CONSTRUCTIVISM: AN INSTRUCTIONAL STRATEGY FOR REPOSITIONING THE TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS

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Abstract

Students learning problems in mathematics has attracted attention by many researchers with hide or no emphasis on how learning lakes place in students. This paper examines the use of constructivism as an instructional strategy for leaching and learning of mathematics in schools. A constructivist mode) was developed and used for dynamic teaching and learning of mathematics in some secondary schools in Rivers State. The results from this study showed that constructivism is an effective strategy (hat enhances students learning in mathematics. Hence repositioning the teaching and learning of mathematics through constructivism strategy is plausible in Nigerian schools.

Introduction

Poor achievement in mathematics over the years has been attributed to reasons like; nature of the subject itself (Adetula, 1980; Fajemidagba. 1991), the design of the curriculum (Badmus 1976; Rculmus. 1978; Ohuchc, 1978). teachers' characteristics (Lassa, 1984; Badmus, 1978) and learner's characteristics (Fajemidagba, 1991; Obodo, 1997). The methods of instruction used in fostering understanding of basic mathematics concepts have not changed (he situation. The various research work that have been carried out over the years have not addressed how the learners are involved in the learning process. Despite these, mathematics had been a tool for describing the whole world. For so many years, it had been involved in the development and advancement of science. Mathematics has changed science and science had influenced mathematical endeavours. A sound background in mathematics has accelerated the current knowledge explosion we are witnessing. Mathematics plays an important role in objectivity, and accurate communication in scientific work. Scientific and technological development cannot do without the sophisticated tools in mathematics. A good mastery of mathematics is important in understanding the world around us. While the nation is striving towards Scientific and Technology Literacy (STL), a strong background for students in mathematics will be an excellent preparation for a wide variety of careers in areas of aviation, communication, computer, engineering, to mention a few transforming human lives in recent times. What is worrisome is the nature which the teaching and learning of mathematics takes. Most teaching is done *by* unqualified teachers (Lassa,1984; Adepoju, 1995; Obodo, 2001), and usually devoid of true life experiences. It is usually characterized by memorization of formulae, reasoning in abstract terms without reference to happenings in the immediate environment (Yager, 1991).

Udousoro and Abimbade (1997), opined that, the way students learn is as important as what they are learning. The selection and proper usage of appropriate and most effective method like constructivism epistemology, highlights the central role of learners in the learning process. This is because children's reasoning depends on their general level of development and the experiences they have in similar situations. Children start learning by constructing facts rather than retrieving them. The development of mathematical understanding in any child is influenced by culture, curriculum and classroom practice. Hence the ability for one to acquire knowledge in mathematics depends on one's existing knowledge which makes the understanding of subsequent ideas for a particular concept easier. The teacher can make clear and rational decisions about how to interact with the cultural environment so that students can confront their own misunderstanding and rebuild an idea and in the

process come closer to the desired meaning. This is true of constructivism which emphasizes the importance of knowledge, belief and skills that individuals bring to the experiences of learning. The elements of constructivism portrayed by teachers, make them negotiate, facilitate, construct, mediate, socialize, provide experiences as well as making cultural tools of science available to their students at all times. Particular interest is on probability concepts since most students cannot solve problems on probability concepts correctly (Ogunkunle, 2000).

Constructivism and Learners in Mathematics Education

Although, students' learning is done independently, students are expected to learn the same concepts. This is done by allowing each student to construct" his/her own unique meaning through each one's cognitive processes. Phillips (1995) identifies three (3) distinct roles of learners in constructivism. The\ are:

a. the active learner, knowledge and understanding as actively acquired.
b. the social learner, knowledge and understanding as socially constructed and
c. the creative learner, knowledge and understanding as created or recreated.

An active role for the learners is basic. In practice, social and creative aspects often accompany this role. This is why priority should be focused on students[1] understanding resulting from increased learning. Learners search for understanding that motivates them to learn more. Various activities and interactions are made possible and also serve as a basis for further activity. The teacher -gives instruction using an established language. This language is shared and creates knowledge and understanding, hence fulfilling the prime justification for setting up the education system. Mercer (1995), contends, this is the process of guided construction of knowledge to be carried out effectively. Similarly, Stage, Muller. Kinzie & Simmons (1998), noted that, students that participate in : constructivist approach to learning perceive more meaningful learning experience and in some cases actually learn more than students in conventional learning situation. This is in agreement with Perkins (1992) position that constructivist learning experience exert high cognitive demands on learners but not all learners respond well to these challenges. This can be attributed to the differences between students in their homes, parent-child relationship, and parents' attitude towards doing well at school. All these have a marked influence in fostering and reinforcing the child's achievement-related-efforts at school (Chazan, 1992).

