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Value-Added Measures as predictors of Student' Achievement in Mathematics

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Abstract

The persistent poor achievement of students in Mathematics in public examinations has been of great concern to stakeholders in Nigeria. This study, therefore, examined Value-added Measures as predictor of student achievement in Mathematics. Correlation research method was used for the study with a targeted population of all public senior secondary two (SS2) students of Mathematics and their teachers in Ife/Ijesha Senatorial District. The sample consists of 300 students randomly selected from 10 schools with their mathematics teachers. Four instruments with rs = 0.89, 0.80**,** 0.71 and 0.87 were used. The data generated was analyzed using correlation and multiple regressions. There is significant joint contribution of teachers' assessment, attitude, and pedagogical skills to students' achievement in Mathematics, where R = 0 .938 and (P < 0.05). It was recommended that teachers should be motivated for professional development programme, sandwich courses and seminars in order to increase their knowledge, skills and competences.

INTRODUCTION

Mathematics is the study of quantitative and relations through the use of numbers and symbols. It is also one of the most useful and fascinating division of human knowledge. Onoshakpokaiye (2006), stated that Mathematics is an expression or graphical representation of what resides in the sub-conscious and also of mental activity. Based on what the author has said, it helps in many important area of study, and has the power to solve some of the deepest puzzle of man's life. In all primary and secondary schools in Nigeria, it is regarded as one of the core subjects. Despite the usefulness of Mathematics to the world at large, student achievement in Mathematics has been a great concern to the stakeholders in Nigeria.

For several years, educators, administrators or managers, researchers have debated over which factors influence student's achievement in Mathematics (Adeleke & Ogunremi ,2013;

Omotayo & Adeleke**,** 2017). An increasing body of evidences proposes that schools can make a great difference in terms of students' achievement in Mathematics and a substantial portion of that difference is attributed to teacher's factors (Popoola & Adeleke, 2019). Student achievement has become an important topic in education today. This is because student achievement is the outcome of educational system. It is the extent to which a student, teacher or institution have achieved their educational goals. However, student achievement measures the amount of academic content a student learns in a determined amount of time. And it increases the accountability for classroom teachers. Again, mathematics achievement has to do primarily with the performances of the students in their either teacher-made test or standardized achievement test administered by examining bodies. However, the major goal of any teacher is to improve the ability level of the students and prepare them for adulthood. Each grade level has learning goals or instructional standards that teachers are required to teach. Standards are similar to a plan that teachers can use to guide their instruction.

Despite the importance of mathematics, studies have revealed continuous under-achievement in the subject at the secondary level over the years. Researchers, in and outside Nigeria have been worried with this problem of under achievement in Mathematics (Ijaiya 2000; Olatoye 2000). According to Sabri (2006), Mathematics achievement level of junior Secondary Assessment showed small fluctuation in percentage from year to year. All these imply that students are not doing well in Mathematics. However, it has been a general believed that students' love, interest and achievement in mathematics at all level of the education system are not encouraging. Umoinyam (1999) also stated that, students' achievement in mathematics at the end of secondary education has not improved in the past decade. However, one of the reasons for poor achievement in mathematics from year to year has been assigned to inadequacies of teachers factors. Empirical studies also reveal that several variables ranging from the learners themselves, teachers, textbooks, curricular and school environment have been responsible for poor students' achievement in Mathematics (Korau 2006). Based on academic achievement of student in Mathematics across the country, poor achievement becomes more noticeable. Value-Added measures, as teacher's factors could play an important role on student achievement.

However, the term "Value-added measures" refer to the contribution of various factors of teachers towards growth in students' achievement (Goldhaber and Anthony, 2003). These various factors can be attributed to teacher factors which determine the growth in students' achievement. Again, value-added measures refer to estimate or quantify how much of a positive or negative effect individual teachers have on students' learning (Abbott, 2014). Hence, value-added measures provide a more 'accurate' estimate of the teachers' contribution to students' academic progress as it incorporates a set of related characteristics of students or institutions (Teacher Advancement Program, 2012; OECD, 2008). Also, value-added measure are those values that attempt to indicate the educational value that the teacher adds over and above which could be predicted the backgrounds and previous attainments of the students within the school. Value- added measure represent an attempt to separate the contribution of teachers to students' learning from all of those other things (such as the previous learning of the students) that may well influence students' performance. However, value-added measures have been used to inform

the professional development of teachers. Again, as a guide to school improvement, value-added measures can indicate in which areas and which students are performing well or performing below expectations. This can assist in directing effort and resources to improve the learning outcomes of the students. Value- added measures, as teacher factors comprise Pedagogical skills, Student perception of teachers' attitude towards student learning and Assessment competence.

