Motivating Students' Achievements and Retention through Guided-Discovery Strategy in Junior Secondary Schools in Basic Science in Ekiti State, Nigeria

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Abstract
This paper examined the effects of guided-discovery strategy in motivating students' academic achievement in Basic Science in junior secondary schools in Ekiti State. The study adopted a quasi-experimental pre-test, post-test, control group design. Four null hypotheses were generated and tested at 0.05 level of significance. The sample consisted of 180 junior secondary school II Basic Science students selected through multistage random sampling technique. The instrument that was used for the study was Basic Science Achievement Test (BSAT). It is a self-designed instrument that consisted of information on bio-data of the respondents and 40 multiple-choice items.Expert judgements were used to ensure face and content validity. Test-retest method was used to determine the reliability and reliability Coefficient of 0.72 was obtained. The data were analyzed using inferential statistics of t-test. The study found out that there was a significant difference between the posttest achievements means scores of students exposed to guided-discovery strategies and conventional strategies. It was also revealed in the study that there was no significant difference between the posttest achievement and retention means scores of students exposed to conventional strategies. Based on this finding, it was recommended among other things that the state government should organize a seminar among the teachers in secondary schools on the effective use of guided-discovery strategy in their various classes to enhance learning outcomes.
Keywords- Guided-discovery, Strategy, Achievement, Retention, Basic Science,

Introduction

Basic science and technology, formerly known as integrated science, is the first knowledge of science and technology which a child encounters at the junior secondary school level. Science and technology play a vital role in the lives of individuals and in the development of a nation. It is widely and generally acknowledged that the gateway to the survival of any nation socially and economically is through scientific and technological literacy which can only be achieved through science and technology education. (Alebiosu & Ifamuyiwa, 2008). In view of this, basic science and technology is being given greater emphasis at the junior secondary schools in Nigeria.

According to Godek (2004), there cannot be any meaningful development without science education. Science advancement has been seen as the single most important factor in sustained economic growth. It has also been described as the principal driving force behind long-term economic growth of developed countries and their rising standard of living. According to Bilesanmi-Awoderu (2006), the level of development of a country is a measure of its scientific advancement, as such science education cannot be undermined in any country's development.

To further promote the study of science and technology, the FGN (2012) has stressed in a policy that 60 percent of the students seeking admission into the nation's tertiary institutions should be admitted into science and technically-oriented programs, while the remaining 40 percent of the students could be admitted into Arts and Social Science. This is in a bid to encourage youngsters to select science and technology subjects. In this connection, educators are of the view that changes in students' outcomes in Sciences especially, must be supported by parallel changes in curriculum and methods of instruction (Ajibola, 2008).

There are a variety of methods for teaching basic science and technology, namely, project method, field trip, enquiry, exposition, demonstration, experimentation, guided discovery method among others. All these methods rely on various forms of teacher-student activities. However, some are more activity oriented than others. The Guided Discovery (GD), for example, has been recommended for teaching the contents of Junior Secondary School (JSS) basic science and technology curriculum by the Federal Government of Nigeria in its National

Policy on Education (2012). This approach is activity based for both students and teachers. The method stresses the principle of effective questioning, appropriate directives and demonstration by the teacher, high quantity and quality of students' activities (laboratory work, inquiry, project, field trip and classroom discussion). Among these, guided discovery has been strongly advocated for teaching science and technical subjects. Ajiboye & Ajitoni (2008) observed that children learn best by being interested fully in their own work, by seeing themselves, doing themselves, by puzzling themselves, by verifying their own suppositions; by experimenting themselves, by drawing conclusions themselves on the strength of evidence which they have collected themselves. They should always make mistakes which they then should rectify themselves in the light of new information and evidence that they have uncovered themselves. This pedagogic concept should be participatory through social interaction, togetherness, and action-oriented communication. Guided discovery strategy belong to these pedagogic concepts.

Guided discovery strategy as a philosophy or strategy of learning is based on the constructivist views of learning. It is a learning approach where the learners take an active part in the learning process in which they have maximum measure of freedom and self-determination. In this strategy the teacher guides the students in their learning task by asking them thought-provoking questions that would assist them to generate their own correct ideas of the subject matter. The students were made to be active participants in the teaching-

learning process individually. Studies from literature suggest that guided discovery strategy could have positive impact on students' learning outcomes (Hake, 2002).

