International Journal of Research Publication and Reviews

Path Analysis of the Relationship between Teachers' Characteristics and Secondary School Students' Academic Achievement in Mathematics in Benue State, Nigeria

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ABSTRACT

The study investigated the relationship between teachers' characteristics and students' academic achievements in Mathematics in Secondary schools in Benue state using Path analysis. It was guided by three specific objectives. Also, three research questions were raised and answered by the study. One hypothesis was formulated for the study and tested at 0.05 level of significance. The study adopted mixed method research design. The study was carried out in Zone B Educational Zone of Benue State. The population of the study is 21,829. This comprises 21,711 Senior Secondary two (SS2) students and 118 Mathematics teachers in all the 103 public secondary schools in Zone B educational area of Benue state. The sample size for the study was 422 respondents. This comprised 393 students and 29 teachers. The sample size for the study was drawn using Taro Yamane formula for sample size determination. The study used two instruments for data collection. The instruments are structured questionnaire titled "Teachers' Characteristics Questionnaire (TCQ)" and "Students' Profoma (SP)". The instruments were given to three (3) experts for content validation. Cronbach Alpha method was used to determine the reliability coefficient of the instrument and it yielded a total reliability coefficient of 0.77. Data were collected with the help of five research assistants. As a path analytic study, data collected were analyzed using multiple regression analysis in MPlus. The study found that the most meaningful causal model for providing an explanation of the achievement of students in Mathematics is the model involving teachers' characteristics of academic qualification and knowledge of subject matter. Findings of the study also revealed that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study. The study revealed that the significant paths through which the independent variables (teachers' characteristics) caused variation on the dependent variable (students' academic achievement) are those of teachers' academic qualification and knowledge of subject matter. Based on the findings of this study, it was concluded that while teachers' characteristics of academic qualification, knowledge of subject matter, attitude, classroom management and use of instructional materials influence students' academic achievement in Mathematics, they account for only a small portion of the variation (4.7%) in students' academic achievement in Mathematics in secondary schools in Benue State. It was recommended among others that Schools should invest in ongoing professional development programs for teachers to enhance their subject matter knowledge, teaching techniques, and classroom management skills.

Keywords: Path Analysis, Teachers' Characteristics, Academic Achievement, Mathematics

INTRODUCTION

Education is one of the most important aspects in human development. It comprises the most influential social institution in any society. Education aims at revealing systematic and scientific results toward meeting the needs of the individual and the society. In general, education aims at transmitting a common set of beliefs, values, norms, and understanding from the adult generation to the youth (Umar, Ahmad & Awogbemi, 2013). There is a high demand for education because of its effective contributions to the nation's overall development. Subsequently, in an attempt to provide education, many subjects are studied at different levels of educational institutions in every nation towards realizing the goal of education as an instrument for effective national development. The levels are ordered; pre-primary, primary, secondary and tertiary institutions with the study of different subjects. These subjects are grouped and studied in different disciplines such as sciences, arts, commercial and technical.

At the secondary school level, one of the subjects studied is Mathematics. Mathematics is the abstract science of numbers, quantity and space. Mathematics without doubt remains the most serviceable subject to all disciplines and fields of human work and it has become an indispensable tool in the study of Humanities, Sciences and Technology (Adikwu & Chibabi, 2018). Mathematics is the bedrock of science and technology, without Mathematics there is no real development in Science and Technology. Mathematics has all through the years been an important subject both in the role it plays in everyday activities and in its usefulness to other sciences. Mathematics is a body of knowledge centered on concepts such as quantity, structure, space, change and also the academic discipline that studies them (Pierce cited in Umar, Ahmad & Awogbemi, 2013). Mathematics is the science that draws necessary conclusions. These definitions therefore, emphasize the importance of Mathematics.

However, despite the importance of Mathematics, there are a number of observable problems associated with its teaching and learning, especially at the secondary school level. These problems include poor method of instruction according to Ugwuanyi, Okeke and Adimora (2021). The assertion of Agommuoh and Nzewi (2013) attributes the deterioration in students' achievement in Mathematics to ineffective method of teaching. Lack of adequate qualified and experienced Mathematics teachers and of laboratory equipment is two major recurring problems of teaching Mathematics in secondary schools. Fidele, Kizito, Jean and Angell (2014) pointed out that students find Mathematics difficult because they have to contend with different representations such as formulas and calculations, graphs and conceptual explanations at the same time. These problems may have effects on the academic achievement of students.

