

INFLUENCE OF TEACHERS' DEMONSTRATION OF SCIENCE PROCESS SKILLS ON STUDENTS' ACHIEVEMENT IN BIOLOGY IN SECONDARY SCHOOL IN SOUTHWEST, NIGERIA.

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Abstract

The study examined the influence of teachers' demonstration of science process skills on students' achievement in Biology. The study specifically outlined various science process skills used in Biology teaching. It employed a descriptive research design of correlation type. The population for the study comprised all Senior Secondary School two (SSS2) students and Biology teachers in both public and private schools in South West, Nigeria. The sample consisted 1,500 Biology students and 90 Biology teachers selected from 36 schools in 3 participating states (Ondo, Osun, Ekiti) using multistage sampling procedure. The instruments used for the study were: Biology Achievement Test (BAT) and Teachers' Demonstration of Science Process Skills (TDSPS). The instruments were subjected to face, content and construct validity and their reliability co-efficient were ascertained using test-retest method. The reliability co-efficient of 0.79 was obtained for TDSPS while BAT was adapted from West Africa Examination Council and National Examination Council past questions being a standardized test. Two research questions were raised and one null hypothesis was formulated and tested at 0.05 level of significance. The research questions were answered using descriptive statistics of frequency count, percentage and standard deviation while the null hypothesis formulated was tested using inferential statistics. The findings of the study revealed a significant correlation between teachers' demonstration of science process skills and students' achievement. Based on the findings, it was recommended that Biology teachers should engage students in scientific skills that could promote meaningful learning in Biology classroom.

Key Note: Process- skills, content- knowledge, Achievement, Teachers' demonstration.

Introduction

Science process skills are the scientific skills to be inculcated in science students in terms of abilities, potentials and technical know-how which can be developed through experience and used in carrying out mental operations and physical actions (Nwosu 2004). The American Association of Advancement of Science (AAAS) classified the science process skills into fifteen. These are: observing, classifying, measuring, communicating, inferring, predicting, using space/time relationship, using numbers, questioning, controlling variables, formulating hypothesis, defining operationally, formulating models, designing experiments, and interpreting data. These science process skills according to Collette

and Chiappeta (2004) were later grouped into basic and integrated.

According to Rambuda and Fraser (2004), the basic science process skills apply specifically to foundational cognitive functioning especially in elementary classes. They represented the foundation of scientific reasoning that learners are required to master before acquiring and mastering the advance integrated science process skills (Brotheton and Preece, 1995). Rambuda and Fraser (2004), maintained that basic science process skills are interdependent, implying that scientists may display and apply more than one of the skills in any single activity. For instance, to measure the area of a habitat, Biology students

may start by observing the habitat, then measure the dimensions and communicate the same using symbol; thereafter the students may calculate the area. In this scenario, the students have involved in the skill of observing, measuring and calculating. The basic science process skills include: observing, communicating, classifying, measuring, inferring and predicting (Padilla, 1990). From this, it appears that the basic science process skills provide an intellectual groundwork in problem solving.

On the other hand, the integrated science process skills are the immediate skills used in problem solving or doing science experiments. As the term integrated implies, learners are called upon to combine basic science process skills for greater expertise and flexibility to design the tools they apply when they study or investigate phenomena. The integrated science process skills include controlling variables, defining operationally, formulating hypothesis, interpreting data, experimenting and formulating models.

Ozgelen (2012), enthused that science process skills are thinking skills that scientists use to construct knowledge in order to solve problems and formulate results. Implicit in these definitions of science process skills is that these skills are integral and natural to a scientist: they are instruments for the study and generation of scientific knowledge, science learning and development of science process skills are integrated activities.

Therefore, teachers should impart these skills into Biology students during teaching and learning process. Basic science process skills form the backbone of the more advanced problem solving skills and capacities (Padilla, 1990). These include observing, communicating, measuring, inferring, classifying, and predicting. It appears that basic science process skills provide the intellectual ground work in solving scientific problems. Integrated science process skills combine two or more basic process skills and are therefore more advanced than basic science process skills. They are the immediate skills that are used in sciences, they include such skills as identifying variables, formulating hypotheses, describing relationship between variables, designing investigations, experimenting, acquiring data, formulating

model, defining variable operationally, understanding cause and effect relationships.

The researcher observed that science process skills are cognitive and psychomotor skills employed in problem solving. They are the skills which scientists use in problem identification, objective inquiry, data gathering, transformation, interpretation and communication. Science process skills can be acquired and developed through training such as are involved in science practical activities. They are the aspects of science learning which are retained after cognitive knowledge has been forgotten. Using science process skills is an important indication of transfer of knowledge which is necessary for problem-solving and functional living.

