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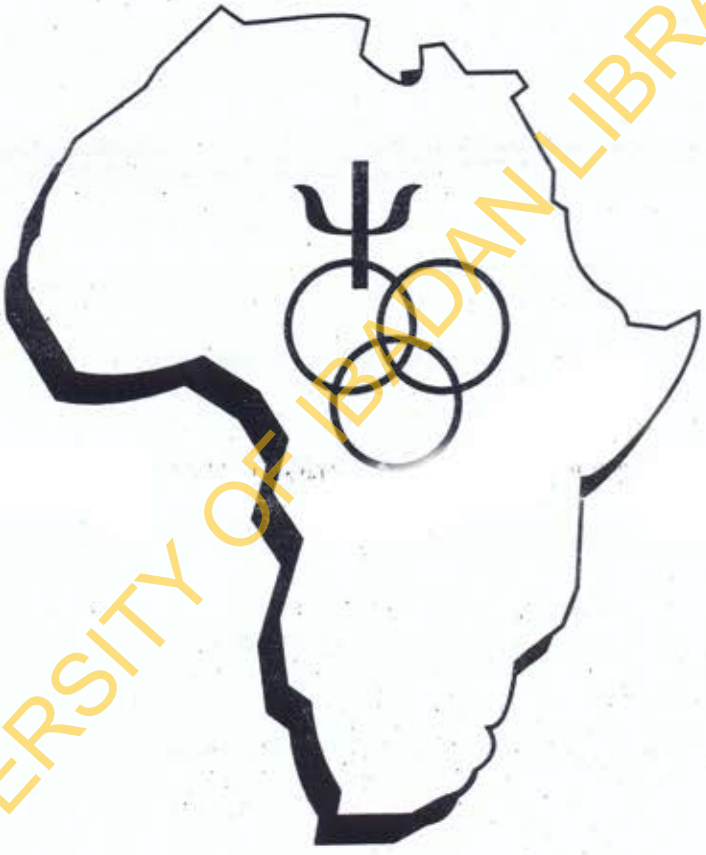

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Editorial Comments

The Society for Psychology in Sport and Human Behaviour has come a long way in meeting the needs regularly demanded by motivated readership as its 12th volume, 2010 of the African Journal of Cross-Cultural Psychology and Sport Facilitation (AJCPSF) can now have continuous page-numbering; effective from its last edition. The current edition is coming with a bang and has varied and interesting articles. The AJCPSF is accessible through the ajol web site online (http:www.ajol/journal). The Journal e-mail: crsscltrlpsychlgy@yahoo.co.uk).

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Introduction: This should be well focused and directly related to the title. The themes and sub-themes should share relevant proximity as well as the theories and, or assumptions upon which the study is built. The language of communication should be lucid and without ambiguities. The aims of the study should be well construed while testable and measurable research questions and hypotheses should be provided where necessary.

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This should be prepared using the Publication Manual of the American Psychology Association (APA) for style. They should be placed on a separate sheet at the end of the paper, double-spaced, in alphabetical order.

References should be quoted in the text by giving the author's name, followed by the year, e.g. (Agor and Bright, 2001) or Agor and Bright (2001).

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Adams, W.U.C (1999).PsychologicalUnderpinings.InR.O.Maxwell, T.W.Y.Dwaflin, and U.K.I.Bills (Eds), Annual Review of Psychotherapy (Vol.12, pp.3456).Lagos-Nigeria: Evans

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Effects of Play-Way and Guided-Discovery Instructional Strategies on Pupils' Achievement in Geometry in Akure South, Ondo State: A Study in School Effectiveness

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Abstract

School effectiveness is measured by the proportion of pupils in the school that can transit from one level of education to the other. Unfortunately, not all the pupils who registered in a cohort complete at the same time. This has implication on the methods adopted in such schools. If the methods of teaching are not pupil centered, there is the likelihood that pupils may not perform well in school subjects especially in mathematics. Therefore, this study was designed to determine the effects of two teaching methods (play-way and guided discovery methods) in enhancing primary pupils' achievement in geometry. The pupils' gender was also taken to consideration in this study. The study adopted a 3 x 2 factorial design, the design incorporated treatment at three levels (two experimental and a control), gender at two levels (male and female). The sample is made up of two hundred and twenty-two (222), primary five pupils from six schools in Akure South LGA of Ondo State. Mathematics Achievement Test (MAT) was used to collect data. Analysis of Covariance (ANCOVA) was employed to test three null hypotheses. The study revealed that pupils taught with the play-way method and guided discovery method achieved significantly ($P<.05$) better than those taught with the conventional method. There is no significant difference between boys and girls' achievement in geometry. It is, therefore, recommended that practicing teachers and teachers in training should adopt innovative teaching methods (play-way and guided discovery teaching methods) that are student-centered interactive in nature and gender friendly.

