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Implications of cognitive abilities in students' performance in physics using group dynamics and visual-clue strategies

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Abstract: The study examined the implications of cognitive abilities of students on their academic performance when taught Physics using group dynamics and visual clue strategies. The quasi-experimental research design was adopted. The study population was 1,920 SSII students from 48 Secondary Schools in Makurdi metropolis from where the sample of 157 was drawn. The instruments: Physics Students' Performance Test (PSPT) and Students' Cognitive Ability Test (SCAT) were used for data collection. Hypotheses were tested at 0.05 level using Analysis of Covariance (ANCOVA). There was significant difference between the mean academic performance of students taught Physics using group dynamics strategy, visual strategy and demonstration method; there was significant difference among the mean abilities of students when group dynamics strategy was used and also when visual clue strategy was used in teaching Physics; there is significant difference between the interaction effect of strategies and cognitive abilities on academic performance of students in Physics. The study recommended among others that since the interaction effect of strategies and cognitive abilities on academic performance of students in Physics was significant, the use of both strategies could be useful in fostering the academic performance of students of high ability groups while use with low and moderate ability groups should be with caution.

Keywords: Group dynamics strategy, visual clue strategy, demonstration method, academic performance, cognitive abilities

Implikasi kemampuan kognitif dalam kinerja siswa dalam fisika menggunakan dinamika kelompok dan strategi petunjuk visual

Abstrak: Studi ini meneliti implikasi kemampuan kognitif siswa pada kinerja akademik mereka ketika diajarkan Fisika menggunakan dinamika kelompok dan strategi petunjuk visual. Desain penelitian kuasi-eksperimental diadopsi. Populasi penelitian ini adalah 1.920 siswa SSII dari 48 Sekolah Menengah Pertama di kota Makurdi yang diambil sampelnya sebanyak 157 orang. Instrumen yang digunakan adalah Tes Kinerja Fisika Siswa (PSPT) dan Tes Kemampuan Kognitif Siswa (SCAT) untuk pengumpulan data. Hipotesis diuji pada tingkat 0,05 menggunakan Analisis Kovarians (ANCOVA). Ada perbedaan yang signifikan antara rata-rata prestasi akademik siswa yang diajar Fisika menggunakan strategi dinamika kelompok, strategi visual dan metode demonstrasi; ada perbedaan yang signifikan antara kemampuan rata-rata siswa ketika strategi dinamika kelompok digunakan dan juga ketika strategi petunjuk visual digunakan dalam pengajaran Fisika; ada perbedaan yang signifikan antara pengaruh interaksi strategi dan kemampuan kognitif terhadap prestasi belajar fisika siswa. Studi ini merekomendasikan antara lain bahwa karena pengaruh interaksi strategi dan kemampuan kognitif terhadap kinerja akademik siswa dalam Fisika adalah signifikan, penggunaan kedua strategi dapat berguna dalam mendorong kinerja akademik siswa kelompok berkemampuan tinggi sedangkan penggunaan dengan rendah dan sedang. kelompok kemampuan harus dengan hati-hati.

Kata Kunci: Strategi dinamika kelompok, strategi petunjuk visual, metode demonstrasi, kinerja akademik, kemampuan kognitif

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INTRODUCTION

Educating students to think critically, solve difficult issues, and prosper in the 21st century society and economy is the primary purpose of the educational process Students' progress and the success of educational initiatives can only be monitored and evaluated if these kinds of skills and knowledge are being measured. Science education has employed a variety of methods to help pupils enhance their overall performance in the field. The study of physics in secondary school is an essential part of every country's scientific and technical progress. Ogunleye and Babajide (2011) argue that Physics serves as a vehicle for long-term science goals because it is instrumental in global technological and socioeconomic development. For the education of scientists, chemists, engineers and other practitioners of various physical or biological sciences, physics plays a critical role (Oludipe, 2012). It is essential to every nation's technological advancement, and its applications may be found in every facet of human existence. Because of its importance in advancing human well-being and increasing material wealth, it is a cornerstone of scientific inquiry.

Considering the significance of Physics, there are a number of issues with the subject's teaching and learning, particularly in secondary schools. There are a number of issues here, such as a lack of skilled scientific instructors, insufficient teaching resources, and poor methods of education (Achor & Gbadamosi, 2020). There has been no improvement in secondary school pupils' results in physics. It is estimated that between 2006 and 2020, the proportion of Nigerian students who pass at credit level or above would be below 50%, according to data gathered from the research library of the West African Examinations Council headquarters Lagos.