Statement of Problem

Learning Mathematics for understanding and also integrating it for future use is not reflected h\ students in schools. This is because teaching is done in a hurry to meet examination deadlines, without recognizing the level of understanding in mathematics among the students. Learners simply learn by memorizing facts passed on to them by their teachers without partaking in the learning process per se. Repositioning the teaching and learning of mathematics in schools through constructivist strategy was carried out in this study. Constructivist learning enables meaningful learning, fasting as well as transferable to other contexts. The research problem of special interest in the present study was the extent to which the constructivist learning model (Ogunkunle, 2004) might be a-fruitful source of effective instructional approaches to boosting Nigerian students' achievement in senior secondary mathematics.

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Research Questions

1) To what extent are the students achievement in the constructivist and non-constructivist groups reflected in their learning on probability?
2) To what extent are students attitude in mathematics reflected in the constructivist and non-constructivist groups'.'

Hypotheses

I) There is no significant difference between the mean score for achievement of students exposed to the constructivist learning model and that of those not exposed to the model.
2) There is no significant difference between the male and female students' attitude to mathematics In the constructivist group and non-constructivist group.

Methodology

The design for the study was quasi-experimental which comprise of a pretest and posttest. This was to establish equivalence in the mathematical abilities of the students. The questions for the test were drawn from a past question paper from WASSCE. The time for classroom interaction-was one (I) week in each of the schools visited. The study covered six (6) randomly selected schools in the twenty-three (23) Local Government Areas (LGA) of Rivers Stale. These include schools from upland and riverine areas, as well as public and private schools.

Researchable Version of Constructivist Model For Mathematics Instruction

A researchable version of constructivist learning mode! was designed by Ogunkunle (2004), base on the Yager (1991), model of learning, for the purpose of mathematics instruction (Fig. 1). The methods of teaching are the constructivist and non-constructivist (conventional) methods. The learning environment could be either of the normal mathematics classes, mathematics laboratory for visual and hands-on activities or even the mathematics clubs. The mathematics club is for "co-curricular activities to enhance students" involvement in mathematics. The content in the mathematics curriculum that is the focus of this study is probability concept. This is practicalized with the use of balls, coins and playing cards. The participants' behaviour include: students attitude, student involvement, teacher involvement and teachers pedagogical practice. This is so because in a constructivist strategy, students' involvement is actively exhibited during the learning process. The teachers pedagogical practice and the extent of the teachers involvement during instruction will determine whether the class exhibited characteristics of a constructivist class. Finally, the learning outcome for this stud\ was measured through a test to give the mathematics achievement of the students in probability theory.

Results

Research Question 1

To what extent are the students achievement in the constructivist and non-constructivist group reflected in their learning on probability?

Table 1: Mean Scores for Achievement of the Students in the Two Groups

		PRETEST		POST TEST	
Groups	n	X	SD	X	SD
Experimental (constructivist)	360	41.5694	9.3729	64.3333	12.4605
Control (Non - Constructivist	360	4(1.8750	9.6310	58.2083	10.4521

Table I shows, that there is a difference in the mean score for achievement during post test of the students in the constructivist group and non-constructivist group. The student in the constructivist group had a high mean score than their counterpart in the non-constructivist group. This can be attributed to the exposure they had in learning using constructivist learning model.

Research Question 2

To what extent are the student's attitude reflected in the constructivist and non-constructivist groups?

Table 2: Students attitude to Mathematics in the Two Groups

Groups	n	Male	Female
Experimental (Constructivist)	360	30.5883	30.1788
Control (Non-Constructivist)	360	3 1.7676	31.4000

The table above exhibits a significant difference control groups. The students in the non-constructivist groups exhibit higher attitude to mathematics than their counterparts in the constructivist groups. These might be due to anxiety for them to be introduced to using constructivist learning.

Hypothesis 1

There is no significant (P< 0.05) difference between the mean scores of students exposed to the constructivist learning model and that of those not exposed to the constructivists learning models.