Key words: Play-way; Guided-discovery; Achievement in Geometry; School Effectiveness

Introduction

The concept of school effectiveness is very complex. In its simplest form, concern for school effectiveness includes such questions as what and how can student learn. How can other teachers' help students learn more with

greater ease, or depth, or speed? What should we be teaching children? How can a curriculum be constructed to maximize students' learning? How should teachers teach the curriculum? It is only after these questions have been considered that we can sensibly ask a school effectiveness question such as how can schools be organized and operated to maximize the quality of curricula and instruction offered to students? (Goldring & Pasternack, 1994) especially in mathematics.

Mathematics as a domain of knowledge is a language of communication especially in the sciences. It can also be used in various and diverse activities apart from science and technology, for example in accounting, business practice, economics and commerce. Mathematics is the basis for which a country will be transformed into a truly human society that satisfies, adequately, the needs of its people. According to Audu (2003), mathematics is frequently encountered in association and interaction with physics and other branches of natural sciences; it also has deep rooted affinities with the social sciences. Salmon (2005) opines that the usefulness of mathematics in human activity can not be underestimated, because it is the centre of scientific discoveries and invention needed for development. In view of the role mathematics plays in the development of the nation, with most of the striking discoveries of our time such as the Information and Communication Technology (ICT) - computer, website, internet, voice and data mails and so on, the demand and ever increasing number of mathematicians and efficient users of mathematics is on the increase. The prosperity of any nation is connected to science and mathematics. Mathematics has continued to be of high regards in the academic circles and by the wider society and that is why it is one of the compulsory subjects at primary and secondary levels so as to achieve the national objectives (Adebayo 2001; FRN, 1998; Amoo, 2002).

Unfortunately, mathematics which has been described as an important subject is a clog in the wheel of progress of majority of students because it is one of the basic requirements for admission into most of our tertiary institutions, for science and related disciplines (Adegoke, 2002 and Oyeniyi, 2007). The aspect of mathematics considered in this paper is geometry. Usefulness of geometry can not be overstressed due its usage, for example, by architects in drawing building plans, civil engineers in constructing solid and durable bridges, tunnels, dams. Various geometrical figures are used in industries and for advertisements and other professions. Many people have studied geometry and as a result have helped them develop their logical reasoning abilities, such people were Rene Descartes, Pascal and Abraham Lincoln (Adegoke, 2002).

Elementary school geometry is highly visual and depends on physical representation; the development of geometrical reasoning abilities at

primary level depends on early identification, stimulation and education. Teaching and learning of geometry can only be goal-oriented through simple description, relation of objects, and so on. The development of geometric concept should be connected with real life situation and not in abstract. Cassa, Spinell and Gavin (2006) assert that this helps the children's understanding of area, as a formula derived rather than as concepts (i.e. the amount of space covered by the inside boundaries of a two dimensional figure).

For quite sometime, mathematics educators have been pre-occupied with how to improve on the quality of teaching and learning mathematics so as to maintain standard and to meet national needs and expectations. This led to several reforms such as; the establishment of National Mathematics Centre, Abuja saddle with the responsibility of organizing seminars and workshops for both primary and secondary school teachers (Adegoke, 2002 & Oyeniyi, 2007). The essence is to enhance students' thinking and problem solving abilities.

Despite all the efforts that have been put in place by mathematics educators towards improving the teaching and learning of Mathematics in our country, students' performance in mathematics is still in a deplorable state at all levels, (Agwagah, 2001) and this is a strong indication that not much effective teaching-learning take place in schools these days. The problem could be traced to teaching methods. Teachers adopted classroom teaching methods that are of little educational worth (Onabanjo & Famuyiwa, 2004). Awodeyi (2004) also states that this problem can be traced to early background of students at the primary school level when the teacher used the authoritarian instruction model. Aremu, (1999), Alio and Harbor, (2000) are of the view that instructional strategy emphasized by teachers influenced cognitive and affect students' performance. Others sources of the problem include: the abstract nature of the course, (Azuka; 2000 & Adegoke; 2002), insufficient qualified teachers, instructional materials, negative attitude of students (Azuka, 2003 & Adewale, 2007).

