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Scope and Editorial Policies

Nigerian Journal of Applied Psychology is primarily meant to publish reports which can make professional as well as laymen utilize psychology principles in making the human organism more mentally and physically healthy. The journal is meant to make it possible for many more people to utilize psychological principles in their day-to-day activities. One of the aims of the journal is therefore to report articles which when ready by people may increase their self-understanding, awareness, problem-solving capacities, creativity and improved adaptive and coping behaviour strategies.

The Journal is an Applied Psychology Journal par excellence. The journal publishes reports which may have applications to individuals in the family, educational contexts, health delivery systems, criminal justice systems. Articles which can analyze and help to solve many problems of society are also welcome.

The editorial policy of the journal will use the following order of publication preference.

6. Reports that suggest practical ways of eliminating, reducing or managing certain socially undesirable behaviour patterns.
7. Programmes that can be self-administered to solve psychological and other behavioural problems.
8. Review articles that expose the various strategies of managing certain maladaptive behaviours.
9. Theoretical or speculative reports for heuristic consideration in problem solving.
10. Book reviews especially review of books that contain some do-it-yourself psychology.

Nigerian Journal of Applied Psychology is considered to include psychology which may be utilize in the following ways for alleviating human problems:

- By an individual
- Education
- Health delivery systems
- Counselling
- Criminal justice systems
- Town and urban planning
- Prisons etc.
- Industry
- Organisational settings
- Agriculture
- Hotel organisation
- Parenting
- Family life education.

General Information and Manuscript Preparation
Manuscript Preparation

9. Two copies of manuscript of typed doubled space on one side of A4 paper submitted alone with electronic copy.
10. Each manuscript should contain, Name and address of the author including his institutional affiliation, abstract, introduction, and the body of the paper.
11. Each page should be numbered consecutively in the upper tight hand corner beginning with the Title page.
12. Papers should not exceed 20 pages including references.

Manuscripts

9. The title page contain a concise but informative statement which should not be more than 15 words.
10. Below the Title should be written the author's names in order, first name, middle name and family name last with the highest degrees. The department of the author, and his/her institutional affiliation.
11. Abstract - The abstract of the manuscript should not be more than 150 words. It should be on page 2 of the manuscript. Abstract should state concisely the purpose(s) of the paper, basic segments and general principles to be put across to readers.
12. If the paper is the report of the study, it should include background, methodology, analyses and results.
    (a) Background includes introduction, and review of literature central to the study.
    (b) Methodology should include concise explanation of design, sample and sampling procedure, instruments and their psychometric characteristics plus a well-explained procedure.
    (c) Results should be presented in form of tables to which reference is made in brief descriptions.

5. References should be written in alphabetical orders. The reference list should include only the cited works within the body of the paper. Reference should follow the APA system.

The format to be followed in writing the reference is as below:

(h) Family name of the author
(i) The Initials
(j) The year of Publication
(k) The title of the paper.
(l) The journal or book in which paper is published.
(m) If a journal, the volume and pages.
(n) If a book, the city and the publisher.

6. Manuscript Submission.

All manuscript should be submitted to the Editor-in-Chief.

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The Effect of Game on students' Achievement in Senior Secondary School Physics in Oyo State

By

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Abstract

Two major problems confront the physics discipline – the problems of low enrolment and poor performance in the subject by those who eventually registered for the subject. Although, many methods were suggested by scholars to improve students' achievement in physics, not much desired effects were recorded. One of the attributes of students at any level is to play, therefore, this study examined the effects of game on students' achievement in physics. The study adopted a 2 x 2 factorial design with pre-test and post-test control groups in quasi-experimental setting. Treatment was administered at two levels: (game and control). The moderator variable used in the study was the gender at two levels (male and female). One hundred and twenty eight senior secondary two (S.S. 2) students in four selected secondary schools from Ibadan North and Akinyele Local Government Areas of Oyo State participated in the study. Two instruments were used: one response instruments- Physics Achievement Test (PAT) and one stimulus instrument (teaching package). Data analysis was done using analysis of covariance (ANCOVA) with the pre-test scores serving as covariates

to test for the interactive and main effects. The results indicated that there is a significant main effect of treatment on students' achievement in physics, gender also has significant effect on students' achievement in physics. The interaction between the treatment and gender was. Based on the findings, it is recommended that games should be used to complement ***teaching of physics.***