Academic achievement is the extent to which a student has attained either short or long term educational goals. Achievement may be measured through students' grade point average. Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. Students' academic achievement however can be affected with a lot of factors. Some of these factors are students', teachers', parents,' and environmental related factors. According to Agba, Ushie, Ushie, Bassey and Agba, (2009), government's inability to effectively sponsor education and motivate teachers to enhance their productivity contribute to the poor achievement of students in Mathematics. Adodo (2015) argued that one factor responsible for the success of students' academic achievement in a given subject is the teacher. Other factors may include teachers' classroom variables such as teachers' classroom management practices, professional development and characteristics external to classroom practices. In the same vein, the National Centre for Education Standards cited in Musau and Joash (2015) stated that teachers' factor stands as a major pivot in students' achievement in Mathematics. Literature shows that most researchers in Mathematics education concentrate on the effect of teaching methods on the achievement of students in Mathematics paying little attention to other variables such as teacher characteristics (Gbore, 2013). Some of these teachers' characteristics include; teachers' qualification, teachers' knowledge of subject matter, teachers' attitude, teachers' classroom management and instructional material utilization.

Teachers' qualification refers to the skills a teacher requires to teach effectively. Teachers' qualification is one of a number of academic and professional degrees that enables a person to become a registered teacher. According to Ibrahim (2010), teachers' qualifications and exposure can go a long way to bringing about students' high academic achievement. Teachers' academic qualifications largely determine their capacity to engage students' minds and hearts in learning process. Asikhia (2010) revealed that there is a perfect positive relationship between teachers' qualification and students' academic achievement while Dahar (2011) with a contrary view observes that there is no significant relationship between teacher quality and students' academic achievement in school subjects. Ademulegun (2011) argued that students taught by more qualified and experienced teachers perform better than those taught by less qualified but experienced teachers. The foregoing has shown that views related to influence of teachers' academic qualifications on students' achievement in Mathematics are inconclusive. These contradictory views necessitated this study which is aimed at determining the causal relationships between teachers' qualification and students' achievement in Mathematics using Path analysis.

Teachers' knowledge of subject matter is a major element of what is transferred along with teaching skills by the teacher. Knowledge of subject matter has a very important role to play because high-quality teaching rests on teachers' understanding of the subjects they are teaching, knowing the structure and sequencing of concepts, developing factual knowledge essential to each subject and guiding their students into the different ways of knowing that subjects (Sunday, 2016). It is also clear that when there is a lack of subject expertise, or it is unevenly spread across teaching groups, then the quality of teaching and students' examination results are at risk (Smithers & Robinson in Sunday, 2016). Knowledge of the subject matter is a variable that influences teachers' quality and may also affects students' academic achievement. Students understand lesson more and with keen interest when lesson is taught by a teacher who master his subject matter very well.

A teacher that masters his/her subject matter teaches very well. He/she is able to perform his/her duty efficiently and effectively. The teacher with good knowledge of subject matters is capable of developing and implementing curriculum. The mastery of relevant knowledge is one of the most important attributes of the teacher. Odiri (2011) opined that teachers of today must have a good grasp of the subject matter if they have to command respect of the students since the frontiers of knowledge keep expanding every day and the level of the students generally keep rising too. Mathematics teacher therefore who wants to keep abreast in the area of specialization should not cease to learn as subject matter knowledge of a classroom teacher is essential and extremely critical. Teacher's knowledge of subject matter may be affected by the attitudes and expectations that their students bring to the classroom. Teacher's understanding of subject matter affects their capacity to simplify content to help students to understand. Sadiq (2019) asserted that teachers' knowledge of the subject matter contributes to secondary school students' academic achievement. Also in the views of Welu, Francis and David (2017), when a teacher has good knowledge of subject matter, it tends to influence students' academic achievement positively. It could be deduced that teacher's knowledge of subject matter can either impact students' achievement and interest positively or negatively. Thus, the focus of this study.