This raises questions on the authenticity and reliability of the high level of bad performance, and by extension, the quality and efficiency of the teaching and learning process that takes place in educational institutions. This pattern of poor performance is not acceptable for a nation with technological aspirations like Nigeria, which has a high incidence of low student enrollment and, as a result, a small number of people who want to study science, technology, and related fields. 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.

The dynamics of a group's interactions and how that affects the way they function are the focus of the study of group dynamics. A teacher who uses a group dynamics teaching style understands that not all of the elements that influence group dynamics are within their control. Among the most important aspects of group dynamics are the resources of the group members, the structure and norms of the group (such as the size and structure of the group), the communication and decision-making processes of the group, as well as the tasks of the group (complexity and interdependence). Cohesion in a group is essential to the formation of group dynamics. Cohesiveness not only improves the output and motivation of the group's members, but it also extends the life of the group. Group members who are able to understand and accept each other are more likely to save their group than those who do not (Alikhani & Bagheridoust, 2017; Pambudi et al., 2022; Rumalolas et al., 2021; Winnie, 2020). Each member of the group benefits from a feeling of belonging to a coherent group, as was previously stated. The group's performance will increase if its members perform well. Because of this, group cohesion has a direct impact on collective output. The amount of time that members of a group spend together has an impact on their ability to operate as a unit. Cohesion may be improved through getting to know each other better as a group. The group's performance will improve as a consequence of its high level of cohesion.

Group dynamics theory (GDT) is concerned with the interactions that take place inside a group during a period of collective learning. In reality, GDT is concerned with scenarios that might inspire students to achieve greater levels of mastery in their studies. Furthermore, it sheds information on how students behave in the context of a social network. Instead of focusing on learning anything separately, group dynamics emphasize working in pairs and groups. Major components of the idea include group cohesion, standards set for groups, style of group leadership, and size of groups, to name a few.

On the other hand, visual clues provide significance to things like events and pictures, since being able to understand them is an important part of the development of social language and social interaction in general. When a teacher uses a visual hint teaching technique, she or he actively encourages pupils to decipher still and moving pictures such as documentary or advertising photography and television programs and films. He or she teaches pupils about the meanings of symbols and signs in visual media, such as painting and photography. Physics education research according to Ayres and Paas, (2007) has investigated how visual cues could help focus learners' attention on relevant areas to approach solving problems.

Liyanage (2015) said that cues could enhance understanding and cues may make easy to select information and sometimes improve learning. Eye movement data according to Thomas and Lleras (2007) could also be used to show the effectiveness of the visual cues to draw the attention in relevant areas. 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, Dakang et al. (2021) found that using an interactive student's notebook with feedback techniques helped improve students' scientific process skills acquisition, performance, and attitude toward physics in Plateau state, Nigeria. When it comes to teaching physics, employing an interactive notebook was proven to be more effective than using a more traditional method of teaching.

The Latin word "demonstrate," which means "to exhibit or explain," is the origin of the phrase demonstration (Salas et al., 2009). This is a pretty near approximation to the most widely accepted definition: It's a procedural description or explanation using examples, specimens, or anything like to demonstrate the point. It has been suggested that demonstrations can be defined as dynamic examples of part or full task performance or characteristics of the work environment that are designed to improve learner performance by showing (through modeling, simulation or any other visual approach) how knowledge, skills and attitudes (KSAs) targeted for skill acquisition are put into action (Ashby et al., 2003).

A Stanford University psychologist called Lewis Terman published the "Stanford Revision of the Binet-Simon Scale" in 1916. This scale, which is now known as the Stanford-Binet and is still in use today, was a revision of the original Binet-Simon scale. This scale defined intellectual ability in terms of four distinct cognitive factors, including the ability to demonstrate language mastery through demonstrations of vocabulary knowledge and sentence comprehension. Other factors included verbal reasoning, the ability to solve verbal problems, and the ability to demonstrate verbal reasoning. This insight into the concept of cognitive ability was the beginning of the understanding of what is now known. Terman's test also resulted in a comprehensive score that he called an "intelligence quotient"; what has been shortened today to an ‘IQ’. Cognitive abilities are brain-controlled abilities that concentrate on memory, reasoning, and problem-solving, and cognitive abilities aid in daily living (Asaph & Raja, 2016).

