International Journal of Education, Learning and Development
Vol. 10, No.10, pp.74-90, 2022
Print ISSN: 2054-6297(Print)
Online ISSN: 2054-6300 (Online)

Fostering Academic Performance of Students of Different Cognitive Abilities in Secondary School Physics Using Group Dynamics and Visual Clue Strategies

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Citation: Achor E.E., and Ngbea P.M. (2022) Fostering Academic Performance of Students of Different Cognitive Abilities in Secondary School Physics Using Group Dynamics and Visual Clue Strategies, *International Journal of Education, Learning and Development*, Vol. 10, No.10, pp.74-90

ABSTRACT: *The study examined the effect of group dynamics and visual clue teaching strategies on the academic performance of students of different cognitive abilities in secondary school (SSII) physics in Benue State. The quasi-experimental research design was adopted. It was a pre-test, post-test non-equivalent control group design. The study population was 1,920 SSII Physics students from 48 Secondary Schools in Makurdi metropolis. The study sample of 157 was drawn from the population through purposive and simple random sampling techniques. Two research instruments named Physics Students' Performance Test (PSPT) and Students' Cognitive Ability Test (SCAT) were used for the study with reliability coefficients of 0.931 and 0.883, respectively. Data were obtained through the administration of pre-test and post-test on SSII students of the selected schools. Mean and standard deviations were used to answer the research questions. The null hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). It is found that there is significant difference between the mean academic performance of students taught Physics using group dynamics strategy, visual strategy and conventional strategy; there is significant difference in the mean ability (i.e low, moderate and high) of students when group dynamics strategy was used in teaching Physics; there is significant difference in the mean ability (i.e low, moderate and high) of students when visual clue strategy was used in teaching Physics; and there is significant difference between the interaction effect of strategies and cognitive abilities on academic performance of students in Physics. On the basis of these findings, the study recommended among others that since the interaction effect of strategies and cognitive abilities on academic performance of students in Physics was not significant, the use of both strategies (group dynamics and visual clue) could be useful in fostering the academic performance of students with different cognitive abilities. The Physics teacher should therefore professionally use both strategies in teaching students in a manner that would enhance students' performance.*

KEY WORDS: group dynamics, visual clue, demonstration, academic performance, cognitive abilities.

INTRODUCTION

The fundamental goal of education is to equip students with the knowledge and skills necessary to think critically, solve complex problems, and succeed in the 21st century society and economy. The measurement of such knowledge and skills is essential to tracking students' development and assessing the effectiveness of educational policies and practices. Science education has used many measures of learning to improve performance of students in science generally. Physics as a science subject at the secondary school level is an important subject that enhances the scientific and technological development of any nation. Ogunleye and Babajide (2011) assert that Physics is a vehicle for achieving long-term goals of science because it is instrumental to technological and socio-economic growth across the globe. The role of physics in the education of scientists, engineers, chemists and practitioners of other physical and biological sciences is enormous (Oludipe, 2012). It is a sine qua non to the technological development of any nation and its application is found in all spheres of human life. It is also the foundation of scientific knowledge as it has contributed immensely to the existence and activities of man towards improved standard of living and growth in wealth.

Despite the importance of Physics, there are a number of observable problems plaguing the teaching and learning of the subject, especially at the secondary school level. These problems include poor method of instruction, inadequate instructional materials, insufficiency of qualified science teachers among others (Kalijali, 2012). Physics students at the secondary school level have therefore, continued to obtain poor scores in the subject. Statistics obtained from the research library of the West African Examinations Council headquarters Lagos show that between 2006 and 2020 in Nigeria, students' performance in physics at the senior certificate level has been poor as their percentage pass at credit level and above consistently fall below 50 percent.

This puts to question the reality and reliability of the high level of poor performance and by extension the quality and effectiveness of the teaching / learning process in schools. This trend of poor performance is not good enough for a technologically aspiring country like Nigeria where there is the incidence of poor enrolment of students and consequently few numbers of persons aspiring to study science, technology and related disciplines. It is therefore, imperative to find out if innovative teaching strategies like group dynamics and visual clue have been able to stimulate students of different cognitive skills towards enhanced performance in Physics. The present study evaluates the effect of group dynamics and visual clue teaching strategies on the performance of students with different cognitive abilities in Benue State using demonstration teaching method for the control group.