Keywords: Game, Students' Achievement in physics, Gender

Introduction

Physics has been identified as an important science subject in the development of any nation (Irogbu 1998 and Okpala 1998), possibly because it is a subject students who want to read Engineering, Medicine, Pharmacy, Computer Science, Veterinary Medicine, Science education and Agriculture can not run away from. Engineering, Medicine, Pharmacy, Computer Science, Veterinary Medicine, Science education and Agriculture are the disciplines needed for a nation's development. Unfortunately, Physics as a subject is unwelcome by most students over the years (Adewale, 2002) as measured by the enrolment pattern. Apart from low enrolment pattern in the subject, students who found themselves offering the subject do not do well at the public examination like WASC (Salami, 1992). The reason could be that the teaching of physics by teachers seems so abstract that an average student does not know its difference from a mathematics class. Hence, few students who survived the gyratory work cannot form any appreciable relationship between what they learn in the classroom and what they encounter in the physical science world. In order to raise students' achievement in physics such projects as the Nigerian Secondary School Physics (NSSP); the Senior Secondary School Physics (SSSP); and the Traditional Physics (TP) were inaugurated. Each of these projects encourages an inquiry method of teaching. Therefore, there is the need to use appropriate strategies and materials, which will make the learning

of physics investigative; enjoyable and adventurous, as possible. Researchers have identified many teaching strategies which could help students to learn physics more accurately. Among the past work on teaching physics include the mastery learning as suggested by Bloom (1968). The most commonly used method of teaching in our secondary schools is the lecture (monologue) method. In this case the teacher passes on some useful information to the learners without giving the learners adequate opportunity to react to the stimuli provided by the teacher (Iroegbu, 1999). Hence, the use of lecture method has some limitations because achievement of learning objectives is lowered. This has prompted Lewis (1972); Joyce and Well (1980) to criticize the use of lecture method in our schools. Another widely use method is the discovery approach, here students are allowed to discover facts for themselves but teachers could be facilitators, a helper and a guide. This, seemingly good (because it can be regarded as one of the learner centred methods) as it is, has the limitation that it is time consuming, difficult to manage and has unpredictable learning outcomes (Abdullahi, 1992). Used of textual materials is another teaching method commonly used in teaching physics. Availability and use of textbooks has consistently raised student achievement level in science (Heyneman and Loxley, 1983). However, some of these texts are not well prepared: pictures diagrams and charts are lacking in some texts, the arrangement and grammatical structures of some texts are enough to discourage a learner from using such as a method of learning. Another factor is that most of these good texts are expensive.

Audio-visuals have been identified as motivating resources for studies in the developing countries such as Nigeria (Lewis, 1972). Iroegbu (1991) also discovered that audio-visual are capable of helping learners to learn and acquire new concepts, assist in motivating them to perform like experts, help in constructing cognitive bridges and consequently capable of promoting the achievement of higher order objectives such as

problem solving. The question is how many of our schools can afford these audio-visuals? Or better still how many of the students have audio-visuals at home. The study of Farombi (1998) revealed that out of forty schools used in Oyo State as at 1998, not a single school possessed an overhead projector nor television set not to talk of video player. Students also were allowed to report freely on whether they possess television and video player at home (the situation is likely to have changed now). Only few of them indicated that their parents had such audio-visual gadgets, hence, audio-visual is limited in its use as a teaching method.

