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Effects Of Analogy-Enhanced Instructional Strategy on Learning Outcomes of Students in Basic Science Practical Skills in Ekiti State, Nigeria

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ABSTRACT: This study investigated the effects of analogy-enhanced instructional strategy on learning outcomes of students in Basic Science practical skills in Ekiti State, Nigeria. The purpose of the study was also to determine the influence gender will have on the student's achievement of practical skills in Basic Science. The study adopted pre-test and post-test control group quasi- experimental research design. The sample of 128 Upper Basic Public School ll (UBPSll) students was drawn using multistage random sampling technique from a total population of 16,256 Upper Basic Public School ll (UBPSll) students in Ekiti State. Two instruments (Basic Science Practical Achievement Test (BSPAT) and Basic Science Practical Skills Rating Scale (BSPSRS) were used to collect relevant data from the respondents. The test-retest method was used to establish reliability coefficient of 0.88 for BSPAT and Inter-rater reliabilities of BSPSRS using Scott's Pi based on observations of students on practical activities and the index of reliability obtained was 0.84. Data collected were analysed using t-test and Analysis of Co-variance (ANCOVA) for hypothesis one and two respectively at 0.05 level of significance. The results of the analysis showed that students' achievement in analogy-enhanced instruction class at post-test was found to be significantly better than that of the control group. The findings also revealed that both instructional strategies were not gender sensitive. Based on the findings of the study, it was concluded that analogy-enhanced instructional strategy improved students' achievement in Basic Science practical skills. It was therefore recommended that this new instructional strategy should be introduced to the teaching of Basic Science practical skills.

KEYWORDS; Basic Science, Practical Skills, Analogy-Enhanced Instructional Strategy, Learning Outcomes and Gender.

I. INTRODUCTION

It is widely believed that the socio-economic and technological development of a nation is a function of her level of education which is itself a function of the nature of her curriculum implemented in schools. This could be the main reason why developed countries of the world achieved their eminence by hard work. Japan, which is one of the leading countries in the production of electronics and automobiles, attached a lot of importance to the teaching of science subjects (Cambell, 2000). The role science can play in national development cannot be over emphasized. The significance of science and technology for sustainable national development is obvious and not in doubt. One of the fundamental issues in Nigeria today is the determination of how effective science is, at all the levels of education. Science, being an activity- based subject, needs practical activities regularly for the ultimate achievement and attainment of the goals of science and science education as outlined clearly in the National Policy of Education (NPE, 2014). Technology employs knowledge, skills and tools to improve human potentials, to solve practical problems and to modify our environment. Technology is therefore concerned with the application of science to obtain practical solution to the myriad of human problems (National Teacher Institutes, 2011).

Basic science is a preliminary and core subject at the junior secondary school level of Education. Basic science presents science as a unified whole in order for learners to have a holistic view of the science subjects (Seweje &Jegede, 2012). It is a subject that teachers approach with wider application in terms of its concept and objectives as an academic discipline. The knowledge of Basic science is necessary for individual to be scientifically trained in different areas of endeavour. It also helps in the development of the nation scientifically and technologically. The subject was introduced into the Nigerian secondary schools as a panacea for some or the problems bedeviling science education especially at the junior secondary school level. The programme as stated in national policy on education emphasizes acquisition of skills and development of the spirit of enquiry as opposed to rote learning. It is also to develop acquisition of scientific attitudes rather than accepting scientific facts as a dogma (Adenike & Busayo, 2003).

Despite the utilitarian value of Basic Science in science and technological advancement and teachers' position in the realization of these objectives. Lack of practical activities in Basic Science has resulted in poor manipulation and observation skills (Adepoju, 2002), and the absence of these skills gave rise to students poor performance in Science subjects both in qualitative and quantitative analysis (Oyedokun and Timothy, 2001).It has been observed by Omebe and Omiko (2015) that the suggested methods of teaching Basic science have been utilized for several years by the Basic Science teachers and yet the results of the students in the Junior Secondary School Certificate Examination (JSSCE) has not been encouraging. The researcher observed through discussion with some upper basic school students in Ekiti State that Basic science has been posing a great threat to many students because of the abstract in nature of the subject. There are complexities due to peculiar ways teachers teach it to the students, thereby making the subject comprehension relatively difficult when compared with some other non-science subjects. It then becomes pertinent to ask whether of a truth, Basic Scienceis difficult to learn or teach.