Certain individuals obviously and consistently comprehend new ideas more quickly than others, are better equipped to quickly find solutions to unfamiliar problems, see connections between seemingly unrelated things in a way that other people are unable to, and are more knowledgeable about a wider variety of subjects. The results of the cognitive ability tests are given as scores based on the performers' respective performances. A pupil who receives a score on a standardized test of cognitive capacity that is less than forty percent is unable to gain mastery and is unable to remember material that has been retained relatively well within a reasonable length of time. This point stresses the importance of the concept in this study. Until the cognitive ability of individual learners in Physics are put into consideration, nothing much can be achieved. Achor and Ejeh, (2019), Mbaubedari et al. (2022), Musa et al. (2021) emphasizes that knowledge of cognitive ability of learners are necessary if the teacher must make progress in teaching.

Walberg's Theory of Academic Performance and Jean Piaget's Theory of Cognitive Development are the two ideas that are important to consider in relation to the academic performance and cognitive capabilities of pupils. Children's mental development proceeds in a linear fashion via a succession of four different phases, as hypothesized by Jean Piaget in his theory about the development of cognitive abilities. His hypothesis is centered not just on the question of how kids pick up new knowledge, but also on the bigger question of what intelligence really is. This is due to the fact that the primary emphasis of his theory is on deciphering the components that make up intelligence. The stages described by Piaget are as follows: The Sensorimotor stage takes place between birth and the age of 2; the preoperational stage takes place between the ages of 2 and 7; the concrete operational Stage takes place between the ages of 7 and 11; and the Formal Operational Phase takes place between the age of 12 and above. Piaget held the belief that children participate actively in the process of learning, behaving in many ways similar to young scientists as they conduct experiments, make observations, and gain knowledge about the world around them. Children's engagement with the world around them results in a steady accumulation of new information, the expansion of previously held beliefs, and the modification of preconceived notions to make room for newly obtained knowledge.

Less significant were the effects of background factors that were farther removed, such as state, district, or school regulations, organizational features, curriculum, and teaching. The research conducted by Wang et al. (1997) came to the conclusion that "direct intervention in the psychological factors of learning provide the most successful pathways for transformation". Wang's research review focuses on the characteristics of student learning on social variables, cognitive abilities, motivation, affective, behavioral, and metacognitive abilities that have the greatest potential to be modified, which in turn can have a significant positive impact on student learning outcomes (DiPerna et al., 2002).

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 and 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 differences for students of different cognitive abilities, with high level of failures in certificate examinations especially for students with low cognitive ability. 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% (NECO, 2020; WAEG, 2020). This implies that the low performance in Physics at certificate examination level is linked to the different cognitive abilities of the students. The problem of this study therefore is: What is the relative effect of group dynamics and visual clue teaching strategies on the academic performance of students with different cognitive abilities in Physics in Benue State? 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.

METHOD

The study adopted a quasi-experimental design. It was a pretest, posttest non-equivalent control group design. 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.

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-items 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 0.93 and 0.88 respectively. These were considered to be highly reliable based on the specification of (Agogo & Achor, 2019).

In order to determine students' performance and cognitive abilities in Physics, pretest 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 posttest was administered for PSPT only since SCAT was for the purpose of categorisation. The scripts collected for both pretest and posttest from the two groups were marked and the scores recorded and used for analysis. The PSPT administered in the pretest was reshuffled before being used for posttest for both experimental and control groups to reduce Hawthorne effect in which participants alter their behaviour as a result of being used for an experiment.

RESULTS

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) Pretest was used as covariate for both students' performance and cognitive abilities in physics. ANCOVA was used because the study used intact class with a pretest which served as covariate

Table 1. Mean performance and standard deviation scores of students in experimental and control groups

Strategy	N	Pretest		Posttest		Mean Gain
		Mean	Std. Dev	Mean	Std. Dev	
Group Dynamics	79	13.91	2.16	31.71	2.91	17.88
Visual Clues	79	10.41	3.41	23.07	3.36	12.66
Demonstration	78	4.05	5.96	7.64	4.73	3.59

Table 1 shows that the pretest 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 posttest 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 pretest and posttest scores of the group dynamics strategy, and the mean gain score of 17.0. The pretest and posttest 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 pretest and posttest respectively. This means that students who were taught Physics using group dynamics strategy performed better than students that were taught using demonstration approach.

