EFFECTS OF INQUIRY-BASED INSTRUCTION ON ACQUISITION OF PROCESS SKILLS AMONG SENIOR SECONDARY SCHOOL BIOLOGY STUDENTS IN LERE EDUCATION ZONE KADUNA, NIGERIA

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ABSTRACT
The aim of the research was to investigate the effects of inquiry-based instruction on acquisition of process skills among senior secondary school Biology students in Lere Education Zone Kaduna, Nigeria. One objective, research question and hypothesis guided the research. The research design for this study was quasi experimental, pretest and posttest, experimental and control group design was used for the study. The population comprised all 1908 senior secondary school Biology students in Lere Education Zone and a sample consisting of 118 students randomly selected from two coeducational schools was used for the study. The experimental group was taught Biology concepts using inquiry-based instruction while the control group was exposed to lecture method. Science Process Skill Acquisition Test (SPSAT) adapted by the researchers was validated by experts and pilot tested for reliability. T-test statistic was used to analyse the data collected. The results of the study revealed that differences exist on acquisition of process skills when students are exposed to inquiry-based instruction and lecture teaching method in favour of experimental group. Based on the research finding, it was recommended that the use of inquiry-based instruction should be encourage among teachers of Biology to enhance students’ acquisition of process skills.

KEYWORDS: Effect, Inquiry-based, Instruction, Acquisition, Process skills

INTRODUCTION
A cursory look at the secondary schools in Nigeria has shown that many teachers in the system still rely much on the traditional “chalk and talk” method of teaching rather than embracing the use of inquiry-based teaching strategy. Okebukola (2009) identified some weaknesses exhibited by tertiary institution graduating teachers that lack practical skills, shallow knowledge of Biology and poor knowledge of teaching methodologies. Ericsson (2008), observed that the difficulty perceived by science students is their inability to make
reasonable connection between concept areas and its application in solving problems in Biology. Okebukola (2009) also attributed the poor acquisition of process skills in Biology to the use of ineffective teaching and learning strategies and lack of appropriate learning environment under which Biology teaching takes place. This study therefore investigated the effect of inquiry-based instruction on acquisition of process skills among senior secondary school Biology students.

One of the most common methods of teaching science at the Senior Secondary level is lecture method. According to Bichi (2002) this is a method of teaching that emphasizes “talk and chalk” in the teaching of science subject. More than 80% of the scientific information and principles are delivered as lectures. Teachers embrace this method for easy coverage of the school syllabus. It is characterized by one-way flow of information from the teacher who is always active, to the students who are always passive. In its true nature, lecture method is not effective for science teaching. James (2000), Usman (2000) and Bichi (2002) all argued against it because it does not promote meaningful learning. They further explained that the use of lecture method of teaching in science leads to rote learning. Achilles and Pate (2002) reported a decree in skills acquisition when lecture method is used. However, lecture method of teaching should not be totally discouraged, but there is need to improve on it for effective teaching and learning of Biology. This can be done by the use of inquiry-based instruction.

The National Research Council (NRC) reports (2000) called for inquiry-based methods that led to current reforms and an increased emphasis on inquiry in science curricula. Inquiry has been identified as a teaching and learning method that provides learners with motivation to learn and develop skills to be successful throughout life (Mayer, 2008). NRC explained that students benefit by learning science through authentic investigations similar to those conducted by professional scientists. In theory, with the placement of science in a context through inquiry-based instruction, teachers and students begin to develop their approach to science, and this investigative learning leads to better understanding (NRC, 2000).

