O_1, and O_3 were pretest for the two groups and O_2 and O_4 were posttest for the two groups.

3.2 Sampling Technique

The target population for this study was all the SS 2 students in Omu-Aran town of Kwara State, Nigeria. Two schools were purposively selected and assigned to different treatments to avoid interaction that may occur among the groups if two or more groups are located in the same school. To avoid disrupting the school program or arrangement, intact classes were used. A total number of 179 SS 2 students were involved (The experimental group has 88 students and control group has 91 students).

3.3 Research Instrument

Basically, the instrument used for the study was a Mathematics Academic Performance Test (MAPT) prepared by the researchers on set theory for the purpose of this research work. A stimulus instrument (instructional guide) for the teacher was also used. The MAPT comprised 5 theory questions on set theory prepared according to the contents and the set behavioural objectives. Each question attracted 20 marks. The instrument was validated by lecturers of Mathematics Education in the Department of science education, University of Ilorin for proper scrutiny and necessary corrections. The questions were drawn from the West African School Certificate Examinations past questions assumed to be reliable.

3.4 Procedure for Data Collection

The experimental and control group students were taught the concept of set theory in Mathematics for a period of two weeks. The students in the experimental group have access to the teacher's set behavioural objectives before the commencement of the lesson while the students in the control group have not. The usual Mathematics teacher of the students were used as research assistants after due training. The research instrument was administered as pretest to the subjects (both the experimental and the control groups) of the study before the treatment. Then the two groups were taught set theory by their teachers while the experimental group teacher taught by given the students the set behavioural objective, the control group teacher taught without given the students the set behavioural objective. At the end of the instruction, the pre-test instrument, that is MAPT, were re-organized and administered as post-test to both the experimental and the control groups, thus marking the end of the experiment.

3.5 Procedures for Data Analysis

The MAPT scores formed the basis of data analysis. The research hypotheses 1 was tested with t-test and research hypothesis 2 was tested with Analysis of Variance (ANOVA).

4. Results

The data collected from the pre-test and the post test for both the experimental and the control groups were analyzed using mean scores, standard deviation, t-test analysis and analysis of variance based on the two formulated null hypotheses tested at an alpha level of 0.05 in order to determine the existence of significant differences.

4.1 Hypothesis One

There is no significant difference between the academic performances of students exposed to behavioural objective-based instructional strategy and their counterpart in the control group.

An independent sample t-test statistic was employed to test for significant difference between the two groups using the pre-test scores and post test scores separately.

Table 1. T-test statistic on the pre-test scores of both the experimental and the control groups

Group	**No.**	**Mean**	**SD**	**Df**	**t_{cal}**	**t_{tab}**	**α**
Experimental Group	88	27.88	10.07				
				177	0.33	1.96	0.05
Control Group	91	28.41	11.24				

Table 1 shows the means and standard deviation of both the experimental and the control groups. The calculated t-value was 0.33 and the t_{tab} was 1.96 at $\alpha = 0.05$ significant level. Since the calculated t-value is less than that of table value (i.e., $0.33<1.96$) it means that there was no significant difference in the pre-test mean scores of the experimental and the control groups. Thus, the two groups were equivalent before exposing to the treatment.

Table 2. T-test statistic on the post-test scores of both the experimental and the control groups

Group	**No.**	**Mean**	**SD**	**Df**	**t_{cal}**	**t_{tab}**	**α**
Experimental Group	88	55.86	10.70				
				177	7.80	1.96	0.05
Control Group	91	41.88	13.12				

Comparing the post-test scores for the two groups in table 4, the calculated t-value was 7.80 and the t_{tab} was 1.96 at $\alpha = 0.05$ significant level. Since the calculated t-value is greater than that of the table value (i.e., $7.80>1.96$) it means that there was significant difference in the post-test mean scores of the experimental and the control groups. Thus, there is a significant difference between the mean scores of students taught set theory using behavioural objective-based instructional strategy and those in the control group. This implies that the effect of the use of behavioural objective-based Instructional strategy is significant over the control group.

4.2 Hypothesis Two

There is no significant difference in the students' scoring levels when taught word problem involving Set theory using behavioural objective-based instructional strategy pattern.

The students were grouped into three categories based on their performance in the pre-test administered by the researchers. The groups are the Low scorers, the Medium scorers and the High scorers. Analysis of Covariance test was employed to test for significant difference among the three categories difference in performance among low, medium and high scorers exposed to the treatment.

Table 3. ANOVA Computation of the categorized experimental group into low, medium and high scoring levels

Source	Sum of Squares	Df	Mean Square	F	Sig.
Model	6787.529	5	1357.506	36.194	.000
Covariate (Pre-test)	24.851	1	24.851	0.663	.418
Group	362.567	2	181.284	4.833	.010
Residual	3075.551	82	37.507		
Total	9863.080	87			

Table 3 shows the Analysis of Covariance *F*-test with the *F* value of 4.833at 0.010significant level. Thus the calculated *F*-value is less than the critical value ($p<0.05$). This implies that there is significant difference in the Mathematics academic performance scores of students exposed to behavioural objective-based instructional strategy at the three different levels of low, medium and high in set theory. As such the null hypothesis was rejected. Therefore, There is a significant difference in the students' scoring levels when taught word problem involving Set theory using behavioural objective-based instructional strategy pattern

5. Discussion

The study revealed that the experimental group exposed to behavioural objective-based instructional strategy performed significantly better in Mathematics Set Theory than their counterparts in the control group. This attests to the efficacy of the use of behavioural objective-based instructional strategy as a tool for improving students' academic performance in Mathematics. This finding lend support to empirical studies carried out by Aniashi and Umoren (2007), who reported significant enhancement in retention of learnt materials. Similarly Marzano (2007) found improvement in students' achievement scores as a result of prior presentation of objectives. Beskeni et al (2011) reported positive impact of prior knowledge of the objectives of the lesson in a chemistry class. On the contrary, a number of studies have recorded that the availability of behavioural objectives did not help leaning (Barker & Hapkierwicz, 1979; Draper, 2001). This implies that the result on efficacy of prior objectives is non conclusive. Also, ANCOVA computation of hypothesis two showed that difference exists in the performance of high, medium and low scoring students when taught Set Theory using behavioural objective-based instructional strategy, with the low scorers being the most beneficiary of the instructional strategy.

6. Conclusion

Findings from the study revealed the efficacy of the use of behavioural objective-based instructional strategy in improving students' academic performance in Mathematics. Other findings from the study were that the use of behavioural objective-based instructional strategy was beneficial to Mathematics students irrespective of the academic abilities. This indicates that students irrespective of their levels of education and academic attainment would benefit from effective use of the instructional strategy. The use of behavioural objective-based instructional strategy can enhance academic performance of students in Mathematics, especially the weak students.

7. Recommendations

The following recommendations are considered appropriate and relevant based on the findings of the study:

1) The use of behavioural objective-based Instructional strategy should be encouraged in the teaching and learning process in order to enhance students' better academic performance.

2) Authors of Mathematics textbooks should include the behavioural objectives of each of the major topic at the beginning of each topic in their textbooks in order to encourage self-development among students.

3) Mathematics teacher should provide guidance to students or refer them school counsellors for professional assistance.

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