The conventional method is insufficient in educating an individual who is supposed to have the contemporary skills, and then one of the most effective ways to do it is taking advantage of instructional technologies perhaps Analogy-Enhanced Instructional Strategy (Abiona, 2001). It is in light of this that Okebukola (2005) advocated a re-examination of instructional approaches to teaching of science subjects in educational institutions. This kind of re-examination is vital today in the teaching of Basic Science practical and science in general as Nigeria today need competent scientists to harness the country's natural resources. Otor (2010) also believed that improved method of teaching science could enhance technological and industrial development. Based on these findings, effects of new teaching strategies have been investigated and they includes: Use of Analogy in pictorial representation (Abiona, 2001), Game- based learning instruction (Ogunmola, 2004) and Project based instructional strategy (Mofi and Barizai, 2006). However, not much has been done on Analogy-enhanced instructional strategies especially in the area of Basic Science. Hence the need for this study became very important.

Analogy-enhanced instruction is basically a teaching strategy that involves a mapping mechanism which helps a learner construct new knowledge on the basis of his or her identification of similarities between different concepts Kipnis (2005).Analogical thinking extracts useful structural and relational information from a repertoire of familiar instances or events (the analogue or base domain) and maps it on to the unfamiliar science concept (which is called the target). The familiar teaches the student about the unfamiliar (mayo, 2006). Analogies are interesting and motivating for students when the teacher's analogy can be enriched from the students' own experience. If, however, the analog is unknown to or poorly visualized by the students, then they will feel marginalized or frustrated and this will lower their interest in the analogical discussion. Interest and engagement are, therefore, crucial to learningChi (2000).

Purpose of the Study: The study was to determine the effects of Analogy-Enhanced Instructional Strategy in teaching Basic Science practical skills within the present 9-3-4 educational structure in Nigeria and also to determine what effect will gender have on the student's achievement of practical skills in Basic Science.

Significance of the Study : It is hope that the result of the findings would be significant as the findings will equip both trained and untrained teachers on the need to integrate the teaching and learning with Analogy- Enhanced Instructional Strategy in Basic Science practical lesson for better achievement. The result of the findings is expected to equip the teachers with adequate knowledge to boost their logistics of enhancing analytical mind of students towards acquisition of Basic Science practical skills which will improve their achievement. The study would also make available to teachers, curriculum developers and planners and textbook authors information that will assist in making based decision regarding the interactive effect of Analogy-Enhanced Instruction Strategy and gender to improve achievement in Basic Science practical skills.

Research Hypotheses: Two research hypotheses were postulated in this study.

1. There is no significant difference in the performance of students exposed to Analogy-Enhanced Instructional Strategy and Conventional Method in Basic Science Practical Skills.
2. There is no significant difference in the performance of male and female students in the group exposed to Analogy-Enhanced Instructional Strategy.

Research Design: The study design was pre-test and post-test control group quasi- experimental research

Population: The population of the study comprised all 10,256 Upper Basic Public School ll (UBPSll) students in Ekiti State, Nigeria. Upper Basic Public School ll (JSSll) students were considered relevant because they were not involved in Junior Secondary School Certificate Examination (JSSCE) and therefore they were readily available for the study.

Sample and Sampling Technique: The sample of this study was 128 Upper Basic Public School ll (UBPSll) students in Ekiti State. The multistage sampling procedure was used to select the sample. Stage one involved the selection of two Local Government Areas from each of the three Senatorial Districts in Ekiti State using simple random sampling technique. The second stage involved the use of purposive sampling technique to select an Upper Basic School from each Local Government Area selected in the State, putting into consideration sex and school with Basic Science laboratory. This was followed by the use of students in an intact class of an arm randomly selected from each school to be considered.

Research Instruments: This study made use of Basic Science Practical Achievement Test (BSPAT) and Basic Science Practical Skills Rating Scale (BSPSRS) which consisted of 4 theory items to assess the performance of students in Basic Science practical skill.

Basic Science Practical Skills Rating Scale (BSPSRS); this also made up of 24 items rating scale. The rating was done by research assistants on this guide, poor- 1 point, average-2 points and good-3 points. These were distributed among 8 science process skill categories which were sub-divided into seven categories.
The rating was done by research assistants who were expected to rate the skills based on the guide below:Poor-1 point, Average- 2 points and Good-3 point

Validity of the Instrument: Face and content validity of the instrument were ensured. The instruments were validated by experts in Basic Science and Test, Measurement and Evaluation. All their corrections were properly incorporated into the instrument before use.

Reliability of the Instruments: The method of test-retest was used to establish the reliability of the Basic Science Practical Achievement Test (BSPAT) as administered to 60 students outside the normal sample for the period of two weeks. The test showed no ambiguity in the instrument with the co-efficient correlation value of 0.88. The inter-rater reliabilities of Basic Science Practical Skills Rating Scale (BSPSRS) as well as of its skills categories were estimated using Scott's Pi based on observations of students on practical activities. The scores awarded by two independent raters were used and the index of reliability obtained was 0.84.