Group dynamics refers to the relationships between learners in a group and the impact that this has on the way they work. In group dynamic teaching strategy, the teacher recognizes which of the factors contributing to group dynamics that are within his or her control, as not all are. The key

elements of group dynamics are groups member resources, structure (group size, group roles, group norms, and group cohesiveness), group processes (the communication, group decision making processes, power dynamics, conflicting interactions, among others) and group tasks (complexity and interdependence).

Visual clue on the other hand, ascribes meaning to events and images as being able to interpret them is a crucial element in the development of social language and social interaction, including eye contact, touching, hugging and verbal response, among others. The teacher who adopts visual clue teaching strategy actively encourages students to decode still images such as documentary or advertising photography, and moving images such as commercials, newscasts, and dramatic or comic television programmes and films. He or she explores with students the signs and symbols in art and visual media. Kaswa (2015) examined the effect of visual learning aids on students' academic performance in public secondary schools and found that students who used visual learning aids in classrooms performed better than students who did not use visual learning aids. In the same vein, Escalada (1995) investigated the effect of using interactive digital video in Physics classroom on students' learning and attitudes and found that students' initial feelings of comfort/anxiety in using computer applications were significantly related to the students' computer experience but students' initial feelings of computer application usefulness was not significantly related to students' computer experience.

The term demonstration is rooted in the Latin word "demonstrate", meaning to show or explain (Salas,2009). This definition is very close to the most relevant common definition. It is "a description or explanation as a process, illustrated by examples, specimens, or the like" (Dictionary.com, 2006).Ashby, Ell and Waldron (2003) define demonstration as a strategically crafted dynamic example of partial or whole task performance or of characteristic of the task environment intended to increase the learner's performance by illustrating (with modelling, simulation, or any visualization approach) the enactment of knowledge, skills, and attitudes (KSAs) targeted for skill acquisition.

The insight into the concept of cognitive ability began when Stanford University psychologist Lewis Terman released the 'Stanford Revision of the Binet-Simon Scale' (now known as the Stanford-Binet and still in use today) in 1916 which defined intelligence in terms of four separate cognitive factors: verbal reasoning for instance, the ability to solve verbal problems and to demonstrate language mastery through demonstrations of vocabulary knowledge and sentence comprehension; quantitative reasoning for instance, the ability to solve mathematics problems; abstract/visual reasoning for instance, the ability to solve problems requiring comprehension of complex relationships between geometric shapes; short-term memory (for instance, the ability to hold facts in memory for a short period of time. Terman's test also resulted in a comprehensive score that he called an "intelligence quotient"; what has been shortened today to an 'IQ'

The theories that are relevant to students' performance and cognitive abilities are Jean Piaget's Theory of Cognitive Development and Walberg's Theory of Academic Performance. Piaget's theory of cognitive development suggests that children move through four different stages of mental development. His theory focuses not only on understanding how children acquire knowledge, but also on understanding the nature of intelligence. Piaget's stages are: Sensorimotor stage: birth to 2 years; Preoperational stage: ages 2 to 7; Concrete operational stage: ages 7 to 11; and Formal operational stage: ages 12 and up. Piaget believed that children take an active role in the learning process, acting much like little scientists as they perform experiments, make observations, and learn about the world. As kids interact with the world around them, they continually add new knowledge, build upon existing knowledge, and adapt previously held ideas to accommodate new information.

Walberg's (1981) theory of educational performance on the other hand, is one of the few empirically tested theories of school learning based on an extensive review and integration of over 3,000 studies (DiPerna, Volpe & Stephen, 2012). Wang, Haertel, and Walberg (2010) analyzed the content of 179 handbook chapters and reviews and 91 research syntheses and surveyed educational researchers in an effort to achieve some consensus regarding the most significant influences on learning" (Greenberg., 2003, p. 470). Using a variety of methods, Wang, (1977) identified 28 categories of learning influence. Of the 11 most influential domains of variables, 8 involved social-emotional influences: classroom management, parental support, student- teacher interactions, social- behavioral attributes, motivational- effective attributes, the peer group, school culture, and classroom climate (Greenberg, 2003).
Distant background influences (e.g., state, district, or school policies, organizational characteristics, curriculum, and instruction) were less influential. Wang (1997) concluded that "the direct intervention in the psychological determinants of learning promise the most effective avenues for reform" (p. 210). Wang research review targeted student learning characteristics (i.e.,social, behavioral, motivational, affective, cognitive, and metacognitive) as the set of variables with the most potential for modification that could, in turn, significantly and positively affect student outcomes (DiPerna., 2002).