Table 2. Mean scores and standard deviation of academic performance of students of different cognitive abilities taught physics using group dynamics strategy

Strategy	Cognitive Ability	Pretest		Posttest		Mean Gain
		Mean	Std. Dev	Mean	Std. Dev	
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 ability taught Physics using group dynamics at pretest and posttest were

12.11 and 23.75 with standard deviations of 3.16 and 2.74 respectively, while the mean performance for moderate cognitive ability 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 ability for pretest and posttest were 6.79 and 10.48 respectively with standard deviations of 5.18 and 3.07. This gives mean gain scores of 11.61, 6.49 and 5.69 for high, moderate and low cognitive ability groups, respectively. Thus, the higher the cognitive ability the higher the mean gain in academic performance of students taught Physics using group dynamics strategy.

Table 3. Mean scores and standard deviation of students' cognitive abilities and academic performance using visual clue teaching strategy

Strategy	**Cognitive Ability**	**Pretest**		**Posttest**		**Mean Gain**
		Mean	**Std. Dev**	**Mean**	**Std. Dev**	
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 ability taught Physics using visual clue strategy at pretest and posttest levels were 7.60 and 15.44 respectively with standard deviations of 6.29 and 3.58, while the mean performance for moderate cognitive ability 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 ability in the visual clue class at pretest and posttest levels 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. Thus, the higher the cognitive ability the higher the mean gain in academic performance of students taught Physics using visual clue strategy.

Table 4. One-way ANCOVA summary result on post-performance score of students

Source	**Type III sum of squares**	**Df**	**Mean square**	**F**	**Sig.**
Corrected model	136.502a	2	68.251	7.036	0.001
Intercept	5078.902	1	5078.902	523.575	0.000
PRE-PSPT	31.975	1	31.975	3.296	0.071
Group	117.529	2	117.529	12.116	0.001
Error	1493.867	154	9.700		
Total	83949.000	157			
Corrected Total	1630.369	156			

Table 4 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 = 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 5. Pair-wise comparisons of mean scores of students with different cognitive abilities

[I] Strategy	[J] Strategy	Mean Difference (I-J)	Std. Error	Sig.
Demonstration	Group Dynamics	1.82*	0.60	0.02
	Visual Clue	1.37*	0.60	0.04
Group Dynamics	Visual Clue	-0.45	0.60	0.16

** Significant at the .05 level*

The results of the bivariate comparisons of the ways of teaching physics and its influence on the mean performance of students are shown in Table 5. The demonstration and group dynamics strategies were found to have a significant impact, with a p-value of less than 0.05. In a similar vein, when comparing the ways of teaching Physics and its influence on the overall performance of the students, the significance level for demonstration and visual hint teaching tactics was found to be significant at $p = 0.000 < 0.05$. This indicates that there is a substantial difference in the mean academic performance of students who were taught Physics using the group dynamics strategy, the visual clue strategy, and the demonstration approach respectively.

However, when comparing the ways of teaching Physics and their influence on the mean performance rating of students, the comparisons for the group dynamics strategy and the visual hint teaching strategy did not provide significant results at a significance level of $p = 0.16 > 0.05$. This indicates that there is not a significant difference between the mean academic performance of students who were taught Physics using the group dynamics method and students who were taught using the visual hint technique.

Table 6. 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.
Corrected model	163.284a	2	33.412	9.671	0.003
Intercept	7811.961	1	5580.513	923.281	0.000
PRE-PSPT	49.500	1	31.975	2.732	0.071
Ability Groups	437.335	2	17.529	10.315	0.000
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 6 shows that on the F-value of 17.529 is significant ($p=0.000<0.05$) at df = 2, 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 group dynamics strategy was used in teaching Physics.

Table 7. 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

Table 7 shows that 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 were significantly different at $p = 0.02 < 0.05$ for low cognitive ability and high cognitive ability groups. Also, the bivariate comparisons of the mean ability groups were significantly different at $p = 0.04 <0.05$ for moderate cognitive ability and high cognitive ability groups. This implies that there is significant difference in mean academic performance of students of low, moderate and high cognitive ability groups when group dynamics was used in teaching Physics.