Table 3: ANOVA Showing Pretest and Posttest Mean Scores of Students in the Two Groups

Source	DF	Sum of Squares	Mean Squares	F Prob.	
Between Groups	3	151540.4687	50513.4896	.0000	Sig
Within Groups	1436	159797.0139	111.2793		
Total	1439	311337.4826			

The table shows significant difference in the mean score for the pretest and posttest of students in the constructivist and non-constructivist groups. Specifically, the students in the posttest and constructivist group differ significantly from all other groups and have a mean score at 64.33. There are also significant differences between the posttest non-constructivist students who had a mean score of 58.2 and (hose of pretest constructivist group with mean score of 41.57 and pretest non constructivist group with a mean score of 40.88, the null hypothesis was thereby rejected.

Hypothesis 2: There is no significant (P< 0.05) difference between male and female students' attitude to mathematics in the constructivist group and non-constructivist group.

Table 4: ANOVA Showing Students' Attitude *to* Mathematics in the Two Groups

Source	DF	Sum of Squares	Mean Squares	, F Prob.	
Between Groups	3	300.6777	100.2257	0003	Sig
Within Groups	716	11162.5223	15.5901		
Total	719	11463.2000			

The table shows a significant difference between male and female students attitude to mathematics. In a posttest, significant difference were exhibited between female students in the control groups with mean points of 3 1.4 and all students in the experimental groups. Also the male students in the control group with a mean point of 31,77 and all students in the experimental group. Hence the null hypothesis was rejected.

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Discussion of Results

Constructivist strategy for teaching and learning of mathematics in schools was carried out. There was significant difference exhibited by means scores of students in the constructivist group over their counterparts in the non-constructivist group. This conforms with the views (Yager, 1991; and Stage et al, 1998), that learning through constructivist strategy paves way for meaningful learning. This could also be attributed to active participation by students in mathematics activities, which also serves as a motivating factor in learning mathematics amongst students. There was also a significant difference in the attitude of male and female students towards mathematics.

