Effect of Gender on Basic Science Practical Skills of Lower Primary School Pupils

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Abstract
Basic science prepares pupils to have solid foundation in science and builds them as future scientists. Lack of proper exposure to practical activities had been identified to be responsible for pupils’ especially girls not developing appropriate practical skills needed for scientific and technological development. This study therefore determined the moderating effect of gender on Generative Instructional Strategy (GIS) and Predict-Observe-Explain (POE) instructional strategy efficacy in improving lower primary pupils’ skills. The study adopted the pre-test, post-test, control group, quasi-experimental research design. Three mixed primary schools were selected using simple random sampling technique. Primary three pupils from three intact classes with population between 25 - 35 pupils were purposively selected for the study. The instrument used for data collection was “Pupils' Basic Science Practical Skills Test” (PBSPST) which was designed to test learners’ knowledge of Basic Science process skills. Data collected were analyzed using Analysis of Covariance (ANCOVA) and t-test. Results showed that there was no significant moderating effect of gender on pupils’ practical skills in Basic Science when taught with GIS and POE instructional strategy ($F=0.27; P >0.05$). The study concluded that practical skills should be constantly developed in male as well as in female pupils so as to improve Basic Science practical skills of lower primary school pupils

Keywords: generative, gender, practical skills, basic science, predict-observe-explain, process skill

INTRODUCTION
The development of any nation is indicated by the overall social, economic and political progress and dependent upon man’s activities in his natural environment. These activities revolve around science and its technological applications. It therefore implies that for any meaningful national growth and development to be achieved, Science and Technology must be an essential part of the nation’s culture (Nwagbo, 2006; Opara, 2004; Adeniyi, 2005). Indeed, Science and Technology is a critical instrument for the upliftment of the nation’s economy. Hence, it should form the basis for development as well as an influencing factor of peoples’ thinking and working processes. It is on this note that Ajayi (2009) stated that to achieve this, efforts must begin early in the life of Nigerian learners when fifty percent of the capability to learn would have been formed and not later, that is, at early childhood level.

The science process skills are the tools that students use to investigate the world around them and to construct science concepts, so it is essential for teachers to have a good understanding of these skills. The development of practical skills which is a science process skill should be a major goal of science education as a result of the search for scientific knowledge which is a process-oriented approach (Gayne, 1965; Awodi, 1984; Shaibu and Mari, 1997). These views influenced the emergence of a process-oriented science curriculum that emphasized the teaching and learning of science as "Science A Process Approach" (SAPA).

According to Brewer (2007), science is a process of observing, thinking and reflecting on actions and events, while Nelson (1996) opined that science teaching at all levels does not require direct teaching rather it required a lot of practice. In addition, Kilmer and Hofman (as cited in Iroegbu, 2012), sees science and its skills acquisition as knowledge about content, the process used to collect and evaluate information as well as the application of science to the problems of human adaptation to the environment. For Ross (as cited in Iroegbu, 2012), children learn a lot of science skills such as observation or well thought out theories through play experiences, Iroegbu (2012), states that since children are naturally active and self-motivated, they learn best through play from personal experiences.

Generative instructional strategy is a practical activity-oriented form of instruction based on “philosophy of discovery”, where learners formulate their ideas, fact and theories through their direct interaction and manipulation of objects, materials and apparatus in practical activities classroom (Wittrock, 1991). Nwagbo, (1999) stated that the guided discovery method is a student-centered activity oriented teaching strategy in which the teacher guides students through problem solving approach to discover answers to instructional topic at hand. This has the potential of arousing and sustaining the interest of the learners. It is an active process, a well
designed instructional strategy that prompts or motivates the learner to actively make connections. The advantage of generative learning is the learner’s deeper understanding and longer retention of what is learned. Foundations for the Prescriptions Research also states that a learner can process new information on a continuum.

Predict-Observe-Explain (POE) is an instructional strategy that uses the philosophy of practical activities that is “learning by doing” (Zuziwe, 2006). Here learners perform three different tasks; predict, observe and explain. The Predict-Observe-Explain (POE) strategy was developed by White et. al. (1981) to uncover individual students’ predictions, and their reasons for making these, about a specific event. It works best with demonstrations that allow immediate observations, and suits physical and material world contexts.

The issue of gender and gender stereotyping permeates every aspect of human endeavor. Okeke (2007) observed that the consequences of gender stereotyping cut across social, economic, political and educational development, especially in the areas of science and technology. However, there have been conflicting reports in respect to gender and achievement in science (Ezeliora, 1999). Many researchers have provided reports that there are no longer distinguishing differences in the cognitive, affective and psychomotor skill achievements of students in respect of gender. However, Croxford (2002); Kolawole, (2007) in their studies found that male students performed better than female students in the cognitive, affective and psychomotor skill achievements. There is a strong association between gender and response to science education.

The issue of gender is an important one in science education especially with increasing emphasis on ways of boosting manpower for technological development as well as increasing the population of females in science and technology fields. In Nigeria, and perhaps the whole of Africa, gender bias is still very prevalent (Arigabu and Moji, 2004). This is a view to which Onyeizugbo (2003) has also alluded in pointing out that sex roles are somewhat rigid in Africa particularly in Nigeria. Also, Ogunkola & Bilesanmi-Awoderu (2000) carried out a research on the effectiveness of laboratory-based and lecture methods on students’ achievement in Biology and they found that students’ achievement in Biology was not sensitive to the sex of students. The results revealed no significant gender-related differences, but females achieved slightly higher grades than males. Kolawole (2007) found that boys performed better than girls in both cooperative and competitive learning strategies when he conducted a research on the effects of competitive and cooperative learning strategies on Nigerian students’ academic performance in mathematics.