Pedagogy as the art and science of how something is taught and how students learn suggests that, teachers are to be professional trained in the areas of classroom management and students 'peculiarity. It also includes how the teaching occurs, the approach to teaching and learning, the way the content is delivered and what the students learn as a result of the process (Loughran, 2010). Therefore, beyond the understanding of the content one is teaching, pedagogy involves being able to convey knowledge and skills in a way that students can understand, remember and apply. Again, pedagogical skill is a strategy that can be used to develop students' capacity to learn mathematics independently. Kim (2005) reveals that students in the classroom where teachers are demonstrating pedagogical skills have higher learning skills in Mathematical computation and improve their academic achievement in Mathematics. In such classroom, students change their learning strategies and show upon motivation to learn academic task. Again, it is an effective means for increasing students' understanding of mathematical skills and concepts (Grifpin, 1997). Therefore, it should be effective in increasing student achievement. It also improves achievement and the level of confidence students in Mathematics (Cekolin, 2001). However, teachers possess relatively skills that help them to impart the knowledge to the students. When teaching and learning are going on, some teachers exhibit more pedagogical skills that are capable of enhancing students learning. Teachers' demonstrations are more likely to have positive attitude toward student learning of Mathematics.

Attitude as a concept has to do with an individual way of thinking, acting and behaving. It has very crucial implications for the student, the teacher, the immediate social group with which the individual student relates and the entire school system. Attitudes could be made as a result of learning experiences. They may also be learned simply by following the example or opinion of parent, teacher or friend. This is impression, which also has a part to play in the teaching and learning of mathematics. In line with this, the student may draw from important disposition o others to form his own attitude, which may likely affect his learning outcomes (Yara, 2009) Again, attitude has to do with a disposition to act or react in a particular way as the individual responds to a situation (Amoo and Rahman, 2004). Thus, the students' perception of teachers' attitude towards their learning could influence their achievement in Mathematics. Again, Emenalo (2000) asserted that since the teaching is carried out by the teacher while the achievement in mathematics concerns the student (learner), it then becomes obvious that the attitude posed by the teacher in the teaching-learning process would influence student's achievement in Mathematics. The author further explained that the attitude of teachers in the classroom could cause fear of the subject, which had claimed many casualties over the years in internal and external examinations in Nigeria.

Teachers' attitude towards teaching significantly predicts students' attitude and students' achievement in Mathematics (Yara, 2009). This implies that teachers' attitude towards the

teaching of Mathematics plays an important role in shaping the attitude of students toward the learning of Mathematics. Again, Ogunniyi (1982) in Yara (2009) discovered that students' positive attitude towards science subjects like Mathematics could be improved by the following teacher-related factors which are teachers' enthusiasm, teachers' resourcefulness and helpful behavior, and teachers' thorough knowledge of the subject-matter and their making science interesting. This implies that the roles of a teacher could be the facilitator of learning and the contributions to students' achievement in Mathematics. However, if a teacher develops a positive attitude towards his/her job, it would make the teacher to work harder towards the success of his/her students. When the students perceive that their teachers are hard working and have concern for them, it motivates them and this will result in good achievement in Mathematics. Also, teachers' attitude towards mathematics is a predictor of students' achievement in mathematics (Yara 2009).

However, the role of teacher in the success of any educational system cannot be overemphasized and that is why the National policy on education (2004) stipulated that no educational system can rise above the quality of its teacher, this shows the importance of teacher in the school. The success of the Mathematics lesson depends greatly on the Mathematics teacher since he is the prime mover that will put all that is contained in the curriculum into action. The teacher's attitude in the classroom is very important in the learning of Mathematics. Also, Ololube (2009), stressed that teaching is seen as a diverse and complex activity because the goal of any teaching task is achievement. The author further explained said that all the interrelated actions of the teacher in any given moment in the classroom must lead to students' academic achievement. Teachers are very important in educational effectiveness, they are charged with the responsibility of implementing the school curricular and pedagogical techniques. Hence, the positive attitude of a mathematics teacher in teaching can lead to high level of student achievement in Mathematics. You cannot give what you don't have. Therefore, if there will be good students' achievement in Mathematics, the teacher must have a positive attitude towards the teaching and learning of the subject. It is only teacher with positive attitude and interest on the subject that can motivate the students to learn. The teacher is the students' key to success. They also play an important role in imparting the knowledge and equipping the students to be useful to themselves and the society. Teacher negative or positive attitude towards student learning determines the level of assessment competence of the teacher in the classroom setting.