The need for inquiring into guided discovery strategy is founded on certain considerations. First, the situation in Nigerian schools is such that much of the learning that actually take place is one of reception with the teacher (or text) presenting verbal expositions of the facts or concepts to be learned (Ajiboye & Ajitoni, 2008; Bilesanmi-Awoderu, 2006). The mode of such presentation therefore becomes crucial for learning. It should be useful then, to explore the role that these learning strategies can play in presentation of facts. In addition to differences in how guided-discovery instruction is implemented, researchers have also differed in how they attempt to measure the effectiveness of this instruction. Decades of research from meta-analyses (almost all from pre-college instruction) suggest that guided-discovery instruction results in improved student learning (Schneider, Krajcik, Marx, & Soloway, 2002; Von Secker & Lissitz, 1999;). But, at the college level the data are mixed as to whether increasing discovery instruction can significantly change student learning or attitude toward science (Berg, Bergendahl, Lundberg & Tibell, 2003; Luckie, Maleszewski, Loznak, & Krha, 2004;). Most studies on the effectiveness of guided-discovery investigations have measured student achievement through acquisition of content knowledge, conceptual understanding, and overcoming misconceptions. Using these variables, studies have demonstrated increases in student achievement in classrooms (Sundberg & Moncada, 1994). However, other researchers have found either little or no statistically significant differences in student achievement in discovery labs (Jackman, 1987), or have found increased abilities for reflection and ability to describe concepts, but not in general knowledge or comprehension.

In guided-discovery method, the instructor poses an initial problem, but then guides the students in selecting variables, planning procedures, controlling variables, planning measures, and finding flaws through questioning that will help students arrive at a solution that motivates and boost their achievements. Educationally, achievement may be defined as "the mastering of major concepts and principles, facts, skills and strategic knowledge. More systematically, achievement is sometimes fractionated into knowledge components (Douglas & Kristin, 2000). Ruiz-primo (2011) observed that students can learn both new concepts and skills while solving problems. He explained further that student's achievement improves when they are given the opportunity to discover and invent to be able to practice what they have learnt.

Retention, according to the Oxford advanced learners dictionary (7th edition) is the ability to remember a piece of information acquired over a period of time. The longer the period a student remembers what has been learnt the better the retention and vice-versa. Over the years, a number of methodological problems confront researchers who have tried to investigate the trace decay theory. One of the major problems of researchers is controlling for the events that occur between learning and recall. Clearly, the time between learning something and recalling it could be filled with all kinds of different events which makes it difficult to ascertain that any amount of forgetting which takes place is as a result of the decay in knowledge rather than a consequence of other intervening variables. Teaching methods or approaches, especially in the learning of science and technology are expected not only to enable students acquire knowledge but to retain same over a long period of time and discovery learning can assist in improving the understanding, critical thinking skills, problem solving skills, communication skills of learners, increase the involvement of learners, both individually and socially, in exploring and critically solving problems (Brown, 2004). It has also been found that high school and college students in the good quality motivation through students-centered strategies display the most optimal pattern of education outcomes and score highest on perceived-need supportive teaching (Vansteenkiste, 2009).

This finding stresses the importance of teaching and instruction which is able to better meet the satisfaction of three basic needs of motivation, i.e. 1) students' need for autonomy, 2) competence, and 3) relatedness (Deci & Ryan, 2000 and Vansteenkiste, 2009). Teachers remark that students are more attentive, more collaborative, and more intellectually engaged in science when they are using guided-discovery strategy and moreover some teachers indicate that students whose interest in science had been minimal in the past may have impressive contributions using guided-discovery method and took science more seriously (Slotta & Linn, 2009). In view of these; we should therefore continue to seek strategies which would improve and motivate students' mastery of the subject as well as their academic achievement and retention in schools.

Statement of the Problem

The poor performance of some junior secondary school students in Basic science has been widely reported. It has been observed by the researcher that many students, after learning about science concepts through activities that address the various intelligences and learning styles, still choose not to participate in classroom discussion. The reality of science teaching suffers many obstacles in achieving the educational goals; we often hear complaints in the teaching of science in secondary schools and traditional lecture methods still based on conservation and indoctrination are prevailing, which resulted in a decrease in the level of participation and performance among students. However, one cannot shun the fact that, some schools are been deprived from well experienced teachers, who constantly face the challenges of the most effective methods of instruction that could enhance academic achievement and match the diversity among students. These situations seem to have diverse effects on the effective teaching and learning of Science. It is against these mentioned observations that this research was carried out to investigate the effects of guided-discovery strategy in motivating students' academic achievement and retention in Basic Science in junior secondary schools in Ekiti State.

