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EFFECTS OF COMPONENT TASK ANALYSIS TEACHING STRATEGY ON SECONDARY SCHOOL STUDENTS' PERFORMANCE IN PHYSICS FOR ATTAINING SUSTAINABLE GOALS IN DISORIENTED SOCIETY

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ABSTRACT

The study investigated the effects of Component task analysis teaching strategy on secondary school students' academic performance in Physics in Ekiti State, Nigeria for attaining sustainable goals in disoriented society. The research design adopted in the study was Pretest-Posttest Quasi- experimental. The sample for the study was 120 Senior Secondary One (SSI) Physics students, selected through the multistage sampling technique from a total population of 6,589 SS I students offering Physics in all the 184 public Senior Secondary Schools in Ekiti State. The instrument used to collect relevant data from the subjects was Physics Achievement Test (PAT). The reliability of the instrument was determined through the split-half method with the reliability coefficient of 0.86. Three null hypotheses were tested at 0.05 level of significance. The data collected were analysed using t-test and Analysis of Covariance (ANCOVA) statistical analysis. The results of the analyses showed that there was significant difference in the academic performance of students in Physics in the experimental and control groups in favour of experimental group. Based on the findings of the study, it was concluded that Component task analysis teaching strategy is more potent in boosting students' performance in Physics in secondary schools than the conventional method in vogue in the nation and It was recommended that the conventional method presently in use by Physics teachers should either be improved upon, modified or replaced with an activity- based teaching approach (as appropriate).

KEYWORDS: Component task analysis, teaching strategy, sustainable goals, disoriented society, academic performance

INTRODUCTION

The National Policy on Education of the Federal Republic of Nigeria (2007) emphasized the need to train Nigeria citizens to be able to manipulate the environment towards the development of the society, understand the world around him, acquire appropriate skill, ability and competence in all areas of human endeavour so as to equip the individual to live comfortably within his society and contribute to the development of the society. In the light of this, the National Policy on Education (2007) recommended enrolment ratio of 60:40 in favour of science. Experience over the years showed that few students enroll for Physics and the performance of the very few students who opted for Physics are very low (Sansawal, 2009 and Avaa, 2011).

Science is regarded as a foundation upon which the bulk of the present technological breakthrough is built. Science (Physics in particular) education plays a vital role in the lives of individuals and development of a nation scientifically and technologically (Oludipe, 2011).

Physics is the most basic of the sciences and its concepts and techniques underpin the understanding of other disciplines: A thorough understanding of mechanics is necessary to the chemists and the material scientists since the structure of every atom in the universe is determined by mechanics.

Physics is also a cross-cutting discipline that has applications in many sectors of economic development, including health, agriculture, water energy and information technology (Macmillan, 2012). There is no doubt that a good part of the scientific knowledge is derived from the principles of Physics. Indeed, the knowledge of Physics has led to so many inventions such as the production, application and utilization of integrated circuits, production and use of machines and other contrivances. It also accounts for the discovery and production of hydroelectric power, gas turbine and thermonuclear power plant, telephones, refrigerators, heaters and gas/electric cookers.

Task analysis is the process of breaking down a complex task into its smaller steps or components. Tasks with many steps or components may be divided into phases for teaching purposes (Alberto and Troutman, 2003). Also, according to *Kirwan and Ainsworth (1992)* task analysis is the analysis of how a task is accomplished, including a detailed description of both manual and mental activities,

task and element durations, task frequency, task allocation, task complexity, environmental conditions, necessary clothing and equipment, and any other unique factors involved in or required for one or more people to perform a given task. It is sometimes necessary to break down a complex skill into smaller steps in order to meet the learning needs of the child.

A task analysis is very useful when attempting to teach a complex skill or to see with which step a child may be having difficulty (e.g solving problems involving using equations of motion). Alberto and Troutman (2003) affirmed that the number of steps involved in a task analysis will depend on the child's ability. Some children may require many steps while others only a few.

Fabio (2002) affirmed that task analysis is a model that is applied to classroom tasks to discover which curriculum components are well matched to the capabilities of students with learning disabilities and which task modification might be necessary. It discovers which tasks a person hasn't mastered, and the information processing demands of tasks that are easy or problematic. In behavior modification, it is a breakdown of a complex behavioral sequence into steps. This often serves as the basis for chaining. The results of task analysis are often represented in task models, which clearly indicate the relations among the various tasks (Fabio, 2002).

A task analysis is an easy way to determine child's current level of ability. It is important to also monitor child's progress to ensure that learning is taking place. In task analysis, all skills can be broken down into teachable steps. A new skill or a task that a child may be having difficulty acquiring can be a good starting point. To help a child learn the steps involved in the skill, it may be helpful to provide him/her with a visual breakdown of each step.

