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Dr Babajide V.F.T

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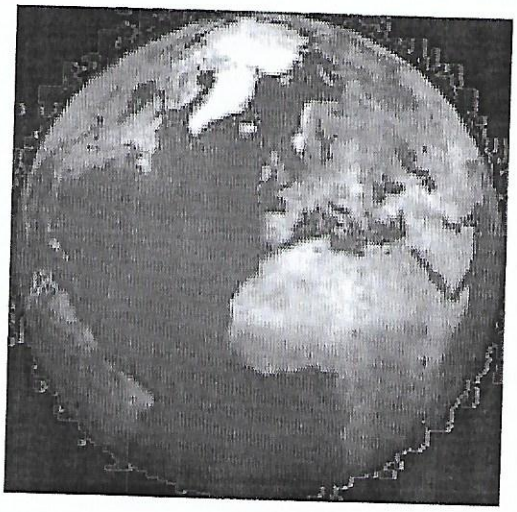

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African Journal of Pedagogy

The **African Journal of Pedagogy (AJEP)** is a Tanzania-based journal that publishes high-quality solicited and unsolicited articles in all areas of education. Such articles must be written in good English language. Articles to be published in the **African Journal of Pedagogy** are usually subjected to peer-review.

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Types of articles that are acceptable

The **African Journal of Pedagogy** accepts two forms of articles for publication. These are:

1) **Report of empirical studies:** These should describe new and carefully confirmed findings, and details of the research methods should be given so that others can verify the work. The length of a full paper should not exceed 6,000 words (i.e. 15 A4 pages).

2) **Reviews or theoretical papers:** Submissions of reviews and perspectives covering topics of current interest may be accepted for publication. The length of a reviewed paper should not exceed 6,000 words (i.e. 15 A4 pages).

Method of Submission of Articles

Articles should be submittedas e-mail attachments to the Editor-in-chief: Josephine Nassimbwa<josephinenassimbwa@yahoo.co.uk>, who will acknowledge receipt of the article and assign a manuscript number to the article within three working days. Contributors must copy the Co-editor: Emmanuel Isah<emmenisah2005@yahoo.com> every mail that they send to the Editor-in-chief.

Every article must follow the under listed guidelines:

1) It must be typed in MS-word, using 'Times New Roman' font 12. The spacing should be 1.5, but the tables and figures should be single spaced.

2) The **title** page sh
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2) The **title page** should include the topic, corresponding author's full address and telephone/fax numbers and should be in an e-mail message sent to the Editor-in-chief, with the file, whose name should begin with the first author's surname, as an attachment.
3) All **manuscripts are peer-reviewed** by qualified scholars carefully chosen. The reviewers' comments are usually made available to authors within two weeks. The authors are expected to submit the corrected copies within a period of one month.
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5) The **Abstract** should be about 200 words. It must contain the background to the problem, purpose of the study, methodology, findings, conclusion and implications for policy/recommendations. Usually, references are not cited in the abstract. Keywords of 3-5 words can be stated below the abstract.
6) A list of non-standard **Abbreviations** should be added. In general, non-standard abbreviations should be used only when the full term is very long and used often. Each abbreviation should be spelt out and introduced in parentheses the first time it is used in the text.
7) *The **Introduction** should provide a clear statement of the* problem, the relevant literature on the subject, and the proposed approach or solution.
8) The **methodology** should be complete enough to allow possible replication of the research. It should contain the research design, population, sampling procedure, sample size, instrumentation, test for reliability, validation, method of analysis and level of significance. Slight variations are allowed.
9) The **results** should be presented with clarity and precision. It should be presented under the directional/research questions or hypotheses. It should be written in the past tense when describing author's findings, but references to previous findings

should be written in the present tense. The results should be explained.

10) The **Discussion** should relate the research findings to the findings of earlier researches that are relevant to the study. Justification should be made for deviation from expectation and previous studies.

11) **Tables** should be kept to a minimum and be designed to be as simple as possible. No table should exceed a page. Each table should be on a separate page, numbered consecutively in Arabic numerals and should bear a title. Tables should be self-explanatory without reference to the text.

12) **References** should be in the latest American Psychology Association (APA) bibliographic format.