Much has been reported about the use of computer in the teaching and learning of physics concepts. Adesoji (1996) is of the opinion that the computer has been effective in stimulating the interest of students and giving individualized tuition at the child's own pace and direction. There are two basic approaches to computer based instruction: The computer managed instruction (CMI) and computer assisted instruction (CAI). Abimbade (1997) describes CMI as an approach in which the computer is used to perform educational management functions of the teacher. He describes the CAI as an automated instruction in which the computer is used to deliver instruction to the learner through interactive process. Abimbade (1997) states that computer based instruction has certain unique characteristics such as learner controlled; self pacing; prompt feedback; random access facilities; adaptability; flexibilities; adjustability; facilities for revision and so on. Thus, in the process of instruction, the computer assesses the initial competence of the learner, diagnoses difficulties and uses this to determine what the learner should engage in. The instruction progresses on the basics of what each learner achieves at every stage, the set of criteria of competence and available alternative instructional materials that can be presented. However, computer has some limitations: in terms of its cost; it demands a lot of time to learn its uses; and an average Nigerian student still considers a computer as one of the "magics of the whites". This

makes computer unpopular in the teaching and learning of any school subject.

It is interesting to note that no single method can be said to be the best (Iroegbu, 1999), however, some methods, presents themselves in such a way that conclusion about them on whether they are good or not will not be difficult. One of such methods is the game based instructional strategy. Game according to Pulos and Snerider (1994) is an enjoyable activity with goals, rules and educational objectives. The fact that a game is enjoyable makes it a motivating tool for learning. Akinyemi (1997) also perceives a game as a contest in which people or players agree to abide by a set of rules in an attempt to achieve a goal or objective. Since it is a contest, this suggests that there are player(s) and opponent(s). Moreover, winner(s) and loser(s) are determined by some rules and regulations and violation of such rules and regulations, attracts penalty. One outstanding feature of a game is that, it involves chance or luck and skill. It follows, therefore that, some low ability students can emerge as winners over the high ability students. Aremu (1998) points out that a game involves competition and cooperation which essentially motivate learners.

In academic games like in this study, students are seen as teaching themselves (peer tutoring) as one of them (opponent) moderates for the one playing. For example, if student A plays, students B should ask the question and cross-check the answer in order to determine if the player is right or wrong. The process is reversed and it continues like that until the game is over. In this way, the game has brought in cooperation. Another feature of game is the rewarding aspect. Like in any other game such as football, table tennis, volley ball and so on, where a winning team is rewarded, here the winner also is rewarded in form of praise or tip-offs by the organiser of the game (teacher). In some instances when students are less busy, they can organise this game among themselves, since the game is less cumbersome.

Apart from game, gender is another important variable considered in this study. Many studies fail to see gender difference in science and mathematics, while some indicated that boys are better in science than girls. Hallinan and Sorenson (1987) believe that in schools which group students by ability, girls are significantly less likely to be put in high-ability groups than are boys of equal ability, and are significantly more likely to be mis-assigned than boys. Chipman and Wilson (1985) observe that both parents and teachers expect girls to do poorly in mathematics and sciences. Their failures are accepted as a necessary shortcoming of being female, and their successes are discounted. Not surprisingly, girls come to have lower confidence in their mathematical and scientific ability than boys have. Therefore, this study also examined the effect of gender on students' achievement in physics. The study also considered the interaction effect of the treatment and gender on students' achievement in physics.

Statement of the Problem

The study sought to examine the main and interaction effects of game based instructional strategy and gender on students' achievement in secondary school physics.

In order to solve this problem, the following research questions were raised.

1. Is there any significant main effect of treatment on students' achievement in physics?
2. Is there any significant main effect of gender on students' achievement in physics?
3. Is there any significant interaction effect of treatment and gender on students' achievement in physics?

Methodology

This study is a non-randomised 2 x 2 pre-test, post-test, control factorial design in which the samples (students) were randomly selected; they were also randomly divided into 2 groups and lastly the treatments were randomly allotted to the groups.

Population, Sampling Technique and Sample

The population of this study comprised the senior secondary school II physics students in two Local Government Areas (LGAs) – Ibadan North and Akinyele. Consents of the school heads were sought before schools are eligible to participate in the study. One of the criteria used in determining whether a school is eligible was the availability of the students after school period. Ten of the schools (six in one LGA and four in the other LGA) indicated their willingness. Two schools each were randomly selected from these local government areas such that a school is allotted to experimental setting and the second to the control group in a LGA, the same procedure was used in the second LGA. An arm of SS 2 science class was randomly selected from each of the four schools. Thirty-two students were randomly selected and used as the sample in each of the four schools selected. Therefore, a total of 128 students constitute the sample of this study. Hence, there were 64 students in the experimental group and 64 students in the control group.