Inquiry-based method of teaching is a teaching method where the learner, with minimum guidance from the teacher seeks to discover and create answers to a recognized problem through procedure of making a diligent search (Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011). Inquiry is a term used in science teaching that refers to a way of questioning, seeking knowledge or information or finding out about phenomenon. Using these method students learn not only concepts and principles but self-direction, responsibility and social communication. It is a highly interactive step by step approach which involves students at all levels of discussion (Obeka, 2010). It is also the way people learn when they are left alone.
The search for a more effective approach for the teaching and learning of Biology that will enhance the acquisition of process skills has persisted over the years. This is because the acquisition of science process skills and the bases for science inquiry and development of intellectual skills and attitudes that are needed to learn concepts are not utilized by Biology teachers. Ibe (2004), asserted that science process skills are abilities which can be developed by experience and used in carrying out mental and physical operations. Fernandes, Moira and Cruickshank (2012) claim that by allowing students to learn science the way scientists practice science they will be able to gain an understanding of science content and develop science process skills. These process skills are fundamental to science due to the fact that it allows students to conduct investigations and from its conclusions are drawn. Cardall, Krupat and Ulrich (2008) suggested that learning can be meaningful by activity-based instructional strategy such as discovery method, problem-solving and inquiry method. Bichi (2002) also observed that as students engage in solving problems; they acquire skills and confidence which aid their capacity to tackle future problem.

From the definitions, inquiry-based instruction can also be seen as a pedagogical approach that invites students to explore academic content by posing, investigating and answering questions to the discovered problem or problems. Also known as problem-based teaching or simply as “inquiry,” this approach puts students’ questions at the centre of the curriculum, and places just as much value on the component skills of research as it does on knowledge and understanding of content.

Osborne, Lupshenyuk and Wideman (2012) opined that, science process skills development requires direct involvement in scientific activities and procedures in the laboratories and in the field. Reading and activity-oriented science emphasized the same intellectual skills and are both concerned with thinking processes. Ibe (2004) reports that the American Association for the Advancement of Science (AAAS) developed a programme known as “Science A Process Approach” (SAPA). This programme sees science processes as true essence of science. The programme was designed to improve children’s skills in the process of science. Ajunwa (2000) reported that science educators and curriculum experts modified them by their expanding or condensing them to suit their special needs or expectations. Some of these science process skills include: observation, measuring, classifying, operational definition, experimentation, communicating, among others. In this study, effects of inquiry-based instruction in acquisition of process skills, in ecology among secondary school students will be investigated.
STATEMENT OF THE PROBLEM

The curricular developmental aspect of Biology has focused more on rote learning over years which makes instruction teacher-centred (Usman, 2000). According to Gyuse (2009), vital abstract contents in Biology can hardly be effectively communicated to the learners theoretically. Students need to be taught using inquiry method. Achilles and Pate (2002) reported poor skills acquisition when lecture method is used to teach Biology concepts and other science related subjects. Most teachers still prefer using the ‘chalk and talk’ method in instructing learners (the lecture method approach). But Swanson and Brown (2008) observed that the problem associated with teaching of Biology can be effectively handled by teaching with inquiry-based instruction.

The need to find solution to students’ poor acquisition of science process skills is therefore an obvious factor as Zayun (2008) opined that several factors have been responsible for low acquisition of science process skills. These include: Teaching methods, learning materials, societal factors and strategies employed by teachers among others. Shehu (2006) discovered that the major problem of Biology is rooted in the difficult nature of Biology as a result of using poor teaching method to teach Biology concepts. Yusuf (2012) added that the difficulty perceived by science students is their inability to make reasonable connection between concept areas and its application in solving problem in Biology as a result of poor methods used by many science teachers. The need to use appropriate method that will boost the acquisition of process skills is a point of concern.

OBJECTIVE OF THE STUDY

Specifically, the study intends to ascertain whether or not using inquiry-based instruction will enhance students’ acquisition of science process skills.

RESEARCH QUESTION

This research question was formulated to guide the study:

1. What is the difference in process skills acquisition between students taught using inquiry-based instruction and those taught using lecture method?

NULL HYPOTHESIS

The null hypothesis was formulated and tested at $P \leq 0.05$ level of significance.

$H_{01}$: There is no significant difference in the acquisition of process skills between students exposed to inquiry-based instruction and those exposed to lecture method.