In addition, science process skills are seen as problem solving skills in which a problem is represented and a systematic process is carried out in order to arrive at solving the problem. Science process skills are important for teaching ways of reaching knowledge. The students need the process skills both when doing scientific investigations and during their learning process (Harlen, 2000; Taconis, Ferguson-Hessier and Broekkamp, 2000). Science process skills are also believed to be able to ensure that students have meaningful learning experience because they help students to develop higher order thinking (Lee, Hairston, Thames, Lawrence & Herron, 2002).

The science process skills must be understood by the teachers so that they can impart on their students a lasting and valuable science comprehension. Science process skills are vital for students and teachers should inculcate them in their students very early in life. It is essential that teachers do not only have an understanding of the science process skills, but must be functional literate in the skills in order to effectively and appropriately teach them to the students during Biology lessons.

Statement of the Problem

Biology teachers are faced with the challenge of improving Biology teaching so that learners can achieve high in their academic career. Since Biology learning leads to higher scientific development of any nation, it is necessary that Biology teachers should demonstrate appropriate science process skills in their classrooms to

enhance effective learning and better academic achievement in Biology. The researcher observed poor demonstration of science process skills as a major deficiency in Biology teaching which could be attributed to the fact that most Biology teachers fail to demonstrate these skills in the classrooms.

The achievement of students have been of great concern to many educators, parents, guardians, curriculum planners, researcher and government. It is of great concern that students are not achieving as expected in Biology, this may be due to poor demonstration of science process skills.

Significance of the Study

The study was designed to determine the relationship between teachers' demonstration of science process skills and students' achievement in Biology.

Research Questions

In order to find solution to the problem of this study, the following research questions were raised:

1. What is the pattern of student's achievement in Biology?
2. Is there any relationship between teachers' demonstration of science process skills and students' achievement in Biology?

Research Hypothesis

One null hypothesis was formulated for the study:

There was no significance relationship between teachers' demonstration of science process skills and students' achievement in Biology.

Research Method

The study employed a descriptive research design of correlational type.

The population for the study comprised all Senior Secondary School two (SSS2) students and Biology teachers in all public and private schools in South West, Nigeria. The sample for this study consisted of 1,500 Biology students and 90 Biology teachers selected from 36 Senior Secondary Schools in three Senatorial Districts of Ondo, Osun and Ekiti states. Both students and teachers for this study were selected through multistage sampling procedure using stratified and purposive sampling technique across the

public and private urban and rural senior secondary schools of the participating states in order to enable all participants have equal chance of being selected for the study. Two research instruments were used to collect relevant data for the study. These were: Biology Achievement Test (BAT), and Teachers' Demonstration of Science Process Skills Questionnaire (TDSPSQ).

The instruments were subjected to face, content and construct validity, this was ensured by given the instruments to experience Biology teachers, experts in tests, measurement and evaluation for their suggestions, correction and to ascertain its suitability. Biology Achievement Test was adapted from West Africa Examination Council (WAEC) and National Examination Council (NECO) past questions hence, a standardized test. The reliability of the Questionnaire on Teachers' Demonstration of Science Process Skills was ensured through test-retest method. The results obtained showed the reliability co-efficient of 0.79 which suggested that the instrument was reliable enough for use.

Results

Question 1

What is the pattern of students' achievement in Biology?

In answering question 1, scores on Biology Achievement Test (BAT) was obtained and expressed in percentages of the total score (25 marks). Students' scores were categorized into 'Fail', 'Pass', 'Credit' and 'Distinction'. Students who scored below 40% were categorized as 'Fail' while those who scores above 40%-49%, 50-69%, 70% and more were grouped into 'Pass', 'Credit' and 'Distinction' respectively. The result is presented in Table 1 and Figure I

Table 1: Pattern of students' achievement in Biology

| Academic performance | Frequency | Percent | Cumulative Percent |
|----------------------------|-----------|---------|--------------------|
| Fail (0-40) | 802 | 53.5 | 53.5 |
| Pass (40-49) | 371 | 24.7 | 78.2 |
| Credit (50-69) | 275 | 18.3 | 96.5 |
| Distinction (70 and above) | 52 | 3.5 | 100.0 |
| Total | 1500 | 100.0 | |

Table 1 revealed that 802 students representing 53.5% of the total sample failed, 371(24.7%) passed, 275(18.3%) had credit while 52(3.5%) had distinction in Biology. cursory look at the result further that about 78.2% of the sample had below credit pass in Biology while 21.8% passed at credit level. This implies that the level of

students' achievement in Biology is low. The level of students' achievement in Biology is further presented in Figure I