Statement of the Problem

Education literature is replete with teaching strategies that are geared towards improving learning outcomes which serve as panacea for understanding educational concepts hitherto perceived to be difficult and fearsome by students. Some of these strategies are regarded as innovative because they provide new ideas of teaching capable of improving the performances of students with different cognitive abilities. The paradox however, is that despite the application of innovative teaching strategies in teaching Physics, students' performance has continued to reflect different cognitive abilities, as high level of failures in certificate examinations are recorded among students with low cognitive abilities. The persistent failure of students in Physics examinations in Benue State has therefore, become a source of worry to all well-meaning individuals. The West African Examinations Council (WAEC) and National Examinations Council (NECO) results of 2006–

2020 show that students' performances in Physics have been poor as the percentage pass at credit level and above consistently fell below 50% (WAEC, 2020). This implies that the low performance in Physics at certificate examinations is correlated to the different cognitive abilities of the students. The problem of this study therefore is: What is the relative effect of group dynamics teaching strategy on the academic performance of students with different cognitive abilities in Physics in Benue State?

Purpose of the Study

The purpose of the study is to examine the effect of group dynamics and visual clue strategies on academic performance of Senior Secondary II students of different cognitive abilities in Physics in Benue State, Nigeria. The specific objectives are to:

1. find out the academic performance of students taught Physics using group dynamics strategy, visual clue strategy, and demonstration method;
2. determine which of the ability groups (i.e low, moderate and high) gained more when group dynamics strategy was used in teaching Physics;
3. determine which of the ability groups (i.e low, moderate and high) gained more when visual clue strategy was used in teaching Physics;
4. determine interaction effect of strategies and cognitive abilities on academic performance of students in Physics.

Research Questions

i. What are the mean academic performances of students taught Physics using group dynamics strategy, visual strategy and demonstration strategy?
ii. Which of the ability groups (i.e low, moderate and high) gained more in academic performance when group dynamics strategy is used in teaching Physics?
iii. Which of the ability groups (i.e low, moderate and high) gained more in academic performance when visual clue strategy is used in teaching Physics?
iv. What is the interaction effect of strategies and cognitive abilities on academic performance of students in Physics?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant difference between the mean academic performance of students taught Physics using group dynamics strategy, visual clue strategy and demonstration method.
2. There is no significant difference in mean academic performance of low, moderate and high cognitive abilities when group dynamics strategy was used in teaching Physics.
3. There is no significant difference in mean academic performance of low, moderate and high cognitive abilities when visual clue strategy was used in teaching Physics.
4. There is no significant difference between the interaction effect of strategies and cognitive abilities on academic performance of students in Physics.

RESEARCH METHOD

The study adopted a quasi-experimental design. It was a pre-test, post-test non-equivalent control group design. The design is represented in the diagram below:

E	:	Q1	X	Q2
C	:	Y1	-	Y2

Key:
Experimental group: Q1 X Q2
Control group: y1 – y2

Where Q1 and y1 are pre-test scores
Q2 and y2 are post-test scores
X is exposure to treatment
- Means no treatment.

The population for this study comprises of 1,920 SSII Physics students from all secondary schools in Makurdi metropolis. A sample of 157 students was selected from four secondary schools in the area. Purposive sampling technique was used to enable the researcher select schools based on the intensity of science teaching in these schools, given that Physics is a subject of interest. Simple random sampling was used to select two intact classes from the four schools selected. The researchers picked two classes from each selected schools and assigned them for both experimental and control groups.

Instrumentation

The researchers developed two instruments named Physics Students' Performance Test (PSPT) and Students' Cognitive Ability Test (SCAT) and were used for this study. PSPT was a 15-item instrument with four options lettered A-E. It was developed using WAEC and NECO past question papers and standards. Topics particularly meant for SSII students such as light and temperature as well as wave were selected and used. Similarly, SCAT was a 15-item instrument with four options lettered A-E. The reliability score of the instruments were tested using Kuder Richardson 21which yielded an internal consistency value of 0.931 and 0.883 for respectively. These were considered to be highly reliable based on the specification of Kwahar and Onov (2017).

Method of Data Collection

In order to determine students' performance and cognitive abilities in Physics, pre-test was administered at the beginning of students' first term in SSII. Research assistants who were their regular teachers were trained and allowed to teach the students for six weeks before the post-test was administered. The scripts collected for both pre-test and post-test from the two groups were marked and the scores recorded and used for analysis. Both PSPT and SCAT administered in the pre-test were reshuffled before being used for post-test for both experimental and control group to

reduce Hawthorne effect in which participants alter their behaviour as a result of being used for an experiment.