It is pertinent to tackle this problem right from the primary school level which is the foundational level to achieve the goal of mathematics education in Nigeria. Primary education in Nigeria is in a state of crisis due to inadequate physical and instructional facilities, as asserted by Fafunwa and Yoloye (1994). The situation has not changed even after 15 years when these assertions were made. There is, therefore, the need to develop a virile school system capable of accomplishing the goals of education as stated National Policy of Education (FRN, 1998) through an appropriate method of teaching.

Teaching-learning process could be made easy or difficult depending on the teaching method adopted. There is difference between knowing

what to do and how to do it well. Ayodele and Adegbile (2003) also opine that teachers' teaching methods determine the extent to which the students can learn effectively, if the technique employed by the teacher is faulty, the whole teaching-learning process could be nothing to write home about. In most cases, teaching is too formal (academic) without bearing in mind that learning can take place when children are allowed to play through games. So, the play-way method used in this study is the mathematical games.

Mathematical games have been used to teach mathematics and science in many countries. Azuka (2003) asserts that games are natural for children and helpful in their growth, a variety of mathematical concepts and skills can be introduced or practiced through the means of play/game, as a prelude to explicit teaching practice skills or consolidate a concept after explicit teaching. In play, children gradually develop concept, causal relationships and power to discriminate, make judgment, imagine and formulate ideas (Bot, 1999).

Mathematical game serves many purposes such as stimulate learners' interest, ease tension and boredom, for discovery, social interaction and practice, as the learners are taught in a relaxed atmosphere. Mathematical game could be fun especially when such topic as geometry is taught using cards, puzzles (Tangram), jigsaw, etc. Games like these involve mental process and skills. Mathematical skills in terms of measurements, association, relationships and new ideas can be promoted for further knowledge after several attempt learners discover patterns, that is why it is ideal to inject formal learning into what the learners enjoy doing as they learn without pain and struggle. Ortiz (2006) states that a close look as the children played the game revealed interesting information about their thinking process. For the effective use of games, the teachers ought to be familiar with some of the fundamental principles underlying mathematical games which include, the philosophy roles, materials needed for making mathematical games and how to choose mathematical games. The game experience could be adapted to the learners' level of understanding and needs, because children are highly imaginative and creative. Most lessons involving practice can be converted into a learning situation by solving problems. For effective use of mathematical games, the pupils must be closely guided and organized so that each pupil has a specific role with a clearly defined goal (Azuka, 2003). Mathematical games can be used to enrich mathematics and vocabulary, review of skills and reinforce specific skills and learning process. Children are intrinsically motivated to make sense of the world, and they look for regularities and exploration and usually, discovery are exciting to them.

Apart from game, another method used in this study was the guided discovery method. Guided discovery method proved to be one of the

effective methods of teaching, with emphasis on teacher/student communication that promote good relationship, as this method affords the teachers and the learners the opportunity to interact and to discover facts and principles (Adetula, 2003 and Azuka, 2003). Guided discovery method is needed to boot knowledge acquisition; the learners are able to manipulate materials/equipment and are able to retain the knowledge gained because of their active participation. Adewale (2007) opines that this method serves as motivation for the students, promotes reflective thinking. Oyeneyin Salau, and Ayodele (1999) state that "to discover solution to problem is by applying a similar situation to form rule, formula, concepts, analyze to find if there is a pattern, apply the pattern discovered, then generalize. This brings to mind the popular Chinese proverb that, "what I hear, I forget. What I see, I remember. What I do, I know." The materials an individual acts upon to build understanding may depend on things seen, heard of, or torched in one's physical surrounding.

These methods of teaching could be intervened by gender of the pupils. The belief that girls tend to perform worse than boys is not entirely unfounded. Although, evidence from the many studies on gender differences in mathematics is inconsistent. Research evident indicates that the gap between male and female students' mathematics achievement is gradually beginning to diminish (Gutbezahl, 1995); however, female students are still underrepresented in advanced mathematics classes as well as in careers involving mathematics (Kerr, 1994; Stage & Maple, 1996). This explains why gender is incorporated into this study.

The researchers are of the opinion that if play-way and guided discovery teaching methods are adopted to teach mathematics, they will go along away to improve performance and ease the difficulty encountered by the learners in understanding mathematical concept especially geometry. It is likely also that the two teaching methods will help the girls perform better in mathematics. Therefore, this study examines the effects of play-way and guided-discovery approaches on primary school pupils' achievement in geometry. It also finds the effect of interaction of treatment and gender on pupils' achievement in Mathematics.

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

Ho_1: There is no significant main effect of treatment on pupils' achievement in Mathematics.

Ho_2: There is no significant main effect of gender on pupils' achievement in Mathematics.

Ho_3: There is no significant interaction effect of treatment and gender on pupils' achievement in Mathematics.

