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Original Paper

School Factors as Correlates of Pre-Service Mathematics Teachers' Achievement in Southwestern Nigeria

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Abstract

Mathematics is bedrock for scientific and technological development. In recent times, the performance of pre-service mathematics teachers in the colleges of education in south western Nigeria has not been encouraging. This study, therefore, investigated availability of infrastructure, textual materials and instructional materials as correlates of pre-service mathematics teacher's achievement in colleges of education in South-western Nigeria. This study is a survey design and Vygotsky's social learning theory provided the framework. Five colleges of education were purposively selected. The college must be government-owned tertiary institution. Total enumeration was used to draw 511 final year pre-service mathematics teachers made up of 211 males and 300 females and 51 mathematics lecturers in the five colleges. Questionnaires were used to facilitate data collection and were analyzed using multiple regression analysis at 0.05 level of significance. There was significant joint contribution of the three variables on pre-service teachers' achievement in Mathematics ($F_{(3,507)} = 6.66$; $R=0.20$) accounting for 3.2% of its variance. Instructional ($\beta = 0.18$, $t = 3.31$) and textual ($\beta = 0.13$, $t = 2.58$) materials predicted pre-service teachers' achievement in Mathematics. Relevant instructional and textual materials were determinants of learner's achievement in Mathematics in colleges of education in Southwestern Nigeria.

Keywords

instructional materials, textual materials, pre-service mathematics teachers, colleges of education

1. Introduction

The contributions that mathematical knowledge and skills have made to economic, industrial and technological growth of modern world are quite obvious. The importance of Mathematics does not only lie in its contributions to scientific and technological development but also in its utility in day-to-day interactions at market places, in transportations, and other various businesses engaged in by both literate and illiterate members of the society. As a result, one cannot escape Mathematics as there is real value in and real-life applications for it. Mathematics has beauty just as it has patterns. It is a tool and it is a language. It has many uses. So, there is need for students to study Mathematics to be properly prepared and equipped to face the challenges ahead if they are to be effective in this present age.

The school factor which could be generalized as school environment factor involves the physical structure of the school like the school building, vegetation, surrounding and every other thing that make up the school such as teacher, students, other non-academic workers, infrastructure like furniture, motor vehicle, generating plant, and other facilities such as library facilities, laboratory facilities and others. According to Fraser (1998), conducive school environment is linked with student's achievement. This means that if teachers have a good working environment, then, there may be better student achievement. In addition, the quality of school can also influence the behaviour of all the students in the school and especially students' academic achievement. The teachers' working environment which could influence his/her attitude towards the teaching of Mathematics, and adequacy of resource materials (Mathematics laboratory inclusive); constitute the school factors.

According to Owoeye (2000), learning can occur through one's interaction with one's environment. In his work that involved university students, Young (2005) indicated that an environment filled with supportive feedback increase students' use of self-regulated strategies. Environments here mean infrastructure or facilities that are available to facilitate students' learning outcomes. This include books, audio-visual, software, educational technology hardware, tables, chairs, chalkboards and shelves on which instruments for practices are arranged (Ferrant, 1991; Farounbi, 1998) and well utilized by the teacher (Akinsola, 1999).

In his view, Owoeye (2000) quoting Oni, said that, facilities or infrastructure constitute a strategic factor in organizational functioning because they determine to a very large extent the smooth functioning of any social organization including education. He further stated that their availability, adequacy and relevance have great influence and lead to high productivity. Facilities, according to Hallak (1990), contributed immensely to academic achievement in the school system. According to him such infrastructural facilities include the school buildings, classroom, accommodation, libraries, laboratories, furniture, recreational equipments, apparatus and other instructional materials. Hallak also added that their availability, relevance and adequacy contribute to academic achievement. Throwing more light on school facilities, Fabunmi (1997) asserted that school facilities when provided will aid teaching/learning programme and consequently improve academic achievement of students and enhanced their self-efficacy (Akinsola, 2009).

Olowo (2001) found that education institutions from nursery to university require buildings for their effective operations. Classrooms, offices, assembly halls, laboratories and staff quarters are needed. Important items like furniture for staff and students, books, science equipments, games and sport equipments should be adequate and should be in good conditions for schools to function properly. That is why Adewale (2004), Amao and Rahman (2004) and Amao and Onasanya (2010) have concluded that teachers vary in their perception of effectiveness culture as well as classroom practices. This then suggests that where adequate infrastructures are provided within the school environment, teachers are likely to perform well, and if otherwise, reverse may be the case (Akinsola, 2013).

A textbook is a very important material in teaching-learning process. It has the quality of conveying permanent information like other learning materials which could be transient. Textbook is durable and at the same time portable and can be used independently that is, without depending on any other medium (such as electronics or electricity). It serves as a basic source of knowledge and formal learning. Without textbooks, the library will not function effectively. It also aids students' studies and as a result serves as one of the important tools for academic achievement. Textbooks provide the major source of information for students as well as the course of student for the subject. "Nothing has ever replaced the printed word as the key element in the educational process and as a result, textbooks are central to schooling at all levels" (Owoeye, 2000). Textbooks serve as excellent and useful resources to many teachers without taking the place of teacher. It should however be noted that the teacher will serve as the only source of information when textbooks are not available or when the cost is too high for the students to afford and so students' academic achievement could be adversely affected.