Jegede (2003) in a study of the effects of component task analysis model of instruction on students' performance in chemistry affirmed that the component task analysis model of instruction produced a better achievement and retention in students than the conventional model of instruction. Jegede (2003) also affirmed that there was no significant difference in the achievement mean scores of male and female subjects in the experimental and the control groups.

The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice.

Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and planet (online SPGs, 2015). Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Disoriented society means lost/confused society. That is, confused people/confused culture/no moral standards. People who are disoriented either don't know where they are because they have lost their sense of direction or they don't know who they are because they've lost their sense of self.

In recent times, there has been a growing public anxiety about teaching and learning in Nigerian schools based on deteriorating performance of students' in internal and external examinations especially in science subjects and Physics in particular. Due to the observed deterioration in students' academic performance, questions are continually being asked by individuals and organizations and various efforts are being made to remedy the situation but unfortunately, it appears as if these efforts have not yielded the much needed result.

The need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science and technology growth has been the yearning of every nation in the 21st century. Adediwura and Bada (2007) and Ehindero and Ajibade (2000) supported good methods of teaching that would make the learners develop and have sound education. The methods that are meant to train the child to become a whole being, helping his mind and personality to grow (Osakinle, Onijigin, & Falana, 2010). It is therefore, imperative to create room for further search for instructional tool that could appeal and arouse learners' interest and at the same time help to achieve the objectives of science education.

This study therefore investigated the effects of Component task analysis teaching strategy on secondary school students' academic performance in Physics in Ekiti State, Nigeria for attaining sustainable goals in disoriented society.

RESEARCH HYPOTHESES

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the achievement mean scores of students in experimental and control groups before treatment.

2. There is no significant difference in the achievement mean scores of students in experimental and control groups after treatment.
3. There is no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups.

METHODOLOGY

The design for this study was Pretest-Posttest Quasi-Experimental. The design afforded the researcher the opportunity to collect relevant data which helped to facilitate better understanding and evaluation of the problem under study. The pre-test was used to establish the knowledge baseline of the students as well as the academic homogeneity of the two groups before the commencement of the experiment. The post-test was used to determine the levels of academic performance of students within the two groups after the application of treatment.

The population of the study was made up of all senior secondary students class One (SS1) in Ado-Ekiti Local Government Area of Ekiti State. Purposive and stratified random sampling techniques was used to select a total sample of 120 public senior secondary class one (SS I) Physics students (this sample was divided into the experimental and control groups in ratio 1:1 meaning that, 60 students from each group) from four senior secondary schools in Ado-Ekiti Local Government Area, Ekiti State. The instrument used for the study was thirty (30) standardized objective questions tagged: 'Physics Achievement Test (PAT)' drawn from the topic (concepts associated with motion in straight line and equations of motion) with four options (A-D) considered for the study. The instructional (treatment) model used for the study was tagged: Component Task analysis model (COTAM).

The teaching covered three weeks with the control group taught using conventional method while the experimental group was taught using Component Task analysis model (teaching strategy). The tests (Pretest and Posttest) questions were administered to students; each of the tests was marked and scored accordingly.

The three formulated null hypotheses were tested at 0.05 level of significance. The data collected were analysed using t-test and Analysis of Covariance (ANCOVA) statistical analysis.

RESULTS AND DISCUSSION

Hypothesis 1

There is no significant difference in the achievement mean scores of students in experimental and control groups before treatment.

Table 1: t-test analysis of achievement mean scores of students in experimental and control groups before treatment

GROUP	N	$\overline{X}$	SD	df	t_{cal}	t_{tab}	Result
Experimental	60	11.53	6.78	118	0.759	3.373	NS
Control	60	10.56	7.22				

P > 0.05 (Result Not significant at 0.05 level), NS = Not Significant.

As shown in table 1, when the mean score of students in the experimental and control groups before the treatments (pre-test) were statistically compared, a *t-value* (t_{cal} = 0.759) with p> 0.05 alpha level was obtained, which was not significant at 0.05 level. This implies that there is no significant difference between experimental and control groups in pretest achievement mean score. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students in experimental and control groups before treatment was accepted.

Hypothesis 2

There is no significant difference in the achievement mean scores of students in experimental and control groups after treatment.

Table 2 : t-test analysis of achievement mean scores of students in experimental and control groups after treatment

GROUP	N	$\overline{X}$	SD	df	t_{cal}	t_{tab}	Result
Experimental	60	22.87	7.98	118	4.696	3.373	*
Control	60	15.97	5.85				

P < 0.05 (Result Significant at 0.05 level). * = Significant.