Purpose of the Study

The purpose of this study was to examine the effect of effects of guided-discovery strategy in motivating students' academic achievement and retention in Basic Science in junior secondary schools in Ekiti State.In addition, the study will find out the achievement and retention levels of students exposed to guided-discovery strategy and those exposed to conventional method. The outcome of this effort will be used to suggest steps that can motivate and improve students' learning outcome in science.

Research Hypotheses

The following null hypotheses were generated and tested:

1. There is no significant difference between the posttest achievement mean scores of students exposed to the conventional strategy and guided-discovery strategy
2. There is no significant difference between the posttest retention mean scores of students exposed to conventional strategy and guided-discovery strategy
3. There is no significant difference between the posttest achievement mean scores and retention mean scores of students exposed to guided-discovery strategy.

4. There is no significant difference between the posttest achievement mean scores and retention mean scores of students exposed to conventional strategy.

Methodology

The study was a quasi-experimental pre-test, post-test, control group design. The pre-test was to establish the knowledge base line of the students that was used for the study while the post-test will measure the level of academic performance of the students after treatment. The design of the study is represented as follows: Experimental Group = $0_1X_10_2$, Control Group =0_3 X_20_4.Where $0_1,0_3$, represent pre-test. X_1= guided-discovery strategy, X_2= Conventional method. Also, $0_2,0_4$, represent post-test.

The target population for this study was made up of all the public Junior Secondary School II Basic Science students in Ekiti State.The sample for this study comprised 180 junior secondary school II Basic Science students selected from the three senatorial districts in Ekitistate using the multistage sampling technique. The first stage involved the selection of three local government areas across the three senatorial districts through random sampling technique. The local government selected were; Ikere, Ido-Osi and Ijero. The second stage also involved selectionof one school from each local government area through random sampling technique, while the next stage involved the selection of sixty (60) students from each of the sampled schools using stratified random sampling technique to ensure gender equality. Intact classes were used in each of the sampled schools.The instrument that was used for this study is Basic Science Achievement Test (BSAT). It is a self-designed instrument. Section A of the BSAT consisted of information on bio-data of the respondents while Section B consisted of 40 multiple-choice items that covers all the content of the chosen topics used as achievement test and re-arranged after few weeks and used as retention test. Expert judgements were used to ensure face and content validity. Test-retest method was used to determine the reliability and reliability Coefficient of 0.72 was obtained.

Results and Discussion

Hypothesis 1: There is no significant difference between the posttest achievement mean scores of students exposed to conventional strategy and guided-discovery.

In testing this hypothesis, the mean total scores and standard error obtained from the posttest achievement mean scores of students exposed to the guided- discovery strategy and conventional strategy were subjected to t-test analysis at 0.05 level of significance.

Table 1: The t-test showing the posttest achievement mean scores of students exposed to the guided-discovery strategy and conventional strategy

Group	N	Mean	SD	df	t-cal	t-table	Result
Guided-discovery method	90	12.58	4.26	149	15.82	1.98	Significant at p<0.05
Conventional	90	8.76	3.25				

Table 1 shows that the achievement mean score of students exposed to guided-discovery strategy is 12.58 with standard deviation of 4.26, while the achievement mean

score of students exposed to conventional method is 8.76 with standard deviation of 3.25. The t-calculated is 15.82, while the t-table is 1.98. Thus the t-calculated is greater than the t-table value; therefore, the null hypothesis is rejected.

Hypothesis 2: There is no significant difference between the posttest retention mean scores of students exposed to guided-discovery strategy and conventional strategy.

In testing this hypothesis, the mean total scores and standard errors obtained from posttest retention mean scores of students exposed to guided-discovery strategy and conventional strategywere subjected to t-test analysis at 0.05 level of significance.

Table 2: the t-test showing the posttest retention mean scores of students exposed to guided-discovery strategy and conventional strategy.

Group	N	Mean	SD	df	t-cal	t-tab	Result
Guided-discovery method	90	27.14	4.12	149	3.26	1.98	Significant at p<0.05
Conventional method	90	29.36	4.28				

Table 2 shows that the retention means score of students exposed to guided-discovery strategy is 27.14 with standard deviation of 4.12, while the retention mean score of students exposed to conventional method is 29.36 with standard deviation of 4.28. The t-calculated is 3.26 while the table value is 1.98. Thus, the t-calculated is greater than t-table value,therefore, the null-hypothesis is rejected. This implies that there is a significant difference between posttest retention means scores of students exposed to guided-discovery strategy and conventional strategy.