Teachers' attitude refers to the ways he/she relates with the students. For a teacher, being able to interact with the student and display positive behavior such as asking questions, understanding their thoughts, showing interest and appreciation increases the students' motivation and success. Attitude is everything that affects and influences a person's behaviour which in turn affects performance. Attitude is the way people reason or acts and most of the times can either make or mar an individual performance while carrying out their tasks and responsibilities. It is often said that attitude may be positive or negative. It often involves feelings, opinions and dispositions which affects behaviour. While working towards providing students at a certain development level information, experience and behavior on a certain topic, teachers though their attitudes become role models for students. Teachers' positive attitudes may lead to success while negative attitudes may lead to failure. This implies that success can lead to positive attitudes while failure leads to negative attitudes. According to Gecer (2012), if teacher engages in belittling comments towards a student due to his/her failure, the negative effects of this will be inevitable. Such teacher's attitude may hinder the academic achievement of students. Certain positive teachers' attitude such as giving feedback for student works, complimenting, wanting to listen to students and being interested in students' academic complaints may help improve their academic

achievement. Kings (2013) opined that teachers' nonverbal actions such as smiling, having a relaxed stance, various gestures and facial expressions come first in improving the learning experience for students whereas the topic of the class itself comes in second.

Student's academic achievement is not completely the result of their work; academic achievement can be affected by many factors and the first one is the attitude of the teacher. A positive attitude from the teacher may affect the student's motivation, attitude towards school and school work, the student's self-confidence and as a result academic achievement. While the positive attitude of a teacher allows him/her to create a positive relationship with students, it also allows for the teacher to dwelve on the positive attitude of students as opposed to the negative, taking on a reinforcing role as well (Yavuzer, 2010). It could be deduced that teacher's attitude can either impact students' achievement and interest positively or negatively. Thus, the focus of this study.

Classroom management refers to actions taken to create and maintain a learning environment conducive to successful instruction (arranging the physical environment, establishing rules and procedures, maintaining students' attention to lessons and engagement in activities). Classroom management according to Dugguh (2017) is the action a teacher takes to create an environment that supports and facilitates instructions, academic, social and emotional learning. It is the process of creating favorable conditions to facilitate instructions as well as that of regulating social behavior of students. Teachers in the classroom are by the nature of their profession, managers of classroom activities. The classroom teachers' job unlike that of other professionals is concerned with maintaining order, allocating resources, regulating the sequence of events and directing his/her own attention towards achieving educational goals. Nearly every teacher agrees that classroom management is an important aspect that impacts successful teaching. In the same effect, Iyorhii (2015) opines that the task of classroom management is important both to the teacher and the school because the entire teaching/learning process in school depends so much on it and this in turn affects the overall performance of the school. Iyorhii further asserts that, classroom management is one area that beginner teachers and even some that are experienced in teaching field find it tasking. However, good classroom management is one of the prerequisites for every meaningful teaching and learning and subsequently, students' academic achievement. It could be deduced that teacher's classroom management can either impact students' achievement and interest positively or negatively, thus, the focus of this study.

The utilization of instructional materials in education brings about fruitful learning outcomes since instructional materials stimulate students learning as well as motivate them to do more. Agina in Effiong, Ekpo and Igiri (2015) view instructional materials as concrete or physical objects which provide sound, visual or both to the sense organs during teaching. Learning is a complex activity that involves interplay of students' motivation, physical facilities, teaching resources, skills of teaching and curriculum demands. Agbulu and Wever (2011) point out that instructional material are important because they help both teacher and students to overcome physical limitations during lesson presentation among others. Giginna and Nweze (2014) emphasize on the importance of instructional materials as follows: concretizing abstract concepts, stimulating students' attention and interest, arousing students' curiosity and promoting students' active participation in the classroom. Availability of instructional materials enhances the effectiveness of teaching as these are basic things that can bring about good academic performance in the students. When the right quantity and quality of human resources is brought together, it can manipulate other resources towards realizing institutional goals and objectives. However, appropriate utilization of instructional materials in school may controls dropout rates, maintains student discipline and makes students remain motivated for long period of learning. The use of instructional materials is critical in making teaching-learning more effective. They help improve access and educational outcomes since students are less likely to be absent from schools that provide interesting, meaningful and relevant experiences to them. It could be deduced that teacher's use of instructional materials can either impact students' achievement and interest positively or negatively, thus, the focus of this study.