The generative and predict-observe-explain (POE) instructional strategies have been used to improve the science practical skills of senior secondary school students in Physics (Babajide, 2010) but the moderating effect of gender on these instructional strategies has not been investigated especially at lower primary school. The study therefore aimed at determining the moderating effect of gender on the efficacy of generative and POE instructional strategies in improving basic science practical skills of pupils.

METHODOLOGY

The research design for this study was pre-test, post-test, control group, quasi-experimental design. The design is represented schematically as follows:

\[ O_1 \times X_1 \times O_2 \times X_2 =\text{Control group} \]

\[ O_3 \times X_3 =\text{Experimental group 1} \]

\[ O_4 \times X_4 =\text{Experimental group 2} \]

\[ O_5, O_6 \text{ are the pre-test scores of control, experimental 1, and 2 groups respectively. Also, O}_7, O_8 \text{ and O}_9 \text{ are the post-test scores of control, experimental 1, and 2 groups respectively. } \]

\[ X_1 = \text{Conventional Teaching Strategy (Control); } \]

\[ X_2 = \text{Predict-Observe-Explain (POE) Instructional Strategy} \]

\[ X_3 = \text{Generative Instructional Strategy} \]

The study population comprised all pupils in lower primary schools in Ondo Town, in Ondo West Local Government Area (LGA) of Ondo State. The sample consisted of three public primary schools randomly selected from the chosen LGA. One arm out of primary three (3) classes consisting of thirty pupils of intact class in each school was purposively assigned to one of the instructional strategies, making a total of ninety (51 males and 39 females) pupils used for the study.

The instrument is a self-designed instrument titled “Pupils’ Basic Science Practical Skills Test” (PBSPST). This was designed to determine the efficacy of the practical skills’ lesson of the pupils’ basic science. It also tested pupils’ abilities to make some deductions on the demonstrations performed based on the six Basic Science process skills of observing, measuring, classifying, predicting, inferring communicating skills. The instrument contained thirty (30)-item multiple pictorials’ choice test on primary three Basic Science module. The items have 50 sub-items that carried two marks each and a total mark of 100.

The “Instructional Package” (IP) was used to arouse the learners’ performance in the Six Basic Science Practical Skills that were demonstrated during the performance and reporting of the experiments/demonstrations in the practical class. Three instructional guides of the same content were
used for the study with one instructional guide for each strategy. All the instructional guides contained the procedures for the two experimental and control groups for the practical topics that were used for the study.

The instrument was subjected to face and content validation by experts in Basic Science and Early Childhood Education. The instructional guides were given to primary science experts and some primary three Basic Science teachers for validation. They went through them with respect to the adequacy, structure, language and relevance of the instrument. Thereafter, a pilot study was carried out to ascertain the reliability of the instrument. The reliability coefficient (r) was calculated for Pupils Basic Science Practical Skills Test (PBSPST) using test-retest method of spearman’s rho (ρ). The reliability value was found to be 0.73. This was an indication that the instrument was reliable and suitable for the study.

The process of data collection for the study took six weeks. After the administration of pre-test, the application of treatments in the two experimental schools and one control school took six weeks of three periods per week to be completed. The procedural steps that were used to carry out the demonstrations were provided for each treatment. The post-test was administered to all the participating pupils after the completion of treatments. The PBSPST results for both pre-test and post-test were scored, collated and analyzed.

**RESULTS**

The data collected were analyzed and the results of the analyses are presented in the tables below:

**Table 1 - Multiple Classification Analysis of Post-Test Practical Skills Scores According to Gender**

<table>
<thead>
<tr>
<th>No.</th>
<th>Unadjusted Mean</th>
<th>Adjusted Mean for Factors and Covariates</th>
<th>Unadjusted Deviation</th>
<th>Adjusted Deviation for Factors and Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>39</td>
<td>61.03</td>
<td>59.31</td>
<td>.94</td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>51</td>
<td>59.37</td>
<td>60.68</td>
</tr>
</tbody>
</table>

Table 1 compared the unadjusted mean score and adjusted mean for factors and covariates of the post-test practical skills of the students by gender. The result showed that though there is little difference in their mean score but not significant. Also, when other factors were taken into consideration, the adjusted mean score showed that there in not a pronounced difference in their score but the mean values showed a slight difference which is not really significant too.

**Figure 4.1**: Graph of interaction effects of CIS, POEIS and GIS and Gender on Pupils’ Practical.

Figure 1 contributes to the fact that female pupils performed slightly better than their male counterparts in the POE instructional strategy as well as in Conventional teaching strategy. On the other hand, male pupils performed slightly better than their female pupils in the Generative instructional strategy group. This implies that POE instructional strategy
slightly favours female pupils while Generative instructional strategy slightly favours male pupils.

DISCUSSION
The result showed that although, there is little difference in the mean score of both male and female but the overall result revealed that gender has no significant moderating effect on pupils’ practical skills in Basic Science. This is in line with the findings of Iroegbu (1998), Babajide (2010), Babajide, (2012) and Johnson and Johnson (1991), who found no significant gender difference among students who were exposed to practical activities at senior secondary schools level. In contrast, Shaibu and Mari (1997) and Adeoye (2000) carried out a research on the effectiveness of laboratory-based and lecture methods on students’ achievement in Biology and obtained significant differences in the performance of boys and girls who are exposed to practical activities.

CONCLUSION
This study had revealed the efficacy of each of the two activity-based instructional strategies on pupils’ practical skills development in basic science of lower primary school and provided empirical data on the moderating effect of gender on pupils’ practical skills development in basic science. Female pupils should not be exempted or marginalized since they have equal chances of excelling as their male counterpart in practical activities. Practical skills should therefore be constantly developed in male as well as in female pupils by the use of activity-oriented form of instruction such as POE instructional strategy.

REFERENCES


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