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CONTENTS

Enhancing Female Participation in Practical Physics: Effects of Instructional Strategies

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Abstract

Physics is a physical science subject that is best understood when it is taught with practical oriented methods. However, research evidences show that female students are underrepresented in physics and its related disciplines. Several recommendations have been put forward on ways of improving female participation in the subject. One of such is the use of diversified instructional methods of teaching. This study therefore investigated the enhancement of female participation in physics using three instructional strategies (Generative, Predict-Observe –Explain and conventional method of teaching) on achievement of students in practical physics. The sample consisted of two hundred and forty one (143 boys and 98 girls) Senior Secondary year two (SS II) physics students selected from six schools of intact classes purposively selected from three Local Government Areas in Oyo township of Oyo state. These schools were randomly assigned to the three instructional strategies. One major instrument known as Practical Physics Achievement Test (PPAT) was used in collecting data. The instrument consisted of three practical questions in physics based on the West African Examination Council standard. This instrument was validated using test retest method (r =0.81).Three hypotheses were tested and answers were provided to two research questions. The data collected were analysed using Analysis of Covariance, estimated means and Scheffe pair-wise comparisons and graph was plotted to show interaction effect of treatment and gender. The result shows that female students in Generative instructional strategy performed best in practical physics test. The researcher recommended Generative instructional strategy for improving female participation and achievement in practical physics.

Keywords. Instructional strategies, female participation in practical physics

Introduction

The importance of physics in scientific and technological development of a nation has been widely reported (Oludipe, 2003; Okoronka, 2004; Adegoke, 2009, 2010; Babajide, 2011, 2012). Studies (Kalijah, 2002; Ukwangwu, 2002; Iheonunekwu, 2005; Isa, 2005; Ogunneye & Lasisi, 2008; Adegoke, 2009, 2010; Babajide, 2010, 2011) have shown that female students are under-represented in physics at secondary and tertiary institutional levels and girls shy away from physics and its related disciplines (Osuafor, 2010). This problem may have contributed to the serious setback in the developmental process of most developing and underdeveloped nation of the world because women constituted the largest population of the whole world. It therefore follows that more than half of the world population is under-represented in physics- a bedrock of national development (Head, 1974; STAN, 2002; Isa, 2005).

Numerous factors have been identified by researchers as causes of this problem and these include: poor method of instruction (Iroegbu, 1998; Oludipe, 2003; Okoronka, 2004; Adegoke, 2009; Babajide, 2010, 2011) and poor condition of teaching as well as misconception on the nature of physics (Ogunneye & Lasisi, 2008). Vockell and Lobone (1981) reported that inadequacy of female role model is another cause, while Babajide (2011) identified mannerisms of some male physics teachers, predisposing and sociological factors as reasons for female underrepresentation in physics. In another dimension, Osuafor (2010) reported that lack of personal interest of female students and fear of not getting job ranked highest as reasons why female students ran away from physical science courses like physics. A greater percentage of the female students sampled by the researcher were of the opinions that majority of the employers don't employ female engineers. This makes them run away from physics and Engineering professions which they believed are full of mathematics and not met for girls but embraces Medicine and its related professions such as Pharmacy, Nursing etc which the students perceived are more prestigious. This area of interest, coupled with their parents' wish

propelled the students in
profession.

This problem has
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This study focused
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understood through
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propelled the students in search for advices from people already in the profession.

This problem has generated several debates among physics researchers and the search for ways of encouraging female participation in physics and its related disciplines is ongoing. The use of diversified instructional strategies is suggested for improving female participation in physics (Iroegbu, 1998; Raimi, 2002; Ogunneye & Lasisi, 2008; Babajide, 2011). Still in line with the above are the submissions of Muloni (2001), Anagbogu (2003) and Isa (2005) that gender friendly strategies should be adopted in order to motivate and increase the interest of girl –child in science and technological based subjects such as physics. Also, Osuafor (2010) suggested that girls should be given opportunities of visiting manufacturing companies, computer industries as well as oil and construction companies so as to stimulate their interest and expose them to varieties of job opportunities in physics and its related courses. This background informed the need for this study which investigated the efficacy of Generative and Predict-Observe-Explain Instructional strategies on senior secondary school students' achievement in practical aspect of physics. It also determined the strategy that would enhance female achievement in practical physics based on the nature of the subject (a physical and practical subject) which might in turn enhance their participation since students will only participate in subjects they are sure of passing very well.

Generative instructional strategy is a practical oriented form of instruction based on the philosophy of discovery; learners formulate their ideas through past experiences and direct interaction with apparatus in a cooperative setting without intervention from the teacher, they are able to identify and correct their misconceptions (Wittrock, 1999). Predict-Observe-Explain instructional strategy is also a practical oriented form of instruction based on the philosophy of learning by doing (Zuziwe, 2006). Learner individually performs three activities; **predict** the outcome of an action/event, **observe** the action to identify similarity or differences in his/her predictions and observations and finally **explain** his/her observations.