Some studies have found no relationship between teachers' characteristics and students' academic achievement, while other researchers have found relationship. Some studies ignore qualitative work that suggests that certain teachers' characteristics are highly related to students' achievement. If this is the case, then teachers' characteristics may indeed explain a substantial portion of the variance in students' academic achievement. This study explored these possibilities through the use of Path analysis.

A path analysis is a technique that examines the predictive association among the variables over time. It is an extension of multiple regressions in that it involves various multiple regression models or equations that are estimated simultaneously (Ugwuanyi, 2017). In path analysis, a variable can be a dependent variable in one relationship and an independent variable in another. These variables are referred to as mediating variables. This provides a more effective and direct way of modeling mediation, indirect effects, and other complex relationship among variables. Path analysis can be considered as a special case of Structural Equation Modeling (SEM) in which structural relations among observed (vs. latent) variables are modeled. Structural relations are hypotheses about directional influences or causal relations of multiple variables (for example, how independent variables affect dependent variables). Hence, path analysis is sometimes referred to as causal modeling because analyzing interrelations among variables is a major part of SEM and these interrelations are hypothesized to generate specific observed covariance (or correlation) patterns among the variables (Ugwuanyi, 2017). SEM is also sometimes called covariance structure analysis. For both types of analyses, observed dependent variables can be continuous, censored, binary, ordered categorical (ordinal), counts or combination of these variable types. In regression and path analyses, for non-mediating variables, observed dependent variables can be unordered categorical (nominal). This study therefore tried to establish the relationship between teachers' characteristics and students' academic achievement in Mathematics in Secondary Schools in Benue State using Path analysis.

Statement of the Problem

Teachers are the implementers of the school curriculum which contains the objectives of subject like Mathematics. As such, the characteristics of the teachers play a significant role in students' academic achievement in core subject like Mathematics.

However, the annual reports of the chief examiners in Mathematics indicated that there was a slight decline in students' achievement in Senior Secondary School Certificate Mathematics examinations over that of the previous year (Chief Examiner's Reports, WAEC, 2021). The WASCE of 2021 results showed that 20869 candidates representing 47.02% out of 44379 candidates passed at credit levels in Mathematics in Benue state (National Bureau of

Statistics, 2021). Also, the researcher as a Mathematics teacher in Benue state has also observed high rate of failure in Mathematics by students at secondary school level termly examination. This persistent abysmal performance poses a serious threat not just to the students alone, but also to the general society considering the place of Mathematics in the field of Education.

Concerns therefore have to be unraveling the root causes of the plethora of factors contributing and correlating to the poor achievement of students in Mathematics at secondary school level in Benue state. Could the poor achievement of students in secondary school Mathematics examination in Benue state be attributed to teachers' characteristics such as their academic qualification, attitude, and knowledge of subject matter, classroom management and utilization of instructional materials? This forms the problem of the study. There is therefore the need to investigate the relationship between teachers' characteristics and students' academic achievement in Mathematics in Secondary schools in Benue state using Path analysis

Objective of the Study

The objective of this study was to investigate the relationship between teachers' characteristics and students' academic achievement in Mathematics in Secondary schools in Benue state using Path analysis. Specifically, the study;

1. determined a causal model for providing an explanation of the academic achievement of students in Mathematics based on the selected Teachers' characteristics.

2. ascertained the directions and estimates of the strengths of causation (path coefficients) of the Teachers' characteristics in the model.

3. Find out the direct and indirect influences of the Teachers' characteristics on the students' achievement in Mathematics

Research Questions

The following research questions guided the study.

1. What is the causal model for providing an explanation of the academic achievement of students in Mathematics based on the selected Teachers' characteristics?

2. What are the directions and estimates of the strengths of causation (path coefficients) of the Teachers' characteristics in the model?

3. What are the direct and indirect influences of the Teachers' characteristics on the students' achievement in Mathematics?

Statement of Hypotheses

The following hypothesis was formulated and tested at 0.05 level of significance.