Method of Data Analysis

Mean and standard deviations were used to answer the research questions. The null hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA) Pre-test was used as covariate for both students' performance and cognitive abilities in physics. ANCOVA was used because the study used intact class with a pre-test which served as covariate

RESULTS

The data collected using the instrument developed for the study was analysed and using mean and standard deviation to answer the research questions. Inferential statistics of Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 level of significance.

Research Question 1

What is the mean academic performance of students taught Physics using group dynamics strategy and demonstration strategy?

Table 1: Mean Performance and Standard Deviation Scores of Students in Experimental and Control Groups

	PRE-SCAT			POST-SCAT		
Strategy	N	$\overline{X}$	σ	$\overline{X}$	σ	Mean Gain
Group Dynamics	79	13.91	2.16	31.71	2.91	17.88
Visual Clue	79	10.41	3.41	23.07	3.36	12.66
Demonstration	78	4.05	5.98	7.64	4.73	3.59

Table 1 shows that the pre-test mean performance score of students in the experimental group was 13. 91 and 10.41 with standard deviation scores of 2.16 and 3.41 for group dynamics and visual clue, respectively. The post-test mean performance scores were 31.71 and 23.07 and standard deviations of 2.91 and 3.36 for group dynamics and visual clue teaching strategies, respectively. This gives mean gain scores of 31.71 and 13.91 between the pre-test and post-test scores of the group dynamics strategy, and the mean gain score of 17.0. The pre-test and post-test performance scores for the control groups were 4.05 and 7.64, respectively. The standard deviation scores for the control groups were 4.02 and 3.36 for the pre-test and post-test respectively. This means that students who were taught Physics using group dynamics strategy performed better than students that were taught using demonstration approach.

Research Question 2
Which of the ability groups (i.e low, moderate and high) gained more in academic performance when group dynamics strategy is used in teaching Physics?

Table 2: Mean Scores and Standard Deviation of Students' Cognitive Abilities and Academic Performance using Group Dynamics Teaching Strategy

		PRE-PSPT		POST-SCAT		
Group	Cognitive Ability	$\overline{X}$	σ	$\overline{X}$	σ	Mean Gain
Group Dynamics	High	12.11	3.16	23.75	2.74	11.64
	Moderate	9.54	4.87	16.03	2.53	6.49
	Low	6.79	5.18	10.48	3.07	3.69

Table 2 shows that the mean performance and standard deviation scores of students with high cognitive abilities taught using group dynamics for pre-test and post-test were 12.11 and 23.75 respectively with standard deviations of 3.16 and 2.74, while the mean performance for moderate cognitive abilities were 9.54 and 16.03 with standard deviation of 4.87 and 2.53 . Also, the mean performance and standard deviation scores of students with low cognitive abilities in the experimental group for pre-test and post-test were 6.79 and 10.48 respectively with standard deviations of 5.18 and 3.07. This gives a means gain score of 11.61, 6.49 and 5.69 for high, moderate and low cognitive ability groups, respectively.

Research Question 3
Which of the ability groups (i.e low, moderate and high) gained more in academic performance when visual clue strategy is used in teaching Physics?

Table 3: Mean Scores and Standard Deviation of Students' Cognitive Abilities and Academic Performance using Visual Clue Teaching Strategy

		PRE-PSPT		POST-SCAT		
Group	Cognitive Ability	$\overline{X}$	σ	$\overline{X}$	σ	Mean Gain
Visual Clue	High	7.60	6.29	15.44	3.58	7.84
	Moderate	5.41	7.18	12.26	3.95	6.85
	Low	3.33	7.53	8.83	4.60	5.50

Results presented in Table 3 show that the mean performance and standard deviation scores of students with high cognitive abilities taught using visual clue strategy for pre-test and post-test were 7.60 and 15.44 respectively with standard deviations of 6.29 and 3.58, while the mean performance for moderate cognitive abilities were 5.41 and 12.26 with standard deviation of 7.18 and 3.95. Also, the mean performance and standard deviation scores of students with low cognitive abilities in the experimental group for pre-test and post-test were 3.33 and 8.83 respectively with standard deviations of 7.53 and 4.60. This gives mean gain scores of 7.84. 6.85 and 5.50 for high cognitive ability, moderate cognitive ability and low cognitive ability groups, respectively.