This study focused on practical aspect of physics based on the fact that physics is a physical science which is best taught and understood through practical activities. It is evident (Chief Examiners' Reports WAEC, 2002-2010) that students' poor performance in physics

is due to poor performance in practical aspect of the subject. Hence, there is the need for investigating the efficacy of the instructional strategy/strategies that will improve female achievement in practical physics; which will further increase their participation in the subject since students will not participate in the subject that they perceived as abstract and which they may not likely to pass.

Statement of the Problem

Female students' low enrolment trend and poor performance in physics at the senior secondary school examination as well as their participation in physics related disciplines at all levels of educational institutions is the major problem of this study. However, several recommendations have been put forward on ways of improving female participation in the subject. One of such is the use of diversified instructional methods of teaching. This study therefore investigated the enhancement of female participation in physics using three instructional strategies (Generative, Predict-Observe –Explain and conventional method of teaching) on achievement of students in practical physics.

Objectives of the study

1. To study the performance of male and female students in practical physics achievement test in the various treatment groups.
2. To identify the instructional treatment group that produces the highest students score in practical physics.
3. To identify the instructional treatment group where female students have the highest practical scores in physics.

Research Questions

1. Which gender has the highest mean score in the practical physics test?
2. Which instructional strategy is responsible for the gender highest mean score?

Hypotheses

H_o1: There is no significant difference in the scores of students exposed to the different instructional treatment groups in the practical physics test.

H_o2: There is no sig
students in the pra

H_o3: There is no sig
on students' scores

Methodology

The study adopted a
pretest, posttest co
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female) senior seco
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Explain) and a contro
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treatment administrati
revision class of three
posttest was adminis
the same pretest ques
Analysis of Covariance
interaction effect of tr

**Procedural Steps for E
practical Group)**

Step 1: Grouping of stu

H_o2: There is no significant difference in the scores of male and female students in the practical physics test.

H_o3: There is no significant interaction effect of treatment and gender on students' scores in practical physics test.

Methodology

The study adopted a quantitative research within quasi-experimental pretest, posttest control group non-equivalent research design. The sample consisted of two hundred and forty one (143 male and 98 female) senior secondary school year two physics students (SSII) of intact classes purposively selected from six senior secondary schools in Oyo town of Oyo state, Nigeria. These schools were randomly assigned to two experimental groups 1 and 2 (Generative and Predict-Observe-Explain) and a control group (conventional practical teaching method) respectively. An instrument called practical physics achievement test which consisted of three practical questions covering mechanics, light and electricity in line with the West African Examination Council (WEAC) standard was used in collecting data. Students were required to answer any two questions only out of the three. The instrument was validated using test retest method; its reliability coefficient was calculated to be 0.81. The study lasted for eight weeks: two weeks were used in training of six research assistants in their various schools on the implementation of the two instructional strategies and conventional method of instruction. The first day of the third week was used in administering a practical pretest which lasted 3 hours in all the sampled schools. The second day of the third week marked the beginning of the treatment administration which came to an end in the ninth week. A revision class of three days was allowed after which the practical posttest was administered on the tenth week in all the schools using the same pretest questions. The data collected were analysed using Analysis of Covariance (ANCOVA) and graph was plotted for the interaction effect of treatment and gender.

Procedural Steps for Experimental Group 1(Generative instructional practical Group)

Step 1: Grouping of students into five (male and female).

Step 2: Presentation of apparatus and diagram for the experiment.

Step 3: Students brainstorm on how to perform the experiment without a guide on the procedure but with the provision of materials and diagram.

Step 4: Students jointly discover/agreed on the appropriate procedure for the experiment.

Step 5: Students perform the experiment using their agreed procedure and available materials and diagram.

Step 6: Students report result of experiment.

Step 7: Facilitator provides feedback to students with necessary corrections where applicable.

Procedural Steps for Experimental Group 2 (POE Instructional Practical Strategy)

Step 1: Students individually responds to facilitators questions (in form of predictions) on the experiment to be performed.

Step 2: Students fall into group of 5 (male and female).

Step 3: Students perform experiment following procedure and diagram to observe correct trend provided by facilitator.

Step 4: Students explain observation from experiment individually.

Step 5: Students write differences between each prediction and observation.