1. There is no significant model fit between the empirically observed data and theoretical model proposed for the study

METHODOLOGY

The study adopted mixed method research design. The mixed method research design is a design that comprised two or more research design used in a study. In this study, the mixed method research design comprised of correlational survey research design and ex-post facto research design. The study was carried out in Zone B Educational Zone of Benue State. The population of the study is 21,829. This comprises 21,711 Senior Secondary two (SS2) students and 118 Mathematics teachers in all the 103 public secondary schools in Zone B educational area of Benue state (Benue State Ministry of Education, 2023). The sample for the study is 422 respondents. This comprises 393 students and 29 teachers. The study used two instruments for data collection. The instruments are structured questionnaire titled "Teachers' Characteristics Questionnaire (TCQ)" and "Students' Profoma (SP)". The instruments were given to three (3) experts for content validation. Cronbach Alpha method was used to determine the reliability coefficient of the instrument. The instrument yielded a total reliability coefficient of 0.77 and it was adjudged to be a good coefficient according to Emaikwu (2015). The reliability of the Student' Profoma was not established and this is because it was just used in collecting students' academic achievement in Mathematics. Data were collected through face to face administration of copies of the instrument to the respondents (Mathematics teachers) with the help of five research assistants. As a path analytic study, data collected were analyzed using multiple regression analysis in Mplus which is Path analytic statistical software. Research question one was answered descriptively using the arrow headed lines in the path diagram. Research questions two and three were answered using path coefficients. Hypothesis one was tested using Chi-square goodness of fit in Mplus. A P-value of 0.05 and below implies a significant difference/relationship while a P-value above 0.05 implies no significant difference/relationship.

RESULTS AND DISCUSSION

The results of the study are presented according to research questions answered and hypotheses tested as follows:

Research Question 1

What is the casual model for providing an explanation of the academic achievement of students in Mathematics based on the selected teachers' characteristics?

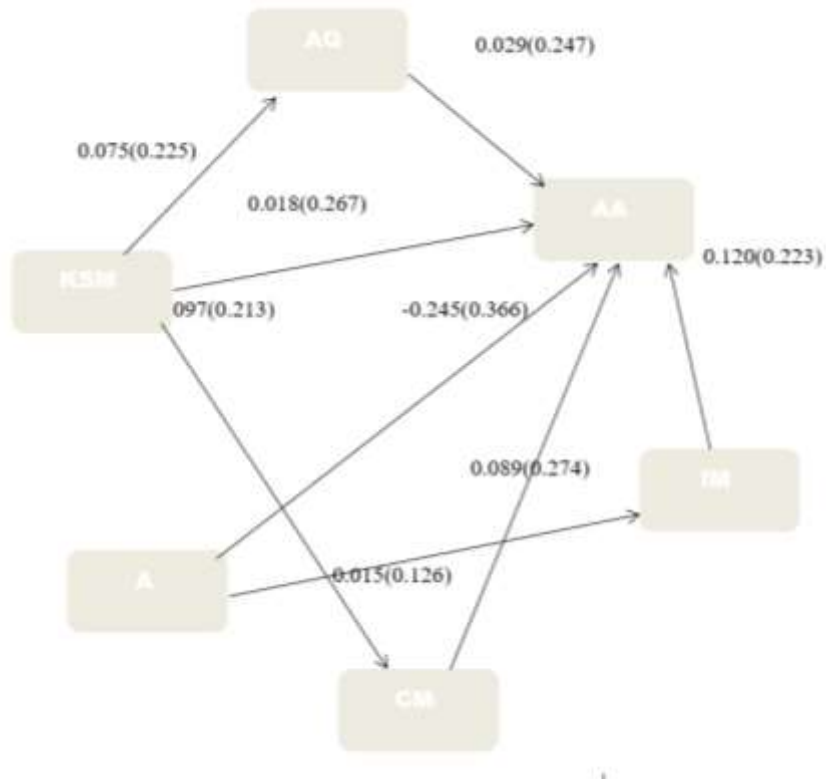To answer this research question, Figure 2 and Figure 3 were used.