Table 8. One-way ANCOVA result on post-performance score of students of different cognitive abilities taught physics using visual clue strategy

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	163.284a	2	50.251	11.378	0.004
Intercept	7811.961	1	1400.316	317.530	0.001
PRE-SCAT	49.500	1	50.261	3.255	0.084
Ability Groups	437.335	2	13.830	12.385	0.007
Error	1644.621	154	8.145		
Total	62941.212	157			
Corrected Total	2421.336	156			

Table 8 shows that the F-value of 12.385 is significant ($p=0.007<0.05$) at df = 2, 154. The null hypothesis is therefore, rejected. This implies that there is significant difference in mean academic performance of low, moderate and high cognitive ability students when visual clue strategy was used in teaching Physics.

Table 9. 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

Table 9 shows that 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. This implies that there is no significant difference in mean academic performance of low and moderate cognitive abilities students 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 groups. 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 groups. 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.

Table 10. One-way ANCOVA on posttest interaction effect of the strategies and cognitive abilities on academic performance of students in physics

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	147.567a	2	73.784	12.746	0.000
Intercept	7303.620	1	7303.620	1261.660	0.000
PSPT	34.105	1	34.105	5.891	0.016
SCAT	97.253	1	97.253	16.800	0.000
Strategies*Ability	67.842	1	26.2835	8.482	0.061
Group	891.490	154	5.789		
Error					
Total	60953.000	157			
Corrected total	1039.057	156			

Table 10 shows that the F-value of the interaction effect between the strategies and cognitive abilities on academic performance being 8. 48 is not significant at df = 1,154. This is because the p-value of 0.061 is greater than the -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

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, bivariate pair analysis shows there is no significant difference between the mean academic performance of students taught Physics using group dynamics strategy and visual clue strategy, that is the two experimental groups. 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 (Harso et al., 2021; Ogunleye & Babajide, 2011). The implication of the finding is that a learner-centred strategy such as Group-Dynamics and visual clue strategies will enhance students' performance in physics better than demonstration method.

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. Accordingly, the higher the cognitive ability of students the higher is their mean gain in academic performance when taught Physics using group dynamics strategy. This means that the performance of students with different cognitive abilities is enhanced when taught using group dynamics strategy but decreases in mean gain as the effect of the strategy as their cognitive ability decreases. Thus, students with low and moderate cognitive abilities who hitherto, could not grasp Physics instructions improved and those with high cognitive ability among them tend to perform better and gained more when taught using the group dynamics strategy. This finding is supported by that of Deary et al., (2007) who found that students tend to perform better when in group, thus the use of group dynamics became an advantage. Dewi (2019) found that the characteristics of the leader and group members have influence on the changing characteristics of a group when group dynamics is used in teaching and this influenced their achievement. Further, Rauch and Frese (2014) found that the characteristics influencing individual success are determined by: innovation, autonomy, locus of control, and self-efficacy, the need for achievement, risk taking. These characteristics must have influenced the high achievement of students in this study.

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. Again, the higher the cognitive ability the higher the mean gain in academic performance of students taught Physics using visual clue strategy. This suggests that students with low and moderate cognitive abilities who hitherto, could not grasp Physics instructions imparted gained reasonably and those with high cognitive abilities in them tend to perform better when taught using the visual clue strategy. According to the findings of Gaard (2018), the use of visual cues is effective in assisting students in the transition into the following topic. The students were provided with a baseline for determining how much time they had left to prepare their materials, despite the fact that the statistics about the transition times were not statistically significant. A instructor would be able to change the time according to his or her requirements if they were provided with a visual signal.. There are great implications in the performance of students of different cognitive abilities in Physics when each of the experimental strategy was used. On the one hand it implies that students of low and moderate cognitive abilities were not as favoured in mean gain as those in high ability class. On the other hand, when a class of physics students consist of mixed ability groups, the use of group dynamics and visual clue strategies may not be appropriate.

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. There is no doubt that students in the posttest group performed comparatively better than those in the pretest 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 are used in teaching them. By implication, each of the strategy (that is, group dynamics and visual clue strategies) can be complement one and another.

CONCLUSION

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 high cognitive ability achieved higher in mean performance when taught using Group-Dynamics and Visual Clue instructional strategies. This has obvious implications for the choice of group dynamics or visual clue strategies in teaching physics in mixed ability class. On the basis of this conclusion, the following recommendations were made:

1. The Physics teachers in various Secondary Schools should use of Group-Dynamics and Visual Clue instructional strategies interchangeably for the teaching of Physics concepts among high ability students. However, if it must be used for mixed ability groups, caution must be taken to carry along students of low and moderate ability groups.
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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