As shown in table 2, when the mean score of students in the control and experimental groups after the treatments (posttest) were statistically compared, a *t-value* (t_{cal} = 4.696) with P < 0.05 alpha level was obtained, which was significant at 0.05 level. This implies that there exists significant difference between the control and experimental groups achievement mean scores after the treatment in favour of experimental group. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students in experimental and control groups after treatment was rejected. As such, the conventional method of instruction (control group) can be said to be less effective compared with Component task analysis teaching strategy (experimental group).

Hypothesis 3

There is no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups.

Table 3: Summary of ANCOVA analysis on the achievement mean scores of male and female students in each of the experimental and control groups

Source of variation	SS	df	Ms	F_{cal}	F_{tab}	P	Result
Corrected model	1693.176[a]	7	420.549	49.68	2.42	0.000	
Covariate (pretest)	31.245	1	31.245	2.65	4.37	0.106	
Gender	.860	1	.860	0 .34	4.37	0.750	NS
Group	1623.452	1	1623.452	182.88	4.37	0.000	*
Gender *Group	12.823	1	12.823	1.50	4.12	0.239	NS
Error	2226.331	89	8.466				
Corrected Total	2875.450	119					
Total	52705.000	120					

P > 0.05 (Result Not significant at 0.05 level), NS = Not Significant , and * = Significant

Table 3 showed that the computed *F-value* ($\mathbf{F_{cal}}$ = 0.34 < $\mathbf{F_{tab}}$ = 4.37) with a *P-value* (P > 0.05 alpha level) obtained from the analysis of the students' gender was not significant. Hence, the mean achievement scores of male and female students were not significantly different. The table also revealed that the compared *F-value* ($\mathbf{F_{cal}}$ = 1.50 < $\mathbf{F_{tab}}$ =4.12) with a *P-value* (P > 0.05 alpha level) obtained for the interaction of gender and group was not significant as well. The null hypothesis was thus not rejected. It, therefore, implies that there is no significant interaction between gender of students and scaffolding teaching strategy applied.

In other words, gender of students has no significant influence on either the effectiveness (or otherwise) of the approach of instruction applied.

DISCUSSION

The result of this study revealed that the pre-test mean scores of the students in the Component task analysis teaching strategy was not significantly different from that of those exposed to conventional method. The implication of this is that the two groups involved in the study exhibited comparable characteristics. Thus, they both entered the instructional experiment on equal strength and ability which showed that the two groups were suitable for the study when comparing component task analysis teaching strategy with conventional method on achievement in Physics.

Furthermore, the result of the study also revealed a relative increase in the post-test mean score of the students in the Component task analysis teaching strategy group over those taught with the conventional method. Thus confirmed that Component task analysis teaching strategies are learner-centered and capable of making remarkable impart on instructional practices. This result agrees with the findings of Jegede (2003) that students exposed to Component task analysis method of teaching performs better than their counterparts who were exposed to conventional teaching method and it also agrees with the findings of Adediwura and Bada (2007) that good method of teaching would make the learners develop sound education.

Moreover, the findings of this study also revealed that: There was no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups before and after the treatment. In other words, the achievement of male and female students exposed to Component task analysis teaching strategy did not differ significantly as female students were found to have similar achievement in Physics as their male counterparts in the two groups involved in the study. The implication of this result is that gender was not a significant predictor of students' achievement in Physics. The finding agrees with the findings of Jegede (2003) that there is no significant difference between the mean academic performance of male and female students exposed to Component task analysis method of teaching.

CONCLUSION

Based on the findings of this study, it can be concluded that Component task analysis teaching strategy is more potent in improving students' academic performance in

Physics in secondary schools than conventional method in vogue in the nation in term of performance and retention.

The study however found no significant difference between academic performance of male and female students in Physics when Component task analysis teaching was used as strategy of instruction. This simply implies that performance of students taught using different teaching strategies is not in any manner affected by either their gender.

RECOMMENDATIONS

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

1. Component task analysis teaching strategy assessment should be practically applied to classroom situations. Teachers should use Component task analysis strategy to arouse the interest of their students in Physics teaching. They should be trained and encourage to use Component task analysis teaching strategy.
2. Principals of secondary schools should encourage their Physics teachers through sponsorship to attend refresher courses and other forms of in-service training to enable them acquire the needed skill that can help them use or apply different strategies in the classroom teaching and learning. Thus help eradicate mediocrity among Physics teachers and expose them to a wide range of methods which can enhance their teaching in classroom situation.
3. Authors of Physics textbooks should present the content and concepts alongside the worked examples using Component task analysis strategy.

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