Instruments

Two types of research instruments were used here. One serves as a response instrument (the physics achievement test) and stimulus instrument (the game).

Physics Achievement Test

The items used in the test were developed from the SS 2 physics syllabus (curriculum-referenced) to ensure good content coverage. Distribution of items by content and cognitive behaviours is presented in Table 1. The first three levels of cognitive operation (knowledge, comprehension and application) were used in this study. Since the students were in SS 2 it was expected that they would have covered the area of syllabus used in this study.

Table 1: Table of Specification

Content	Level of Cognitive Operation			Total (100%)
	Knowledge (40%)	Comprehension (30%)	Application (30%)	
Measurements (15%)	4	3	2	9
Motion, type, speed, velocity, acceleration, Newton's laws of motion, graphs, etc (35%)	8	6	7	21
Force (10%)	2	2	2	6
Work, energy and power (15%)	4	3	2	9
Simple machine (15%)	4	2	3	9
Pressure (10%)	2	2	2	6
Total	**24**	**18**	**18**	**60**

The questions (as it relates to this study) are in form of one word answer, completing the statement and providing numerical valued-answer. The questions used were exposed to criticisms by 2 University lecturers in the area of physics education and 2 practicing physics teachers in secondary schools. The test - retest

reliability coefficient of 0.81 was established. This is an evidence of high stability of the test.

The game was initially developed for secondary school Biology and is adapted for physics. The game is made up of four items: the chart (like ludo) and dice; the physics questions (one hundred of them); the correct answers (keys) to the questions; and the game manual.

Procedure

Before the beginning of each lesson, students in the two groups were given a topic to study. Questions on that topic were asked during the lesson. However, there are other specifics that are different with respect to each treatment group.

The Experimental Group

The class was divided into 8 groups with each group having 4 members in a group. Each group was divided into 2- the players and the opponents. With 4 in a group, 2 of them were players and the remaining 2 the opponents. A player tossed the dice and the number on the dice determined the number of steps (s)he took. As (s)he moved his seed to the appropriate position, the number on that position is used in determining the question number. Rewards and penalty for correct and wrong answers are contained in the question booklet. The experiment lasted for six weeks of three period a week (a double period and a single period). Usually, the double period came before the single period. Game took place during the double period, Questions that are difficult during the game period are noted by students (players and opponents) and were clarified during the single period

The Control Group

This is a normal classroom setting where the teacher is the coordinator. The teacher asked the students set of questions drawn from mechanics and properties of matter (same questions as in the experimental setting). The students in turn provided the answer to the questions. Answer booklets were consulted from time to time as the need arises.

Data Collection

Before the commencement of the treatment packages, the physics achievement test was administered on the students, the scores on this test serves as the pre-test scores which was used as covariates for the achievement in physics. The treatments lasted for 6 weeks and at the end of the 6 weeks, the physics achievement test in physics was administered on the students used for the control and experimental treatments.

Data Analysis

The students test was marked and the scores obtained by each student were used as his/her achievement score on the subject (physics). Data were analyzed using the 2 x 2 Analysis of Covariance (ANCOVA) with pre-test scores as covariates and the post test scores as criterion measures. The ANCOVA was used in order to correct for any initial differences (among participants) in the dependent variables. Multiple Classification Analysis (MCA) technique was employed to detect the direction of the differences among the groups.

Results and Discussion

The three research questions were answered and the results are presented as follow:

Research Question 1
Is there any significant main effect of treatment on students' achievement in physics?

Tables 1 and 2 show a significant main effect of treatment on students' achievement in physics ($F_{(1, 123)} = 6.032$; $P < 0.05$). Tables 3 and 4 revealed that students exposed to the game based on instructional strategy had better performance in physics than those exposed to the conventional method of teaching. The post means achievement score being 55.94% for the game-based instructional strategy. The mean achievement score of 49.06% for the control group was observed.

Table 2. ANCOVA of Treatment and Gender on Students' Achievement in Physics.