Meyer (1989) observes that if the material is not potentially meaningful, then any attempts to help students to understand it will be with failure. On this issue of textual materials, Ayoola (2011) found that primary and secondary school books in Nigeria were written and published locally, thus reducing cost, however, most tertiary Mathematics texts are imported, and so are unaffordable by students, teachers and sometimes libraries. Ilori (2003) declares that university libraries do not stock current books and journals anymore because of lack of funds. This is also applicable to college of education and polytechnics' libraries. He adds that imported Mathematics textbooks have, since the introduction of the Structural Adjustment Programme (SAP) in Nigeria, been out of the reach of most Nigerian students, because of our weak currency. There is therefore the challenge for Nigerian authors to produce Mathematics textbooks for use by our students. In his own research, Kuku (2012) says that imported textbooks at tertiary level are so expensive that neither students and teachers, nor even libraries can afford to buy many of them. Yet, there are relatively few quality textbooks written by African scientists. He therefore suggests that NEPAD/AU should provide funds to encourage African scientists to write books at tertiary levels and publish them in Africa so that the books could be sold at affordable prices. He adds that such financial support from NEPAD could be channeled through the professional organizations in the continent. In conclusion, examination of the appropriateness and adequacy of textbook is therefore, of paramount importance in order to enhance performance in Mathematics.

Squire (1991) stated that individuals seeking to improve the quality of education believed that availability and adequacy of instructional materials would lead to changes in actual teaching, thus leading to improve academic performance of the students. Research reports have shown that availability of instructional materials in the laboratory and ability of Mathematics teachers using them are vital determinant of teaching methods to be used by the Mathematics teachers thereby leading to Mathematics achievement (Afolabi, 2010). Popoola and Olarewaju (2006) thus make it clear that for solid foundation in tertiary level of education, Mathematics laboratory is necessary in primary and post primary institutions. They add that, when abstract ideas are made concrete, the content becomes clearer. Mathematics laboratory thus reduces abstract nature of the subject. Also, project and other teaching/learning activities of pre-service teachers are carried out in the Mathematics laboratory. So its usefulness in the academic achievement of students cannot be overemphasized.

2. Method

2.1 Research Questions

The following research questions were raised for this study:

- What is the composite contribution of instructional materials, textual materials and infrastructure to pre-service teachers' achievement in Mathematics?
- What are the relative contributions of the three to pre-service teachers' achievement in Mathematics?

2.2 Population

The population for this study is all the students and lecturers in Colleges of Education in Southwestern Nigeria. All the six states in Southwestern Nigeria were involved in the study except for the state that was used for validation of research instruments.

2.3 Sample and Sampling Technique

Purposive sampling technique was used to select colleges. A total number of five colleges of education were selected for this study. The selections of the colleges were based on the following criteria:

- The Colleges chosen were considered eligible if they are government-owned tertiary institutions.
- Such college must have demonstrated willingness to participate in the study.

Also, the only 300 level compulsory second semester course which all students must offer was selected for the study. All the mathematics students at 300 level were used because the population was not too large to be sampled. In all, a total number of five hundred and eleven students comprising male and female were used for the study.

2.4 Validity and Reliability of Instruments

For face, construct and content validities, both the Pre-service Teachers Mathematics Achievement Test (PRETMAT) and School Factors Questionnaire (SFAQ) were given to four lecturers in the Department of Mathematics at the College of Education. Their comments and corrections were collected and reflected

in the copies that were given to two lecturers in the Department of Teacher Education in the university for their expert contribution and advise. The final copies of the instruments were administered to the pre-service mathematics teachers in another college different from the colleges considered for the actual study. The reliability co-efficient obtained after subjecting PRETMAT to Kuder-Richardson formula (KR-20) was 0.75.

2.4 Instrumentation

Both the questionnaire and the achievement tests were administered to the pre-service mathematics teachers in order to facilitate the success of the exercise. Support and cooperation of the Heads of Mathematics Department and other lecturers in the departments were sought in administering the questionnaire to the students in all the colleges of education used for the study. The pre-service teachers, that is the year three students were also briefed about the importance and why they needed to participate actively in the study. School Factors Questionnaire (SFAQ) were given to them to respond to and were collected thereafter accordingly. The same was done in all the colleges of education under study. The researcher, through the Mathematics lecturers in the various colleges of education used for the study, informed the pre-service Mathematics teachers to prepare for the Pre-service Teachers Mathematics Achievement Test (PRETMAT) the following week. This was done accordingly, the following week. The researcher, the research assistants and the lecturers in the Mathematics Department of the Colleges under study were involved in carrying out the administration and collection of the questionnaire as discussed earlier.

3. Result

Research question 1: What is the composite contribution of instructional materials, textual materials, and infrastructure to pre-service teachers' achievement in Mathematics?