Step 6: Student report findings

Step 7: Facilitator gives feedback to students with necessary correction where applicable

Procedural Steps for Co

Step 1: Teacher sets up a

Step 2: Teacher perform

Step 3: Teacher takes rea

Step 4: Teacher presents

Step 5: Teacher allows st

Step 6: Teacher allows st

Results

H_o1: There is no significa to the different instructi test.

Table 1: Summary of treatment and gender.

Source	Sum square
Intercept	50698.3
Pre	29.4720
Treatment	15550.4
Gender	2685.467
Treatment X Gender	4999.500
Explained	18235.90
Error	22594.80
Total	40830.79

From table 1, there is a s in the three groups i.e t students' scores (achieve This implies that mean di Hence, we reject H_o1. I instructional group, tables

Procedural Steps for Convectional Practical Teaching Method

Step 1: Teacher sets up apparatus for practical lesson.

Step 2: Teacher performs experiment for students to observe.

Step 3: Teacher takes readings.

Step 4: Teacher presents result of experiment to students on the board.

Step 5: Teacher allows students to ask questions.

Step 6: Teacher allows students to write results of experiment.

Results

H_o1: There is no significant difference in the scores of students exposed to the different instructional treatment group in the practical physics test.

Table 1: Summary of ANCOVA of post practical test scores by treatment and gender.

Source	Sum of square	DF	Mean Square	F	Sig
Intercept	50698,330	1	50698.3330	29.789	.038
Pre	29.4720	1	29.472	.305	.581
Treatment	15550.462	2	7775.235	80.53	.000
Gender	2685.462	1	1342.731	20.066	.000
Treatment X Gender	4999.500	2	2499.750	25.888	.000
Explained	18235.924	5	3647.1848		
Error	22594.806	234	96.559		
Total	40830.73	239	170.839		

From table 1, there is a significant difference in the scores of students in the three groups i.e treatment caused significant difference in the students' scores (achievement) in practical physics (F_2 =80.53; $p<.05$). This implies that mean difference of the students' score is significant. Hence, we reject H_o1. In order to identify the contribution of each instructional group, tables 2 and 3 are presented.

Table 2: Estimated Marginal Mean for Treatment

Treatment	Mean	Std deviation
1 (Generative)	38.366	1.167
2 (POE)	27.247	1.133
3(Convectional)	17.444	1.125

Table 2 showed that students in the Generative instructional strategy group had the highest mean score (M=38.37, SD=1.17) followed by the students in the Predict-Observe-Explain group (M=27.25, SD=1.13) while students in the convectional practical group had the least mean score (M=17.44, SD=1.13) in practical physics. Table 3 showed the pair wise comparisons of treatment between the groups.

Table 3: Pairwise comparisons of treatment between groups

Treatment (i)	Treatment(j)	Mean Difference (i-j)	Significant
1	2	11.119	.000
	3	20.922	.000
2	1	-11.119	.000
	3	9.803	.000
3	1	-20.922	.000
	2	-9.803	.000

Table 3 showed there were differences in the mean scores of the students in various practical groups and these differences were significant. The highest mean difference existed between groups 1 and 3 followed by between groups 1 and 2 while the least difference was observed between groups 2 and 3.

H_o2: There is no significant difference in the scores of male and female students in the practical physics test.

From table 1, main effect of gender was significant (F_1=20.066, p<.05). This implies that difference in the mean scores of male and female students in practical physics was significant. Hence, H_o2 was rejected. Table 4 showed the estimated marginal mean scores for male and female students in practical physics.

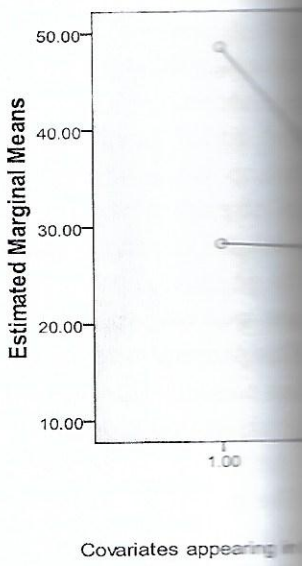
Table 4: Estimated
Physics

Gender
1 (Male)
2 (Female)

Table 4 showed that
(M=31.11, SD=.99)
SD=.83).