Figure 2: Theoretical Proposed Model

(Researcher's field work, 2023)

Key: AA= Academic Achievement, AQ=Academic Qualification, KSM=Knowledge of Subject Matter, A=Attitude, CM=Classroom Management, IM=Instructional Material

Figure 3: Observed path diagram

(Researcher's field work, 2023)

Key: AA= Academic Achievement, AQ=Academic Qualification, KSM=Knowledge of Subject Matter, A=Attitude, CM=Classroom Management, IM=Instructional Material
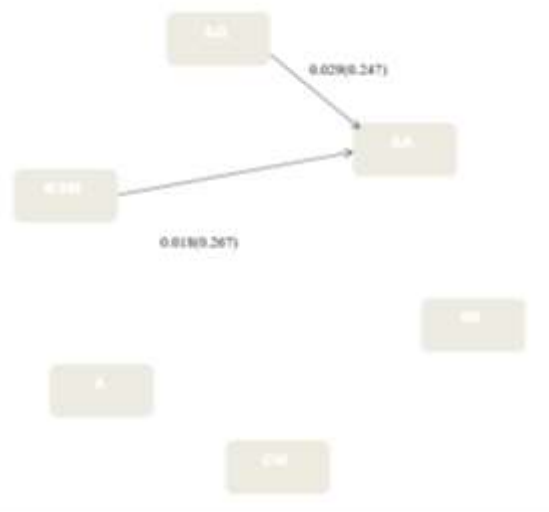
Figure 2 shows the theoretically proposed model for the study developed by the researcher. Figure 3 is the observed path diagram developed by the researcher after the analysis and it shows that out of the 5 teachers' characteristics (academic qualification, knowledge of subject matter, attitude, classroom management and instructional material usage), only academic qualification and knowledge of subject matter had significant path with the students' academic achievement. Thus, only academic qualification and knowledge of subject matter were included in the final observed path model (figure 3). This implies that figure 3 was obtained as the model for providing an explanation of the academic achievement of students in Mathematics based on the selected teachers' characteristics.

Research Question 2

What are the directions and estimates of the strengths of causation (significant path) of the teachers' characteristics in the model?

Table 1: Path coefficients of the teachers' characteristics

S/N	Variables	Direct Path (Estimates)	Indirect Path
1	AA-------AQ	$P_{AAAQ}(0.029)$	----------
2	AA-------KSM	$P_{AAKSM}(0.018)$	-----------

Key: AA= Academic Achievement, AQ=Academic Qualification, KSM=Knowledge of Subject Matter, A=Attitude, CM=Classroom Management, IM=Instructional Material

Result presented on Table 1 shows that the significant paths through which the independent variables (teachers' characteristics) caused variation on the dependent variable (students' academic achievement) are those of teachers' academic qualification and knowledge of subject matter. This implies that teachers' academic qualification and knowledge of subject matter were the only significant causal paths.

Research Question 3

What are the direct and indirect influences of the teachers' characteristics on the students' achievement in Mathematics?

Table 2a: Variables with direct paths

Variables	AQ	KSM	A	CM	IM
AA	0.029	0.018	-0.245	0.089	0.120
KSM	0.075			-0.097	
A					0.015

Key: AA= Academic Achievement, AQ=Academic Qualification, KSM=Knowledge of Subject Matter, A=Attitude, CM=Classroom Management, IM=Instructional Material

Result presented on Table 2a shows that all the teachers' characteristics (academic qualification, knowledge of subject matter, attitude, classroom management and use of instructional materials) had direct influences on students' academic achievement. Also, among the teachers' characteristics, academic qualification and classroom management had direct influence on knowledge of subject matter, while teachers' attitude had direct influence on teachers' use of instructional materials.

Table 2b: Variables with indirect paths

Variables	KSM	A
AA	0.000	0.000

Key: AA= Academic Achievement, AQ=Academic Qualification, KSM=Knowledge of Subject Matter, A=Attitude, CM=Classroom Management, IM=Instructional Material

Result presented on Table 2b shows that among all the teachers' characteristics (academic qualification, knowledge of subject matter, attitude, classroom management and use of instructional materials), only teachers' knowledge of subject matters and teachers' attitude had indirect influences on students' academic achievement. However, all the influences were not significant.

Research Hypothesis 1

There is no significant model fit between the empirically observed data and theoretical model proposed for the study.