Research Question 4
What is the interaction effect of strategies and cognitive ability groups on academic performance of students in Physics?

Table 4: Mean Scores and Standard Deviation of Students' Cognitive Abilities and Academic Performance in the Experimental Group

		PRE-PSPT		POST-SCAT		
Group	Cognitive Ability	$\overline{X}$	σ	$\overline{X}$	σ	Mean Gain
Experimental	High	12.11	3.16	23.75	2.74	11.64
	Moderate	9.54	4.87	16.03	2.53	6.49
	Low	6.79	5.18	10.48	3.07	3.69

Table 4 shows that the mean performance and standard deviation scores of students with high cognitive abilities in the experimental group (sum scores of Group Dynamics and Visual Clue strategies) for pre-test and post-test were 12.11 and 23.75 respectively with standard deviations of 3.16 and 2.74, while the mean performance for moderate cognitive abilities were 9.54 and 16.03 with standard deviation of 4.87 and 2.53 for the post-test. Also, the mean performance and standard deviation scores of students with low cognitive abilities in the experimental group for pre-test and post-test were 6.79 and 10.48 respectively with standard deviations of 5.18 and 3.07. This gives a means gain score of 15.09. Students with moderate cognitive abilities had mean performance score of 7.90 and 22.32 and standard deviation scores of 2.02 and 3.07 respectively. This gives a mean gain achievement score of 11.64 for students with high cognitive ability, 6.49 for students with moderate cognitive ability and 3.69 for students with low cognitive ability. The interaction effect is shown in Figure 1.