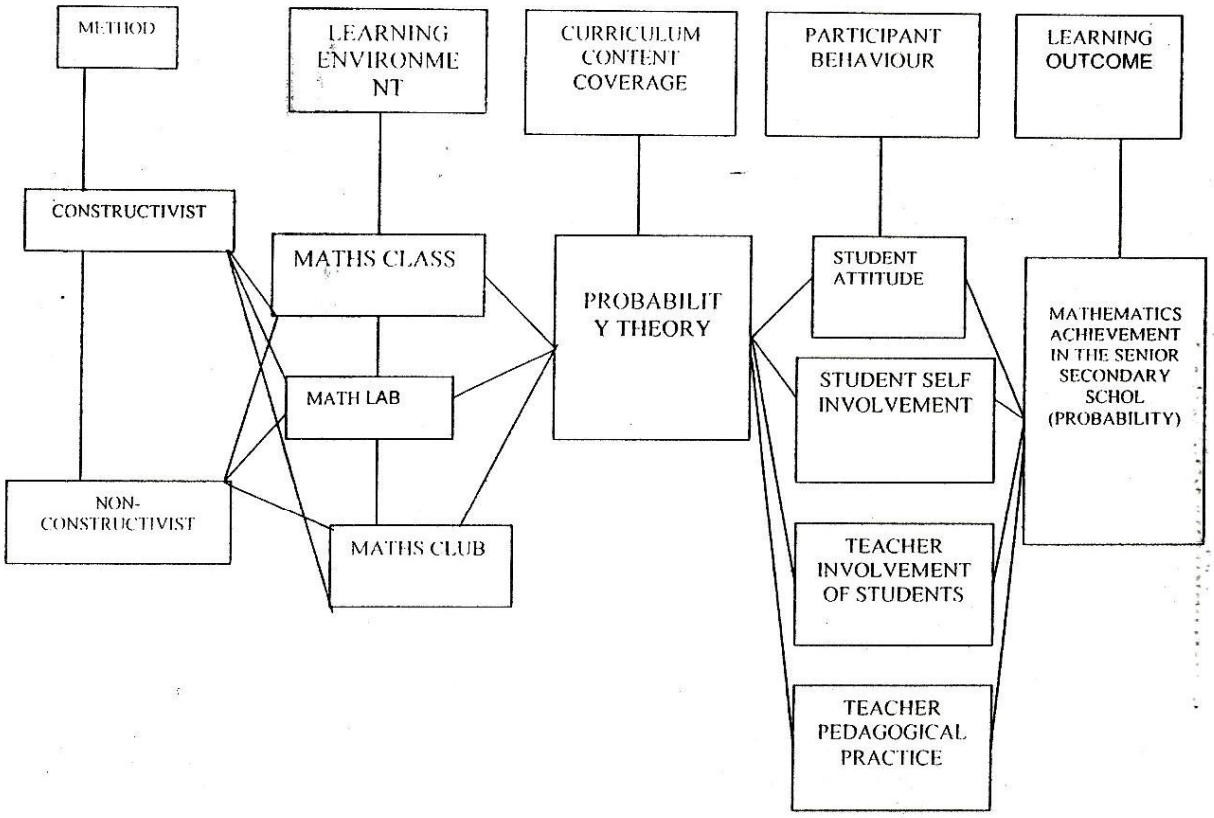
Summary

The study had shown that the use of constructivist learning model (CLM) is a worthy innovation in the teaching and learning of mathematics in schools. There were significant differences observed between the mean scores of students exposed to the constructivist learning model and those not exposed to the constructivist learning model. There were also significant differences observed between male student's attitude to mathematics in the constructivist group and all the students in the non-constructivist group as well as female student's attitude to mathematics in the constructivist group and all the students in the non-constructivist group.

Recommendation

The use of constructivist strategy in different learning environments like the mathematics laboratories and mathematics clubs will complement the use of existing mathematics classrooms. This will contribute significantly to the repositioning of teaching and learning of mathematics in Nigeria. Teachers should also provide opportunities for active participation among their students for meaningful learning in mathematics. The National Mathematics Centre (NMC) should explore avenues for short term vacation courses for mathematics teachers m the national level.

Fig. 1: Researchable Version of Constructivist Model of Mathematics Instruction (Ogunkunle 2004)



References

Adepoju, J. A (1995) Factors and Problems in the Teaching and Learning of Mathematics in Nigeria. NERDC - Publication 172- 183,

Adelula, L, O (1980). Trends in Mathematics Education in Nigeria. A 1978 Modified Paper Presented at M.Ed Seminar in the Faculty of Education. Ahmadu Bello University, Zaria.

Badimis, G. A (1976). A Survey of Promising Innovative/Experimental Field Experiences in Teacher Education. *Nigeria Educational Forum.* 2(2) 59-65.

Badmus, G. A (1978). An Evaluation of Mathematics Education Component of the Primary School Curriculum in Nigeria Between 1930 and 1960 ABACUS 12 65-83.

Cha/.an. M. (1992) The Home and School in Coleman, J. C (ed) *The School Years. 2nd* Edition. London: Routledge.

Fajemidagba, O (1991). Trends in Mathematics Education: Issues and Problems. ABACUS 21 (I) 139 -153.

Lassa, P. N. (1984). Sorry State of Mathematics Education in Nigeria. An Inaugural Address Delivered at the University of Jos.

Mercer, N. (1995). *The Guided Construction of Knowledge: Talk Amongst Teachers & Learners.* Clevedon: Multilingual Matters.

Obodo, G. C. (2001). Promoting Mathematics Teaching and Learning in Schools as an Essential Factor for UBE in Nigeria. Proceedings of September Annual Conference.

Obodo, G. C. (1997). *Principles and Practice of Mathematics Education in Nigerki._* Enugn: The General Studies Unit ESUT.

Ogunkunle, R. A. (2000). Teaching of Mathematics in Schools: The Laboratory Approach. *The Nigerian Teacher Today* (TNTT) 8 (I &2) 184 - 189.

Ogunkunle. R. A. (2004). Effects of Constructivist Learning Model on Senior Secondary Students' Mathematics Achievement in Rivers State. Unpublished Ph.D Dissertation. University of Port Harcourt.

Ohuche. R. O. (19-78). Change in Mathematics Education Since the Late 1950's -Ideas and Realization-Nigeria. *Educational Studies in Mathematics.* 9.271-281.

Perkins, D. N. (1992). *Swart Schools: From Training Memories to Educating Minds.* New York: The Free Press

Phillips. D. C. (1995). The Good, the Bad and The Ugly: The Many Faces of Constructivism. *Educational Researcher 24(1) 5\2.*

Stage. F. K; Mullet. P. A; Kinzie. J & Simmons, A (1998). Creating Learning Centered Classrooms. What does Learning Theory have to Say? ERIC Digest **ED** 42277

Yager, R. (1991). The Constructivist Learning Model, Towards Real Reform in Science Education, *The Science Teacher* 58 (6) 52-57.