II. EXPERIMENTAL PROCEDURES

The pre-treatment stage: At the pre-treatment stage, the researcher visited the selected schools with letter of introduction to obtain permission from the principals and the Basic Science teachers to use their schools laboratories and students with training of the teachers as research assistance.

Treatment stage: On the first day of the treatment, the pre-test was administered on the participating This also was followed by series of lessons designed for the study. The teachers used the teaching manual developed by the researcher as a guide to teach the selected topics using analogy-enhanced learning strategy and the other group conventional strategy group.

Post-treatment stage : At the post-treatment stage, the BSPAT was re-arranged and administered to the students as posttest, so as to determine their level of skill acquisition through the use of BSPSRS by the research assistants.

Data Analysis: The data obtained was analyzed using t-test for hypothesis one while Analysis of Covariance (ANCOVA) statistics was used to analyses hypotheses two. Each hypothesis was tested at 0.05 level of significant.

III. RESULTS AND DISCUSSION

Hypothesis 1: There is no significant difference in the post- test mean scores of students exposed to Analogy-Enhanced and Conventional method in Basic science Practical Skills.
Posttest mean scores of students exposed to Analogy-Enhanced and Conventional Method in Basic Science Practical Skills were computed and compared for statistical significance using t-test statistics at 0.05 level. The result is presented in Table 1.

Table 1: t-test of students' posttest mean scores in Analogy-Enhanced and conventional groups

Group	N	Mean	SD	Df	t	p
Analogy	66	56.03	5.64	126	8.760	0.000
Control	62	49.29	2.27			

***p<0.05**

Table 2 shows that there is significant difference in the performance of students exposed to Analogy- enhanced Instructional Strategy and Conventional method in Basic Science Practical Skills at 0.05 level of significance (t=8.760, p=0.05). The hypothesis is rejected.

Hypothesis 2: There is no significant difference in the performance of male and female students in the group exposed to Analogy- Enhanced Instructional strategy. Performance mean scores of male and female students exposed to Analogy-Enhanced Instructional Strategy were computed and subsequently compared for statistical significance using Analysis of Covariance (ANCOVA) at 0.05 level of significance. The result is presented in

Table 2.

Table 2: ANCOVA of students' performance in Analogy-Enhanced group by gender

Source	SS	df	MS	F	P
Corrected Model	23.490[a]	2	11.745	.362	.698
Covariate (Pretest)	22.467	1	22.467	.692	.409
Sex	.434	1	.434	.013	.908
Error	2046.450	63	32.483		
Total	209270.000	66			
Corrected Total	2069.939	65			

p>0.05

Table 2 shows that there is no significant difference in the performance of male and female students in the group exposed to analogy- enhanced instructional strategy at 0.05 level of significance ($F_{1,63}$=0.013, p>0.05). The hypothesis is not rejected.

IV. DISCUSSION

The findings of this study is that the achievements mean scores of students in analogy-enhanced and conventional strategies were significantly different after treatment. By implication; therefore, analogy-enhanced instructional strategy was more effective in improving students' performance in Basic Science practical skills than conventional mode of teaching. This finding is consistent with the submission of Mayo (2001) that both teacher- and student-generated analogies were found to have significantly positive effect on performance of students in conceptual application of developmental psychology theories such as teaching of science practical skills. Also to Yanowitz (2001) who reported a greater success in learning generated by analogies than traditional lecture discussion approach. Analogical reasoning can be used to overcome learning difficulties and have a lot of advantages.

The result of this study also revealed that there is no significant difference in the learning outcomes of male and

female in Basic Science practical skills when taught with both analogy-enhanced and concentional instructional strategies. This result agreed with the findings of some earlier researchers such Abayomi and Moji, 2004; Bilesanmi- Awoderu, 2006; Sungur and Tekkaya, 2003 who provided reports that there are no longer distinguishing differences in the cognitive, affective and psychomotor skill achievements of students in respect of gender.

V. CONCLUSION

From the findings of this study, it could be concluded that students' exposure to Analogy-Enhanced instructional strategies resulted to a remarkable increase in academic achievement also that both instructional strategies are not a function of gender variable.

RECOMMENDATION

Based on the findings of this study, the following recommendations were made:

1. Conventional method presently in the use by Basic Science teachers should be improved on upon, modified or replaced with an activity-based teaching strategy.
2. Basic Science teachers should be encouraged to adopt the analogy-enhanced in order to demystify and simplify Basic Science in its entirety especially in its practical skills.
3. Government should organize and sponsor teachers to attend training courses on the use of the analogy-enhanced instructional strategy in order to facilitate their adoption.
4. Teachers should study and harness appropriate and familiar analogy and analogy-enhanced instructional strategy in their planning and teach of science concept.

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