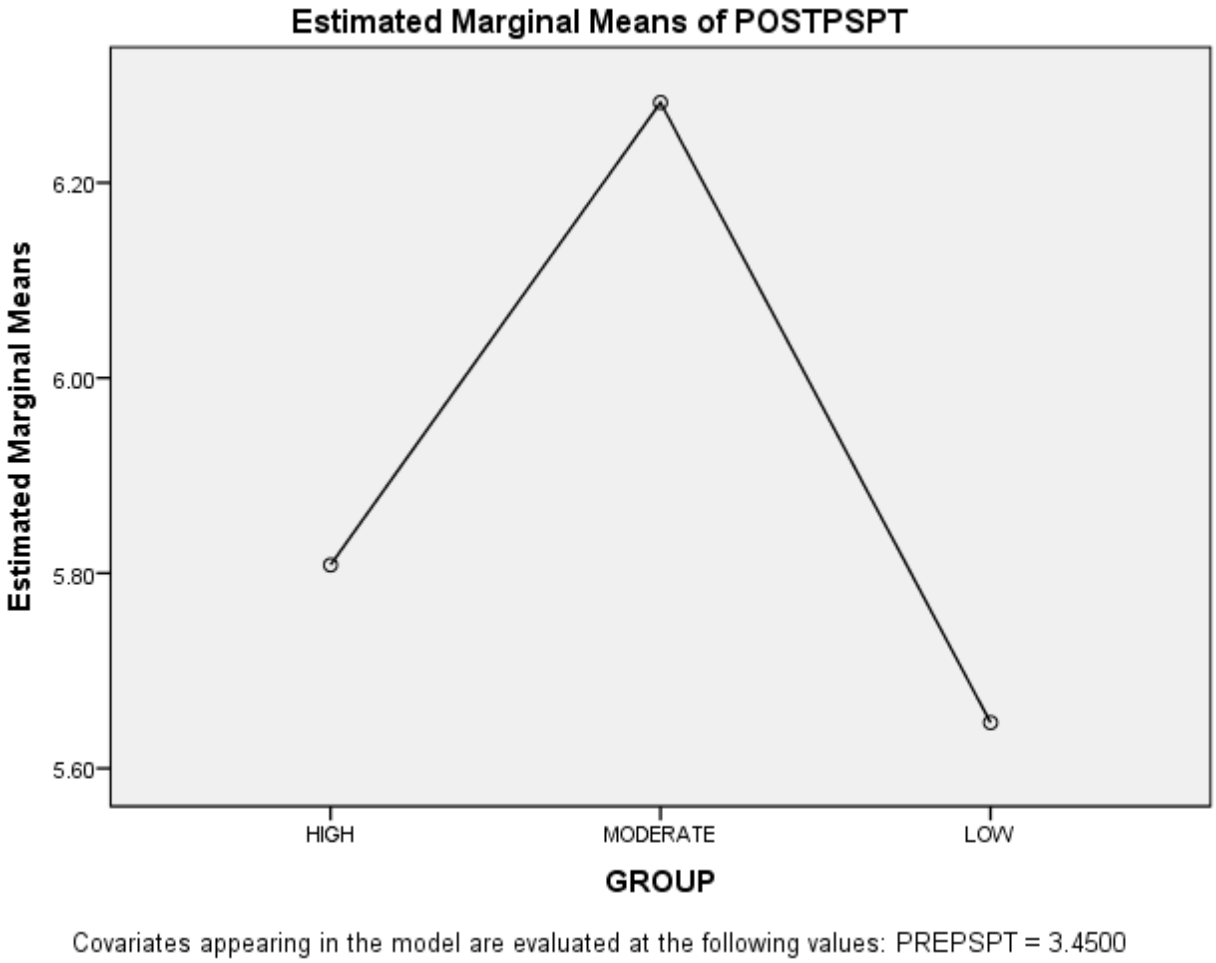

Figure 1: Interaction Effect of Cognitive Abilities on Academic Performance of Students in Physics

Figure 1 shows that there is a significant interaction between ability groups and academic performance of students in Physics. Thus, the estimated marginal means of the interaction effects of low, moderate and high cognitive abilities of students were 5.60, 6.20 and 5.80, respectively.

Hypothesis 1

There is no significant difference between the mean academic performance of students taught Physics using group dynamics strategy, visual strategy and demonstration strategy.

Table 5: One-way ANCOVA Summary Result on Post-Performance Score of Students taught Physics using Group Dynamics Strategy, Visual Strategy and Demonstration Method

Source	Type III sum of squares	Df	Mean square	F	Sig.	Decision
Corrected model	136.502a	2	68.251	7.036	.001	
Intercept	5078.902	1	5078.902	523.575	.000	
PRE-PSPT	31.975	1	31.975	3.296	.071	
GROUP	117.529	1	117.529	12.116	.001	S
Error	1493.867	154	9.700			
Total	83949.000	157				
Corrected Total	1630.369	156				

a. R Squared = .84 (Adjusted R Squared = .072) S = Significant, NS = Not Significant

Table 5 shows that on the basis of group, the f-value of 12.116 is significant at df = 1,154. This is because the p-value of 0.001 is less than the $\alpha = 0.05$. The null hypothesis is therefore, rejected. This implies that there is a significant difference in the performance of students taught Physics using Group Dynamics, Visual Clue and demonstration instructional strategies.

Table 6: Pair-wise Comparisons of Mean Scores of Students with Different Cognitive Abilities taught Physics using Group Dynamics, Visual Clue and Demonstration Teaching Strategies

(I) Ability	(J) Ability	Mean Difference (I– J)	Std. Error	Sig.
Demonstration Strategy	Group Dynamics Strategy	1.82*	0,60	0.02
	Visual Clue Strategy	1.37*	0.60	0.04
Group Dynamics Strategy	Visual Clue Strategy	-0.45	0.60	0.16

*Based on estimated marginal means. * The mean difference is significant at the .05 level*

Table 6 shows the bivariate comparisons of the methods of teaching Physics and its effect on the mean performance of students of different cognitive abilities at $p = 0.02 < 0.05$ for group demonstration and dynamics strategies. Similarly, comparisons of the methods of teaching Physics and its effect on the mean performance of students of different cognitive abilities at $p = 0.000 < 0.05$ for demonstration strategy and visual clue teaching strategy. The null hypothesis is therefore rejected. Therefore, the rejected null hypothesis is confirmed and upheld. This implies that there is significant difference between the mean academic performance of students taught Physics using group dynamics strategy, visual clue strategy and demonstration method.

However, comparisons of the methods of teaching Physics and its effect on the mean performance rating of student of different cognitive abilities shows that $p = 0.16 > 0.05$ for group dynamics strategy and visual clue teaching strategy. Thus, the rejected null hypothesis is not confirmed and

not upheld. This implies that there is no significant difference between the mean academic performance of students taught Physics using group dynamics strategy and visual clue strategy.

Hypothesis 2
There is no significant difference in mean academic performance of low, moderate and high cognitive abilities when group dynamics strategy was used in teaching Physics.