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates	2182.093	1	2182.093	21.563	.000*
Pre Achievement	2182.093	1	2182.093	21.563	.000*
Main Effects	3323.409	2	1107.803	10.947	.000*
Treat	610.439	1	610.439	6.0323	.021*
Gender	492.882	1	492.882	4.871	.038*
2-Way Interactions	112.880	3	370.960	3.666	.023*
Treat x Gender	541.163	1	541.163	5.348	.030*
Explained	6916.975	4	1729.244	17.088	.000*
Residual	12447.025	123	101.195		
Total	4.000	127	162.723		

* = significant at $p < 0.05$

Table 3 MCA of Treatment and Gender on Students Achievement in Physics.

Grand Mean = 53.00%

Variable + Category	N	Unadjusted Dev'n in %	Eta	Adjusted for Independents + Covariates Dev'n in %	Beta
TREATMENT					
1 Control	64	4.08		2.94	
2 Experimental	64	-4.08		-2.94	
			.42		.33
GENDER					
1 Male	70	1.90		1.46	
2 Female	58	-3.80		-2.92	
			.21		.16
Multiple R Squared					.284
Multiple R					.533

Research Question 2

Is there any significant main effect of gender on students' achievement in physics?

Table 1 shows a significant main effect of gender on students' achievement in physics ($F_{(1, 123)} = 4.861$; $P < 0.05$). Table 2 revealed that male students performed better in physics than female students. The post mean achievement score of 54.46% was observed for male students while the mean achievement score of 50.08% was obtained for female students.

Research Question 3

Is there any significant interaction effect of treatment and gender on students' achievement in physics?

Table 1 shows a significant interaction effect of treatment and gender on students' achievement in physics ($F_{(1, 123)} = 5.348$; $P < 0.05$). This shows that the treatment, that is, the game-based instructional strategy is sensitive to gender difference with respect to achievement in Physics. The boys tend to use the game better than the girls and that is the reason why the boys did better than the girls in the achievement in Physics. This is further illustrated with the following graph.

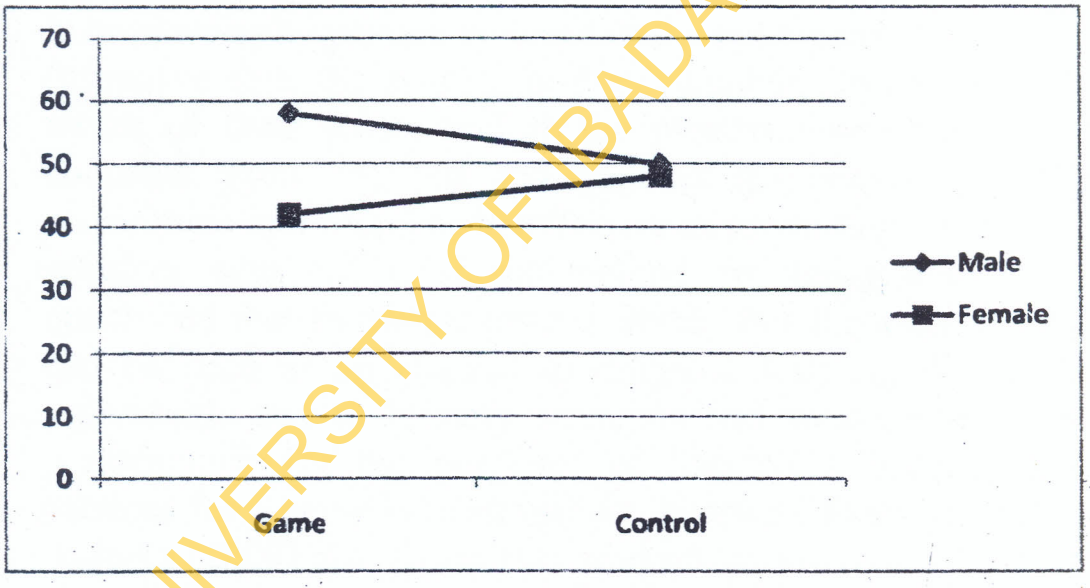

Fig. 1 Interaction Effect of Treatment and Gender

Discussion

The mean performance of students exposed to the experiment is higher then the performance of the control group. The reason for this result could be that students enjoy playing games and the barrier of learning some physics concepts is thus removed. Again,