Hypothesis 3: There is no significant difference between the posttest achievement mean scores and retention mean scores of students exposed to guided-discovery strategy.

In testing this hypothesis, the mean total score and standard error obtained from the posttest achievement mean scores and retention mean scores of students exposed to guided-discovery strategy were subjected to t-test analysis at 0.05 level of significance

Table 3: The t-test showing the posttest achievement mean scores and retention mean scores of students exposed to guided-discovery strategy

Group	Variable	N	Mean	SD	df	t-cal	t-table	result
Guided-discovery method	Achievement Retention	45 45	27.33 13.63	10.40 16.24	89	4.39	1.98	Significant at p<0.05

Table 3 shows that the posttest achievement mean score of students exposed to guded-discovery strategy is 27.33 with standard deviation of 10.40, while the retention mean score of students exposed to guided-discovery method is 13.63 with standard deviation of 16.24. The t-calculated is 4.39 while the t-table is 1.98. Thus the t-calculated is greater than the t-table value; therefore, the null hypothesis is rejected. This implies that there is a significant difference between the posttest achievement means scores and retention mean scores of students exposed to inquiry-based strategy

Hypothesis 4: There is no significant difference between the posttest achievement mean scores and retention mean scores of students exposed to conventional strategy.

In testing this hypothesis, the mean total score and standard error obtained from the posttest achievement mean scores and retention mean scores of students exposed to conventional strategy were subjected to t-test analysis at 0.05 level of significance.

Table 4: The t-test showing the posttest achievement mean scores and retention mean scores of students exposed to conventional strategy.

Group	Variable	N	Mean	SD	df	t-cal	t-table	result
Conventional Method	Achievement Retention	45 45	26.54 25.34	3.20 3.34	89	1.47	1.98	Not Significant atp<0.05

Table 4 shows that the posttest achievement mean score of students exposed to conventional strategy is 26.54 with standard deviation of 3.20, while the retention mean score of students exposed to conventional method is 25.34 with standard deviation of 3.34. The t-calculated is 1.47 while the t-table is 1.98. Thus the t-calculated is less than the t-table value; therefore, the null hypothesis is not rejected. This implies that there is no significant difference between the posttest achievements means scores and retention mean scores of students exposed to conventional strategy.

Discussion

The finding of the study revealed in hypothesis1 that there is significant difference between the posttest achievements mean scores of students exposed to the guided-discovery strategy and conventional strategy.

The study also revealed in hypothesis 2 that there is a significant difference between the posttest retention mean scores of students exposed to guided-discovery strategy and conventional strategy. This is in accordance to the submission of Brown ((2004) who was of opinion that, teaching methods or approaches, especially in the learning of science and technology are expected not only to enable students acquire knowledge but to retain same over a long period of time and discovery learning can assist in improving the understanding, critical thinking skills, problem solving skills, communication skills of learners, increase the involvement of learners, both individually and socially, in exploring and critically solving problems.

In hypothesis 3 there was a significant difference between the posttest achievement mean scores and retention mean scores of students exposed to guided-discovery strategy.This was also supported by Slotta & Linn (2009) who asserted that teachers remark that students are more attentive, more collaborative, and more intellectually engaged in science when they are using guided-discovery strategy and moreover some teachers indicate that students whose interest in science had been minimal in the past made impressive contributions using guided-discovery method and took science more serious and achieve overall improvement in motivation and learning outcome.

In hypothesis 4 there was no significant difference between the posttest achievement mean scores and retention mean scores of students exposed to conventional strategy. It was therefore found from the study that students exposed to guided-discovery strategy performed better than those exposed to conventional method.

Conclusion

Based on the findings of this study, it was found that Guided-discovery strategy was more effective in teaching Basic Science than the conventional method. The guided-discovery instructional strategy allowsstudents to construct their own meanings and discover scientific concepts by teachers guidance, therefore has the potency of producing higher students' learning outcome. It is also concluded that a positive students' motivation through more active instructional strategy will go a long way in improving their achievement and retention in Basic Science. Therefore, teachers must assist their students in this direction to further enhance better learning outcome towards the subject.

Recommendations

Based on the findings, the researcher considers the following recommendations necessary:

1. Basic Science teachers should adopt guided-discovery strategy in classrooms to enable students participate actively and develop their thinking and discovery potentials in order to improve their achievement and retention skills in Basic Science.
2. The curriculum planners should introduce some collaborative packages into the methodologies of teaching sciences to update teachers' knowledge on the application of the guided-discovery strategy.
3. Government should provide enabling environment for teachers and making the school conducive for participatory studentship.

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