Table 7: One-way ANCOVA Result On Post-Performance Score of Students Different Cognitive Abilities taught Physics using Group Dynamics Teaching Strategy

Source	Type III sum of squares	df	Mean square	F	Sig.	Decision
Corrected model	163.284a	2	33.412	9.671	.003	
Intercept	7811.961	1	5580.513	923.281	.000	
PRE-SCAT	49.500	1	31.975	2.732	.071	
SCAT	**437.335**	**1**	**17.529**	**10.315**	**.000**	**S**
Error	1644.621	154	9.700			
Total	62941.212	157				
Corrected Total	2421.336	156				

a. R Squared = .771 (Adjusted R Squared = .508) S = Significant, NS = Not Significant

Table 7 shows that on the F-value of 17.529 is significant (p=0.000<0.05) at df = 1,154.. The null hypothesis is therefore, rejected. This implies that t here is significant difference in mean academic performance of low, moderate and high cognitive abilities when group dynamics strategy was used in teaching Physics.

Table 8: Pair-wise Comparisons of Mean Scores of Students with Different Cognitive Abilities taught Physics Using Group Dynamics Teaching Strategy

(I) Ability	(J) Ability	Mean Difference (I– J)	Std. Error	Sig.
Low Cognitive Ability	Moderate Cognitive Ability	0.54	0.03	0.04
	High Cognitive Ability	0.33	0.03	0.02
Moderate Cognitive Ability	High Cognitive Ability	-0.21	0.03	0.04

*Based on estimated marginal means. * The mean difference is significant at the .05 level*

Table 8 shows the bivariate comparisons of the mean academic performance of students of different cognitive abilities taught Physics was significantly different at p = 0.04<0.05 for low cognitive ability and moderate cognitive ability. Similarly, comparisons of the mean ability groups

was significantly different at p = 0.02 < 0.05 for low cognitive ability and high cognitive ability. Also, the bivariate comparisons of the mean ability groups was significantly different at p = 0.04 <0.05 for moderate cognitive ability and high cognitive ability. Thus, the rejected null hypothesis is not confirmed and not upheld. This implies that there is significant difference in mean academic performance of students of low, moderate and high cognitive abilities when group dynamics was used in teaching Physics.

Hypothesis 3

There is no significant difference in mean academic performance of low, moderate and high cognitive abilities when visual clue strategy was used in teaching Physics.

Table 9: One-way ANCOVA Result on Post-Performance Score of Students Different Cognitive Abilities taught Physics using Visual Clue Teaching Strategy

Source	Type III sum of squares	Df	Mean square	F	Sig.	Decision
Corrected model	163.284a	2	50.251	11.378	.004	
Intercept	7811.961	1	1400.316	317.530	.001	
PRE-SCAT	49.500	1	50.261	3.255	.084	
SCAT	**437.335**	**1**	**13.830**	**12.385**	**.007**	**S**
Error	1644.621	154	8.145			
Total	62941.212	157				
Corrected Total	2421.336	156				

a. R Squared = .771 (Adjusted R Squared = .508) S = Significant, NS = Not Significant

Table 9 shows that on the F-value of 12.385 is significant (p=0.007<0.05) at df = 1,154.. The null hypothesis is therefore, rejected. This implies that there is significant difference in mean academic performance of low, moderate and high cognitive abilities when visual clue strategy was used in teaching Physics.

Table 10: Pair-wise Comparisons of Mean Scores of Students with Different Cognitive Abilities taught Physics Visual Clue Teaching Strategy

(I) Ability	(J) Ability	Mean Difference (I– J)	Std. Error	Sig.
Low Cognitive Ability	Moderate Cognitive Ability	0.65	0.06	0.15
	High Cognitive Ability	1.02	0.06	0.04
Moderate Cognitive Ability	High Cognitive Ability	0.37	0.06	0.01

*Based on estimated marginal means. * The mean difference is significant at the .05 level*

Table 10 shows the bivariate comparisons of the mean academic performance of students of different cognitive abilities taught Physics using visual clue was not significantly different at p = 0.15>0.05 for low cognitive ability and moderate cognitive ability. Thus, the rejected null hypothesis is confirmed and not upheld. This implies that there is no significant difference in mean academic performance of low and moderate cognitive abilities when visual clue was used in teaching Physics.

However, comparisons of the mean ability groups was significantly different at p = 0.04 < 0.05 for low cognitive ability and high cognitive ability. Also, the bivariate comparisons of the mean ability groups was significantly different at p = 0.01 <0.05 for moderate cognitive ability and high cognitive ability. Thus, the rejected null hypothesis is not confirmed and not upheld. This implies that there is significant difference in mean academic performance of students of low, moderate and high cognitive abilities when visual clue was used in teaching Physics.