Methodology

The research design employed for this study was a 3 x 2 factorial design. There were two experimental groups and a control group. The pupils in the first experimental group were exposed to play-way method, the pupils in the second experimental group were exposed to guided discovery, while those in the control group were exposed to the conventional method. The variables used in the study were independent, moderator and dependent variables. The independent variable was the instructional strategy at three levels (.i.e. play- way, guided discovery and conventional methods). The moderator variable was the gender (male and female). The dependent variable was the students' achievement in Mathematics.

Sample and Sampling Procedure

The study involved all primary schools in Akure South Local Government Area of Ondo State. Six schools were randomly selected out of 72 primary schools and intact classes of the selected schools were used. The selected schools in the local government area were randomly assigned to treatment groups. In all, a total of two hundred and twenty-two (222) pupils were used.

Instrumentation

The study made use of Mathematics Achievement Test (MAT). It was divided into two sections A and B. Section A dealt with student's background. Questions on student's gender and age were contained in Section A. Section B is made up of 20 test items in mathematics. Using the Primary Five scheme of work, MAT was developed with an initial item pool of thirty-eight (38) items. The items were set across the cognitive domain using test-blueprint. The instrument was subjected to face and content validity. The test was trial tested on a sample of forty-five pupils (in a school in the local government but far from the sampled schools) similar to the samples designed for the study. The items selected were with the facility indices between 0.40 and 0.60 and high discrimination indices between 0.35 and 1. A total of twenty (20) items satisfied the criteria stated.

Procedures for data Collection

Two schools were randomly assigned to each of the three treatment conditions. The researchers employed the services of the research assistants with the minimum qualification of NCE certificate for not less than three

years of teaching experience to teach in the selected schools. The researchers used the first one week to seek for support and interact with the school authorities involved for necessary arrangements. During the same week, MAT was administered before the commencement of the experiment treatment.

During the second week, the lesson–notes prepared by the researchers were given to the research assistants together with the instructional materials. They were trained, each had opportunity to demonstrate and they were corrected when they were not following the procedure. Experimental group I was provided with the instructional material called Tangram Puzzles, a Chinese game which is a set of seven pieces of different geometrical figures. While the experimental group II was supplied with sets of Geo-board to be used as instructional material which was effectively used under the guidance of the teacher to discover some basic geometrical concepts. The Control Group was not supplied with any instructional material; the teacher used the conventional method to teach the geometrical concepts. The researchers monitor the exercise. The teaching exercise in each school lasted five weeks. One week was used to administer the posttest; all together the experiment lasted eight weeks.

Data Analysis

The research hypotheses were tested by employing Analysis of Covariance (ANCOVA) with pre test scores as a covariate, since there is a significant effect of the treatment on student achievement in mathematics, then multiple classification analysis (MCA) techniques was used to detect the magnitude and direction of the difference among the groups. Scheffe method of post-hoc analysis was used to determine pair-wise comparison of the methods of teaching.

Results and Discussion

The study tested the significance of the hypotheses and interpreted the results at .05 level of significance ($P<.05$).

Ho_1: There is no significant main effect of treatment on pupils' achievement in Mathematics.

Table 1: Summary of Analysis of Covariance (ANCOVA) on Achievement by Treatment and Gender

Source	Sum of Squares	df	Mean Square	F	Sig.
Covariates (Pre-test)	1091.823	1	1091.823	232.469	.000
Main Effects (combined)	1078.503	4	269.625	57.408	.000
Treatment	1065.586	2	532.793	113.441	.000
Gender	7.359	1	7.359	1.567	.212
2-way Interactions (combined)	22.418	5	4.484	.955	.447
Model	2163.682	12	182.807	38.923	.000
Residual	981.597	209	4.697		
Total	3175.279	221	14.368		

The result in this table reveals that a significant difference existed among the experimental groups (i.e. play-way method and guided discovery method) and the control group $F_{(2;209)} = 113.44$, $P < .05$. From this result, H_{01} was rejected.

Table 2: Multiple Classification Analysis on Students' Achievement by Treatment and Gender

Grand Mean = 8.47

Variables	N	Unadjusted deviation	Eta	Adjusted deviation	Beta
Treatment:					
1. Play-way	67	-.18		-.05	
2. Guided discovery	77	3.56		2.88	
3. Conventional	78	-3.38	.767	-2.83	.636
Gender:					
1. Male	119	.36		.18	
2. Female	103	-.39	.099	-.19	.049
R					.827
R^2					.684

The result presented in Table 2 shows that the students in the experimental groups (that is those that were taught using the play-way and guided discovery methods) performed better than those in the control group who

were taught using the Conventional method. Moreover, those taught with guided instruction outperformed those taught with play-way method. The treatment accounted for 68.4%, $(0.684)^2$ of the total variation in the post-test mathematics achievement test scores. The Guided discovery teaching is most facilitative, followed by the play-way method.