the idea here is that without serious academic work, students are being motivated to learning physics and mastery is enhanced because it is a tension free exercise. This result agrees with those of the earlier researchers, such as Randel, Morris, Wetzel, and Whitehill, (1992) who expresses that games have been seen as highly beneficial for classes that have motivational problem. In the same way Ernest (1986) argues that games are effective for learning because games bring about a positive effect on motivation and attitude towards learning and this in turn leads to better achievement. May, (1993) states that games help in the development of the problem solving skills and its implication to the real life. The simplicity of a game makes it adaptable by both the students, parents and teachers. Indirectly, the game affords students the opportunity to learn through test and feedback. This is because as a question is posed to the opponents, this serves as a formative test, the scoring is done immediately the players are aware of their scores and in the process, learn some difficult concepts. Formative test and feedback has been used by many researchers and found to be effective in promoting learning. Such scholars who had used the method are Ibeagha (2002) who concluded that formative testing which uses feedback instruction can be seen as an attempt to diagnose learning difficulties in individuals and to identify strengths and weaknesses in group performance for the purposes of improving instruction as a panacea for a better educational achievement. Kumuyi (2007) and Anjorin (2008) also found that students exposed to formative test with feedback performed significantly better than those exposed to conventional method of teaching. Afemikhe (1985) reported that formative tests with remediation are more effective in improving students' cognitive achievement. Another advantage of the game method of learning over other type of methods is that anxiety is reduced. Although, the effect of anxiety on students' achievement is inconclusive, game assists students to eliminate anxiety that characterized a typical physics class where some students could not differentiate between a mathematics class and a

physics class. The level of anxiety expressed by students sometimes makes them perform below their ability.

The results of effect of gender on students' achievement in physics show that there is a significant main effect of gender on students' achievement in physics in favour of boys. Mathematics is the language of physics and many students found it difficult to separate physics class from the mathematics class. Although evidence from many studies performed on gender differences in mathematics is inconsistent. Recent research indicates that the gap between male and female students' mathematics achievement is gradually beginning to diminish over time (Gutbezahl, 1995 Linn & Hyde, 1989). The same thing can be true of students' performance in physics. From past studies the effect of gender on students' achievement in science and mathematics is not conclusive because, at some instances boys tend to be superior in achievement in science and mathematics and at another time, there was no significant difference between boys and girls' performances. The results of this study corroborate the findings of Benbow and Stanley (1980) who discovered that there was a significant effect of gender on students' academic achievement. However, the findings of Adepoju (1996) observe that gender is not a good determining factor of students' performance as there are no gender differences in the performance of level students. Apart from gender differences in achievement, there is also gender parity of 0.83 (70 males and 58 females) in physics class enrolment. Not many female students were willing to offer physics as a subject. The reason could be because of their orientation. For example, parents treat boys and girls differently from birth. They are more physically active with boys than with girls (Huston, 1983; Lewis, 1972; Parke, 1976) and give boys more specially complex toys and more opportunities to explore their physical worlds (Baennenger & Newcombe, 1989; Miller, 1987; Serbin & Conner, 1979). Parents may allow boys more chances for active interaction with the physical world, but they talk more to girls (Maccoby & Jacklin, 1974; Unger & Crawford,

1992). Interaction effect of treatment and gender revealed that boys tend to make use of the game more than the girls as male students respond positively to intellectual games. Girls learn better through the convectional method of teaching. The reason for this is that they can easily see the link between the games and what they have learnt in the classroom.

Conclusion and Recommendations

The study has revealed that game-based instructional strategy is not an expensive in terms of cost to be implemented in any classroom setting as compared to other methods like the use of computer. It can also be observed that students performed better in game-based instructional method than in the conventional method of teaching. The fact that game can be used by anybody is further illustrated in this study. Boys tend to do well in physics using game method than girls as seen in the result. It can be recommended that the use of game-based instructional strategy in the secondary school can raise the student achievement level. Similarly, there are some studies that indicated that girls can perform better in science and mathematics through brainstorming, girls should be taught physics through game while boys should be taught through conventional method.

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