METHODOLOGY

This study investigated the effects of inquiry-based instruction on acquisition of process skills among senior secondary school Biology students in Lere Education Zone. The research design for this study was quasi-experimental involving pretest, post-test and experimental and
control groups. The schools were located at different places to avoid interaction between the
two groups experimental and control. The sample schools were GSS Geshere and GSS Kono.
SS II intact classes were used with a population of 56 for GSS Geshere and 62 for GSS Kono
respectively. The instrument used was Science Process Skills Acquisition Test (SPSAT) made
up of 20 items. The instrument was validated by experts and the reliability was found to be
0.74. The experimental group was taught using inquiry-based instruction while the control
group was taught using lecture method for six weeks. The data collected were analyzed using
mean, standard deviation and t-test statistics at P≤0.05 level of significant.

RESULTS

Research question one: What is the difference in process skills acquisition between students
taught using inquiry-based instruction and those taught using lecture method?

In order to answer this research question, a descriptive statistic of mean scores and standard
deviation were used.

Table 1: Summary of Posttest Mean Score for the Acquisition of Process Skills for
Experimental and Control Group

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Std. Err</th>
<th>Mean Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>56</td>
<td>52.650</td>
<td>7.2589</td>
<td>1.3253</td>
<td>11.167</td>
</tr>
<tr>
<td>Control</td>
<td>62</td>
<td>41.483</td>
<td>3.9072</td>
<td>0.7133</td>
<td></td>
</tr>
</tbody>
</table>

In table 1 the results showed that there was difference in acquisition of process skills
when students were exposed to inquiry-based and lecture teaching methods. Their computed
mean acquisition of process skills was 52.650 and 41.483 for the experimental and control
groups respectively indicating a mean difference of 11.167 in favour of the experimental group.
This showed that the group exposed to inquiry-based instruction have higher mean score for
the acquisition of process skills than their counterparts taught using lecture teaching method.

Null Hypothesis

Ho1: There is no significant difference in the acquisition of process skills between students
exposed to inquiry-based instruction and those exposed to lecture method.

To answer the null hypothesis, t-test was used for the analysis at p≥0.05 level of
significance for retaining or rejecting the null hypothesis.

Table 2: Independent t-test Statistics on The Difference in the Acquisition of Process
Skills in Experimental and Control Group

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Std. Err</th>
<th>Df</th>
<th>P</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>56</td>
<td>52.650</td>
<td>7.2589</td>
<td>1.3253</td>
<td>116</td>
<td>0.001</td>
<td>S</td>
</tr>
<tr>
<td>Control</td>
<td>62</td>
<td>41.483</td>
<td>3.9072</td>
<td>0.7133</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p ≤ 0.05
The results in Table 2 showed that the p-value of 0.001 was observed at df= 116. Since the p-value is less than the alpha value of 0.05, it means therefore that the difference in the acquisition of process skills when students are exposed to inquiry-based instruction and lecture method was significant in favour of the experimental group. Therefore, the null hypothesis was rejected.

DISCUSSION

From the result in Tables 1 and 2, the findings showed that there was significant difference when students were exposed to inquiry and lecture teaching method in favour of experimental group and this could be as a result of the use of inquiry-based instruction to teach the experimental group. The null hypothesis was therefore rejected. This agreed with Mayer (2008) who stated that inquiry has been identified as a teaching and learning method that provided learners with motivation to learn and develop skills to be successful throughout life. The findings agreed with Tamim et al. (2011) who came out with a similar finding on effects of discovery method on secondary school students’ process skill acquisition in Abuja Municipal Area Council, Nigeria. The authors found out that discovery method was more effective in fostering students’ acquisition of science process skills.

The research results agreed with that of Bichi (2002) who observed that as students engage in activities; they acquire skills and confidence which aid their capacity to tackle future problem. This is also in line with the work of Osborne et al. (2012) who found out that, science involves active participation of the learner in the learning process; consequently, science is about doing things; that is, activity-oriented. Active participation of the learner can help him acquire science process skills.

CONCLUSION

Based on the findings of this study, it was revealed that students have higher mean acquisition of process skills when exposed to inquiry-based instruction than those exposed to lecture method.

RECOMMENDATION

On the basis of the findings emanating from this study, the use of inquiry-based instruction should be encouraged among teachers of Biology to improve students’ acquisition of process skills.

REFERENCES