Table 3: Scheffe Post-Hoc Analysis of Students' Achievement in Mathematics

	Mean	Play-way	Guided discovery	Conventional
Play-way	8.29			
Guided discovery	12.03	*		
Conventional	5.09	*	*	

* Significant ($P < .05$)

There is a significant ($P < .05$) difference between the performance of students exposed to play-way and guided discovery and convectional methods. In addition, there is a significant ($P < .05$) difference between the performance of students exposed to guided discovery and convectional methods.

H_{o2}: There is no significant main effect of gender on pupil's achievement in Mathematics.

The result in Table 1 reveals that there is no significant difference between male and female pupils in Mathematics $F_{(1;209)} = 1.57$, $P > .05$. Table 2 shows that the difference between the performance of male and female students in mathematics is small with males having a hedge over the females.

H_{o3}: There is no significant interaction of treatment and gender on pupils' achievement in Mathematics.

The result from Table 1 reveals that there is no significant interaction effect of treatment and gender on pupils achievement ($F_{(2;209)} = 1.233$; $P > .05$). Therefore, the Null hypothesis was not rejected. The result shows that gender has no significant interaction effect of treatment on pupils' achievement in Mathematics, i.e. the teaching methods are gender insensitive, because the achievement between male and female do not vary. It shows that the methods are useful and helpful to both male and female.

Discussion

The discovery method is based on the notion that learning takes place through classification and schema formation (Gellenstien, 2004). This explains why the students exposed to the guided discovery outperformed the other two groups of students. The discovery method is a teaching technique that encourages students to take a more active role in their learning process by answering a series of questions or solving problems designed to introduce a general concept (Mayer 2003). The result agrees with the findings of earlier study on the impact of student-centered teaching methods in improving students' performance than the teacher-centered teaching method (Adegoke, 2002). The learner is directly involved in the teaching-learning process and gained more due to less direction from the teacher.

Guided discovery works greatly with capable students (Mayer, 2003), however, when there are a wide range of students' abilities in the classroom, discovery learning may not always work. Therefore, homogenous grouping as found in this study (same ability between boys and girls) is preferable. In case there are three or four different ability groups in the class, it is advisable to have them work on the same task. This could be done by allowing the higher learners to work on their own as much as possible and the middle group is given guidance and leading questions along the way. A lot of time is devoted to work with the lower learners in the attempt to get them to discover some of the material on their own.

The mean scores of the male and female students' performance is generally in the same pattern irrespective of the gender differences. However, there has been a common belief that females are less mathematically capable than males. This belief is fairly constant across populations (Eccles, 1987). Classroom studies have shown that this belief is in place by the time children enter the third grade (Crawford, Herrmann, Holdsworth, Randall & Robbins, 1989). This belief is mirrored by students' parents. By the time children enter kindergarten, parents expect girls to do better at verbal tasks and boys to do better at mathematics (Lummis & Stevenson, 1990). This belief continues through elementary school (Entwistle & Baker, 1983) and on throughout the academic process (Hyde & Linn, 1988; Yee & Eccles, 1988). This belief is not entirely unfounded. Although evidence from the 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 (Olowojaiye, 2001 & Etukudo, 2004) as indicated in this study. This is an indication that the teaching method adopted was not gender bias but gender friendly since their level of performance does not vary. The methods adopted were relevant in meeting the needs of both male and female.

Conclusion and Recommendations

These results show that the performance of the pupils exposed to Play-way method and the Guided discovery are significantly higher than the performance of those that were exposed to the conventional method. This is because the learners are opportune to learn on their own and at their own pace, with little supervision by the teachers. Gender was found not to have significant main effect on pupils' achievement in Mathematics. Therefore, more effort must be put in place by making use of teaching method that is not stereotype, but the one that is student-centered and interactive in nature. It is therefore recommended that practicing teachers and teachers in training should adopt innovative teaching methods (play-way and guided discovery teaching methods) that are student-centered interactive in nature and gender friendly. Teachers are encouraged to be creative and imaginative by making use of local materials children like to play with in the environment to facilitate meaningful teaching-learning process, this will bring about the desired result in the educational system. The pupils are also encouraged to investigate, ask and answer questions when in doubt especially when exposed to problematic situations.

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