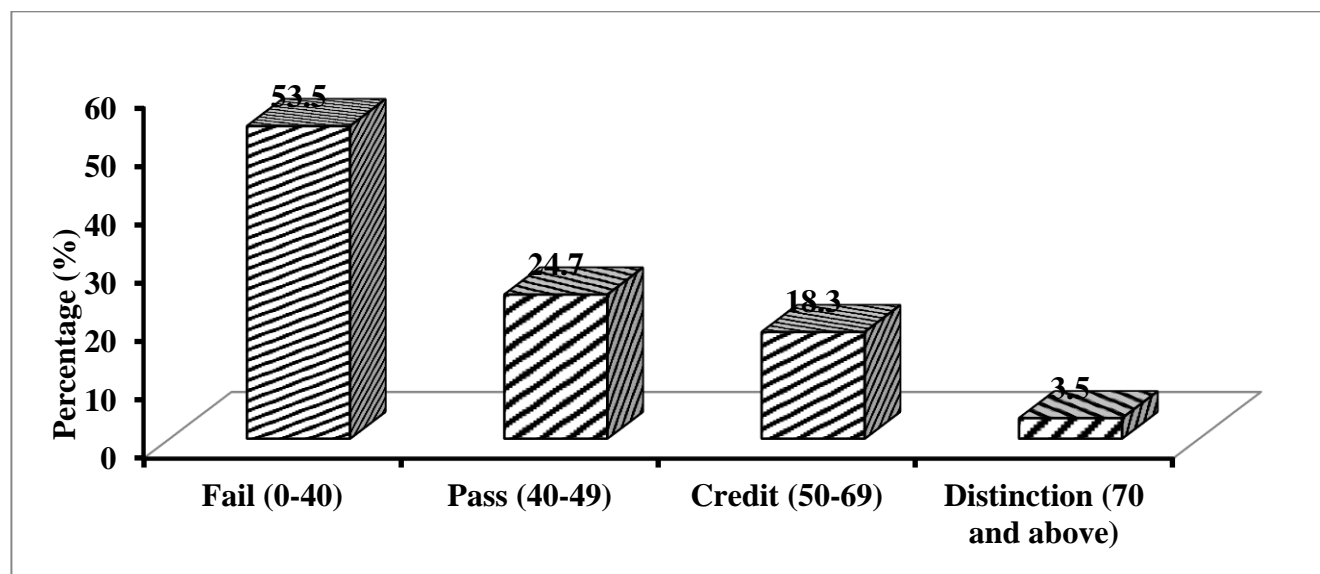


Figure I: Pattern of students' achievement in Biology

The chart indicated that 53.5% students failed Biology examination, 24.7% scored average marks between 40-49; 18.3% Biology students scored between 50-69 marks while only 3.5% Biology students scored 70 and above. Hence, the achievement of Biology students is low.

Hypothesis

There is no significant relationship between teachers' demonstration of science process skills and students' achievement in Biology.

Table 2: Pearson's Correlation of teacher's demonstration of science process skills and students' achievement in Biology

| Variable | N | Mean | SD | r_{cal} | r_{table} |
|---|------|-------|------|-----------|-------------|
| Teacher's demonstration of science process skills | 90 | 23.53 | 6.90 | 0.228* | 0.195 |
| Students' achievement in Biology | 1500 | 9.81 | 2.43 | | |

* $p < 0.05$

Table 2 revealed that $r_{cal}(0.228)$ is greater than $r_{table}(0.195)$ at 0.05 level of significance. The null hypothesis is rejected. This implies that there is significant relationship between teachers' demonstration of science process skills and students' achievement in Biology. The correlation between teacher's demonstration of science process skills and students' achievement is low, positive but statistically significant at 0.05 level. Hence, teacher's demonstration of science process skills could promote students' achievement in Biology

Discussion

The result of the findings revealed a significant correlation between teachers' demonstration of science process skills and students' achievement. This implies that teachers' demonstration of science process skills could engage students in scientific skills, promote meaningful learning and develop adequate understanding in Biology students. The finding is consistent with Sevilay (2011), who revealed that the mastery of science process skills enable students to conceptualize at a much deeper level, the content they do know and equips them for acquiring content knowledge

in the future. Content knowledge is acquired more efficiently and understood at a deeper level when obtained through inquiry using science process skills. The science curriculum that emphasizes science process skills will be able to help students to improve the skills in decision making, critical, and creative thinking. These skills can be transferred to other disciplines (Meador, 2003; Halim and Meerah, 2012). It was also revealed that science process skills are terminal skills for carrying out any experiment in Biology. This was in agreement with Opaleye (2012) who enthused that science process skills are helpful on the development of favourable scientific attitudes and a disposition in the learners. These include being curious and imaginative, enthusiasm about inquisitiveness.

Conclusion and Recommendations

It was concluded that science process skills are essential in promoting scientific skills during Biology lessons. Science process skills are very important for science achievement and for other science related subjects. Demonstration of science process skills in the classroom by teachers help students to move from one cognitive development level to the next, enhance operational ability and problem-solving skills in Biology classroom.

It was therefore recommended that Biology teachers should inculcate science process skills in their students to provide them with active skills, foster a natural sense of curiosity which is for scientific creativity. Biology teachers should present the subject to the students in a way that students would comprehend and acquire scientific skills as this would enhance their interest in the subject. Biology students should be engaged in scientific skills that could promote meaningful learning in Biology classroom.

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