This hypothesis was tested using Chi-square goodness of fit test and Root Mean Square Error of Approximation (RMSEA) as presented in Table 6

Table 3: Chi-square goodness of fit test and Root Mean Square Error of Approximation (RMSEA)

Parameters	Value
Chi-square Test of Model Fit	
Value	3.053
Degrees of Freedom	3
P-value	0.6420
RMSEA (Root Mean Square Error of Approximation	
Estimate	0.000
90 Percent C.I	0.000 - 0.065
Probability RMSEA <= .05	0.788

Result presented on Table 3 shows that the developed model had a Chi-square value of 3.053 with a probability value of (p-value) of 0.6420 at degree of freedom = 3. Also, the model had Root Square Error of Approximation (RMSEA) value of 0.000 with a probability of 0.788. Thus, the Chi-square value of 3.053 and RMSEA value of 0.000 showed that the data used for the study fitted the model. This implies that there is no statistical significant model fit in the proposed model for the study and the empirically observed model. Therefore, the hypothesis was not rejected.

Summary of Major Findings

The following findings emerged from the study based on the research questions answered and hypotheses tested.

1. The study found that the causal model for providing an explanation of the achievement of students in Mathematics is the model involving teachers' characteristics of academic qualification and knowledge of subject matter. The study also found that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study.

2. The study found that the significant paths through which the independent variables (teachers' characteristics) caused variation on the dependent variable (students' academic achievement) are those of teachers' academic qualification and knowledge of subject matter.

3. The study found that all the teachers' characteristics (academic qualification, knowledge of subject matter, attitude, classroom management and use of instructional materials) had direct influences on students' academic achievement while only teachers' knowledge of subject matters and teachers' attitude had indirect influences on students' academic achievement.

Discussion of Findings

The study found that the causal model for providing an explanation of the achievement of students in Mathematics is the model involving teachers' characteristics of academic qualification and knowledge of subject matter. The study also found that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study. The findings of this study agreed with that of Maruff (2015) who conducted a study titled "A Path-Analytic Study of Socio-Psychological Variables and Academic Performance of Distance Learners in Nigerian Universities" and found also that the data used for the study fitted the model and that there is no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study. The results of this study also conform with that of Francis and Oludipe (2013) who carried out a study that constructed and tested a model for providing a causal explanation of secondary school students' achievements in Chemistry in terms of student variables and found that the data used for the study fitted the model and that there was no significant difference in the model fit of the empirically observed model and the theoretical model proposed for the study.

The study found that the significant paths through which the independent variables (teachers' characteristics) caused variation on the dependent variable (students' academic achievement) are those of teachers' academic qualification and knowledge of subject matter. The finding conform with that of Effiong, Ekpo, and Igiri (2015) who conducted a study on impact of teachers' qualification and instructional materials in teaching and learning of Biology in senior secondary school in Yakurr Local Government Area of Cross River State and found that there is a positive achievement in students taught by highly qualified teachers.

The study found that all the teachers' characteristics (academic qualification, knowledge of subject matter, attitude, classroom management and use of instructional materials) had direct influences on students' academic achievement while only teachers' knowledge of subject matters and teachers' attitude had indirect influences on students' academic achievement.

The study found that out of the 4.7% influence that the predictor variables (academic qualification, knowledge of subject matter, attitude, classroom management and instructional material) had on criterion variable (students' academic achievement in Mathematics), 4.839% were direct while -0.139% were indirect. The finding agrees with that of Francis and Oludipe (2013) who studied student and teacher related variables as determinants of secondary school students' academic achievement in Chemistry in Lagos State, Nigeria and found that direct effect accounted for 3.46% of the total effect of all the variables while its indirect effect accounted for 0.12% of the total effect.

Conclusion

Based on the findings of this study, it was concluded that while teachers' characteristics of academic qualification, knowledge of subject matter, attitude, classroom management and use of instructional materials plays a role in students' academic achievement in Mathematics, however, they account for only a small portion of the variation (4.7%) in students' academic achievement in Mathematics in secondary schools in Benue state.

Recommendations

The following were recommended by this study;

1. Schools should invest in on-going professional development programs for teachers to enhance their subject matter knowledge, teaching techniques, and classroom management skills. This will help teachers continually improve and stay up-to-date with best practices in education.

2. School principals should promote a positive attitude among teachers towards teaching and learning. They should encourage teachers to cultivate a growth mindset, emphasizing the belief that all students can improve. Fostering a motivating and supportive classroom environment can positively impact student engagement and achievement.

3. Government should ensure that schools have access to adequate instructional materials, including textbooks, teaching aids, and technology. Properly equipped classrooms can enhance the learning experience and make lessons more engaging and effective.

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