Hypothesis 4
There is no significant interaction effect of strategies and cognitive abilities on academic performance of students in Physics.

Table 10: One-way ANCOVA on Post-Test Interaction Effect of the Strategies and Cognitive Abilities on Academic Performance of students in Physics

Source	Type III sum	Df	Mean square	F	Sig	Decision
Corrected model	147.567a	2	73.784	12.746	.000	
Intercept	7303.620	1	7303.620	1261.660	.000	
PSPT	34.105	1	34.105	5.891	.016	
SCAT	97.253	1	97.253	16.800	.000	
PSPT*SCAT	**67.842**	**1**	**26.2835**	**8.482**	**.061**	**S**
Error	891.490	154	5.789			
Total	60953.000	157				
Corrected total	1039.057	156				

a. R Squared = .842 (Adjusted R Squared = .131) S = Significant, NS = Not Significant

Table 9 shows that the F-value of the interaction effect between the strategies and cognitive abilities on academic performance being 18. 482 is not significant at df = 1,154. This is because the p-value of 0.061 is greater than the α-value of 0.05. The null hypothesis is therefore not rejected. This means that there is no significant interaction effect of strategies and cognitive abilities on academic performance of students in Physics.

DISCUSSION OF FINDINGS

The study found that there is significant difference between the mean academic performance of students taught Physics using group dynamics strategy, visual clue strategy and demonstration method. However, there is no significant difference between the mean academic performance of students taught Physics using group dynamics strategy and visual clue strategy. This finding is in line with that of Okoronka. (2004) who observed that continued use of teacher-centred or teacher-dominated strategies would yield nothing but learning by rote thereby making it difficult for students to recall pieces of information from memories or retention. The poor performance of students in Physics over the years is linked to the use of poor instructional strategies as reported by Ogunleye and Babajide (2011). The implication of the finding is that a learner-centred strategy such as Group-Dynamics will enhance students' performance in physics.

The study also found that there is significant difference in mean academic performance of students of low, moderate and high cognitive abilities when group dynamics was used in teaching Physics. This means that the performance of students with different cognitive abilities is enhanced when taught using group dynamics strategy. Thus, students with low and moderate cognitive abilities who hitherto, could not grasp Physics instructions imparted and those with high cognitive abilities in them tend to perform better when taught using the group dynamics strategy. This finding is supported by Deary, Strand, Smith, and Fernandes, (2017) who found that students tend to perform better when in group.

Similarly, the study found that there is significant difference in mean academic performance of students of low, moderate and high cognitive abilities when visual clue was used in teaching Physics. This suggests that students with low and moderate cognitive abilities who hitherto, could not grasp Physics instructions imparted and those with high cognitive abilities in them tend to perform better when taught using the visual clue strategy.

However, results of the study show that there is no significant difference between the interaction effect of strategies and cognitive abilities on academic performance of students in Physics. Specifically, the mean scores the prêt-test group were 12.11, 9.54 and 6.79 for students with high, moderate and low cognitive abilities respectively. For the post-test group, the mean scores were 23.75, 16.03 and 10.48 for students with high, moderate and low cognitive abilities respectively. There is no doubt that students in the post-test group performed comparatively better than those in the pre-test group. However, since the result was not significant, it implies that students with different cognitive abilities tend to perform at same level in Physics when Group Dynamics and Visual Clue strategies were used in teaching them complementarily.

CONCLUSION AND RECOMMENDATIONS

The study concluded that Group-Dynamics and Visual Clue instructional strategies are better strategies for teaching of Physics students compared to demonstration strategy. Physics students with different cognitive abilities tend to achieve higher mean performance when taught using Group-Dynamics and Visual Clue instructional strategies are compared to those taught using demonstration strategy. On the basis of this conclusion, the following recommendations were made:

1. The Physics teachers in various Secondary Schools should use Group-Dynamics and Visual Clue instructional strategies for the teaching of Physics concepts
2. Workshops should be organised by educational bodies such as Science Teachers Association of Nigeria (STAN) to sensitise teachers and physics educators on the use of group-dynamics and Visual Clue instructional strategies.
3. Government should encourage the use of group-dynamics and Visual Clue instructional strategies through workshops, conferences and refresher when planning a policy in education.

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