H_o3: There is no
on students' achieve
Graph in fig 1 shows

Fig 1: Interaction effect



Covariates appearing

Figure 1 showed that
1(Generative Instructional

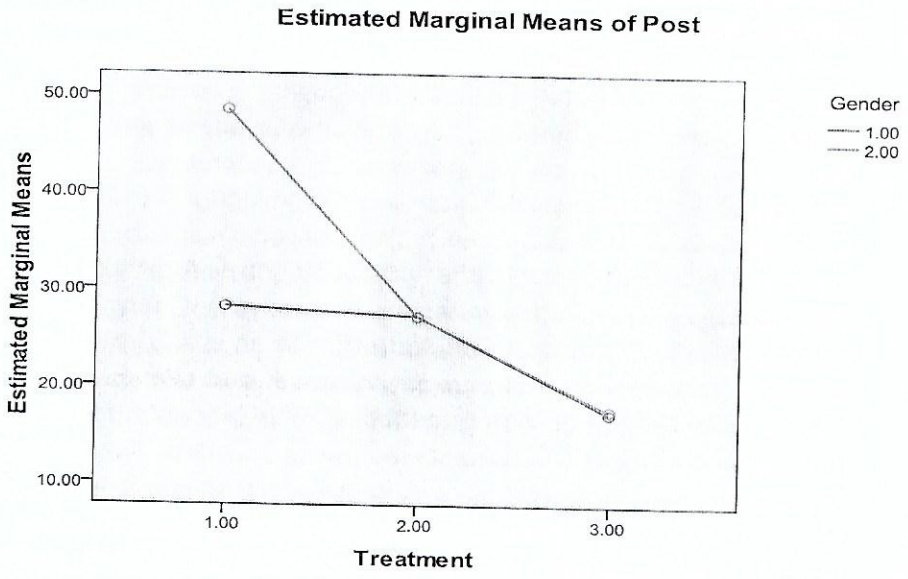
Table 4: Estimated Marginal Mean Score for Gender in Practical Physics

Gender	Mean	Std deviation
1 (Male)	24.262	.828
2 (Female)	31.109	.999

Table 4 showed that the female students had the highest mean score (M=31.11, SD=.99) as against that of the male students (M=24.26, SD=.83).

H_o3: There is no significant interaction effect of treatment and gender on students' achievement in practical physics.
Graph in fig 1 shows the interaction effect of treatment and gender.

Fig 1: Interaction effect of treatment and gender.



Covariates appearing in the model are evaluated at the following values: Pre = 6.8880

Figure 1 showed that female students in experimental group 1(Generative Instructional Practical Group) had the highest estimated

mean score; hence performed better than male students in all the groups.

Answers to research questions

Research Question One: Which gender has the highest mean score?
Table 4 showed that the female students had the highest mean score (M=31.11, SD=.99) in comparison with the male students (M=24.26, SD=.83) in the practical physics test.

Research Question Two: Which instructional strategy is responsible for the gender highest mean score?
Figure 1 showed that the Generative instructional practical strategy was responsible for the female highest mean score.

Discussion of Results

The apparent superiority of girls in the Generative Instructional practical group over boys may be due to the fact that the strategy assisted girls to be more patient, take delight in discussing issues in a systematical manner and highly meticulous in generating ideas from previous experiences, following information carefully as well as making discoveries. The process of discovery in Generative Instructional strategy also assisted the girls to retain and apply the information discovered as at when applicable. This is not so with the boys who might not be endowed with the potentials of painstaking and such might not necessarily bother to involve themselves in a long process of brainstorming but would prefer and eager to go straight to specific point in reasoning such as **predict, observe** and **explain** which are specific activities rather than general ones. This process may not assist girls to retain and apply information as at when needed. This result is in line with previous findings (Shaibu & Ameh, 1982; Shaibu & Mari, 1997) that showed that female students have better understanding of practical skills than their male counterparts. The present study result is at variance with the findings of Shaibu and Mari (1997) who obtained no significant difference in the application of practical skills of male and female students. This means that boys and girls do not differ in the application of the practical skills but differ in the understanding of practical skills. Also, the result of this study supports the findings of

Njoku (2002) and Baba
schools performed be
Generative instructiona
practical skills acquisition

Conclusion

This study has found
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Recommendations

Generative instructiona
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the understanding of
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Njoku (2002) and Babajide (2010) who found that girls in single sex schools performed better than boys in mixed schools and girls in Generative instructional strategy group performed better than boys in practical skills acquisition.

Conclusion

This study has found that Generative Instructional strategy enhances female participation in practical physics.

Recommendations

Generative instructional strategy is recommended for the teaching of practical physics to enhance female participation and in turn increase their enrolment as well as improve their achievement in physics generally.

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