Table 1. Multiple Regression Analysis Showing the Composite Contribution of Instructional Materials, Textual Materials and Infrastructure to Pre-Service Teachers' Achievement in Mathematics

R	R Square	Adjusted R Square	Std. Error of the Estimate
.195	.038	.032	1.2276

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Regression	30.090	3	10.030	6.655	.000	Sig
Residual	764.098	507	1.507			
Total	794.188	510				

Table 1 shows the composite contribution of the three independent variables to the prediction of the dependent variable, that is pre-service teachers' achievement in Mathematics. The table also shows a coefficient of multiple correlation (R=.195) and an adjusted R^2 value of 0.032. This means that 3.2% of the variance is accounted for by the three predictor variables when taken together. The remaining 96.8% could be the contribution of other variables not considered in this study. Table 1 also shows that the analysis of variance for the regression yielded F-ratio of 6.655. This implies that the composite contribution of the independent variables to the dependent variable was significant.

Research question 2: What are the relative contributions of the three factors to pre-service teachers' achievement in Mathematics?

Table 2. Multiple Regression Analysis Showing the Relative Contribution of Instructional Materials, Textual Materials and Infrastructure to Pre-Service Teachers' Achievement in Mathematics

Model	Unstandardized Coefficient		Stand. Coefficient	T	Sig.	Remark
	B	Std. Error	Beta contribution			
(Constant)	17.476	.615		28.407	.000	Sig
Instructional materials	.100	.030	.182	3.307	.001	Sig
Textual materials	-0.06204	.024	-.127	-2.575	.010	Sig
Infrastructure	0.0559	.052	.053	1.071	.285	n.s

Table 2 reveals the relative contribution of the three independent variables to the dependent variable, expressed as beta weights, viz: Instructional materials (β=0.182, $p<0.05$), Textual materials (β=-0.127, $p<0.05$) and Infrastructure (β=0.053, $p>0.05$). One should note that instructional materials made the greatest contribution to pre-service teachers' achievement in Mathematics (β=0.182), followed by textual materials (β=-0.127) while infrastructure (β=0.053) is the least.

4. Discussion

From the findings, instructional material is a variable that contributes to pre-service teachers' achievement in Mathematics in this study. This finding is in agreement with the findings of Squire (1991), Popoola and Olarewaju (2006) and Afolabi (2010). The implication of this result is that using instructional materials will lead to the changes in the teaching of the pre-service teachers, which may lead to improvement on academic achievement of the pre-service teachers. There can also be a positive change in the attitude of lecturers if there is a well-equipped mathematics laboratory in these colleges. The assertion of Ani (2006) also corroborates this statement that instructional materials help the

teacher/lecturer to present the subject matter effectively to the students. He adds that instructional materials help teachers/lecturers in improving their skills and widening their knowledge. With instructional materials in place, the subject will be made meaningful, very interesting and exciting to the pre-service teachers. Mathematical exploration, manipulation and usage by the pre-service teachers will thus be encouraged. The availability of equipped library and other models will also aid the teaching of Mathematics and as well keep the students alive and more application of Mathematics to situations and life generally easy.

Textual materials are also very significant in predicting pre-service teachers' achievement in Mathematics from the findings of this study. The findings corroborates that of Sousa (2001), Schnotz (2002), Ilori (2003) and Douville and Pugale (2005). The implication of this result is that mathematics textbooks should not be written abstractly. They should be written using simple language which could also involve graphs, diagrams and pictures for simplification. Also, since textbooks provide the major source of information for pre-service teachers, they should not be too costly so that students will be able to afford them. These is in line with Ayoola (2011) and Kuku (2012) who declared that most tertiary mathematics texts are imported, and so are unaffordable by students, teachers and even libraries. Again, course materials written by the existing teachers in the colleges of education should be keenly prepared that will be free of errors and should not be too expensive so that students will be able to afford them.

Again, from the result, infrastructure, though not significant, made some contribution to the prediction of pre-service teachers' achievement in Mathematics. The implication of this result made one to realize the inadequacy of what is currently on ground in the lecturers 'offices and lecture halls where teaching and learning actually takes place in the colleges. This is line with Tsanwani (2009) who states that what teachers actually do, depends not only on their competence, but also on the conditions under which they provide instruction. He adds that a fully competent teacher/lecturer might perform below expectation in the classroom, if he/she is working in a disorganized and unsupported environment. Most offices have no furniture, fans and two or three lecturers may be managing a room that is not even enough or conducive for a person. As a result they may not even stay in the offices and the implication is that there may be no room for special consultations for the students. The same is also true of the students. The halls they manage for lectures are not well furniture. There are no enough chairs and tables with which they can sit. At times, some students stand throughout when lectures are taking place. Another thing is the issue of staff quarters which are not available for the lecturers. Many of them come from neighbouring towns and cities to have their lectures, continuity of this can hamper pre-service teachers' achievements in Mathematics.

The result arrived at in this study has established that two out of the three factors are good predictors of pre-service teachers' achievement in Mathematics, that is, textual materials and instructional materials are variables that can predict pre-service teachers' achievement in Mathematics. The essence of these variables to the prediction of pre-service teachers' achievement in Mathematics identified the areas that teacher educators-as lecturers-need to pay more attention in addressing the issue of failure in

Mathematics at college of education level.

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