Assessment of students' performance is vital to guide the teaching-learning process. Research shows that both the quality and level of academic achievement and students' engagement can be increased through formative assessment which is known as "assessment for and as learning" (Manitoba Education, Citizenship and Youth, 2006). This assessment for learning is done by the teacher while assessment *as* learning is on the part of the students. To become independent learners, students need to participate in the assessment process. From the beginning, students need to construct an idea of what is to be learned for them. The teacher needs to explain the learning outcomes in such a way that students understand and participate in setting criteria that define success, giving and obtaining feedback, and planning the next steps to reach in the learning outcomes. However, in classrooms where formative assessment refers to frequent,

interactive assessments of student progress and understanding to identify learning needs and adjust teaching appropriately, the gains in students' achievement are quite considerable (Black, Paul and Wiliam Dylan, 2005). Also, an assessment of mathematics teachers' competence is therefore an important parameter of student achievement. It is of high relevance to ascertain whether and how teacher competence contributes to the development of student achievement.

Assessing student achievement in the classroom has been one of the most critical or crucial responsibilities of the teacher. It is revealed that teachers spent up to 50 percent of their time on assessment-related activities (Plake 1993). According to Stinging (1999), the quality of instruction in any classroom depends on the quality of the assessments used. Therefore, there must be meaningful and accurate information gathered from the classroom assessment, so as the information will be valid and reliable. Research has recognized that teacher's assessment competence is generally weak (Brookhart 2001). In agreement with Stinggins (2005) who stated that there are unacceptably low levels of assessment literacy among practicing teachers and administrators in Nigerian schools. The author moves on by stating that assessment illiteracy has resulted into incorrect assessment of students, thereby, preventing them from reaching their full potential. This is because, most of the serving teachers in schools are incompetent in the development and validation of measuring instruments such as tests, rating scale, checklist, etc., and they are also incompetent in evaluating behavior. However, effective assessment commences with clear goals. It also requires serious thinking before teachers can articulate the specific skills and competencies they can use to teach through the course content. To assess students effectively, teacher must be competent in teaching.

Research Questions

The following researcher questions were answered in this study base on the problems highlighted in the introduction.

1. What is the strength and direction of relationship between value-added measures and student achievement in Mathematics?
2. Is there significant joint contribution of pedagogical skills, student perception of teachers' attitude toward student learning and assessment competencies to students' achievement in Mathematics?
3. What is the relative contribution of pedagogical skills, student perception of teachers' attitude towards students learning and assessment competencies to students' achievement in Mathematics?

Methodology

Research Design

An Ex-post facto design of correlation research type was adopted for the study

Sample

Multi stage sampling technique was used in this study. Ife/Ijesha was randomly selected from three senatorial district in Osun State. From the selected senatorial district which has been sub-

divided into ten (10) Local Government Areas (LGAs), five (5) out of the ten Local Government Areas were randomly selected. Furthermore, from each of the five Local Government Areas selected, two schools each were randomly selected, making a total of ten (10) schools. Ten (10) Mathematics teachers were purposively selected and systematic random sampling technique was employed to select thirty (30) Mathematics students each from the selected schools. In all, a total of three hundred and ten (310) participants (10 teachers and three hundred (300) students) were used for the study.

Instrument

Teacher's Pedagogical Skills Observation Sheet (TPSOS**)** was used to gather data for the study. This instrument was adapted by the researcher from International centre for Educational Evaluation (ICEE) to obtain information on the pedagogical skills of teachers in Mathematics. It consists of two sections, section A wanted information on personal characteristics of teachers and section B presents thirty-eight (38) items. The instrument was subjected to face validity. The estimated reliability coefficient using Scott's - Pie formula was 0.89.

Also, Student perception of Teacher Attitudinal Scale (TAS) was used to collect information for the study. This instrument was adapted by the researcher from Folarin (2014) to obtain information on teacher's attitude towards students' learning of Mathematics. It comprises of two sections, section A focused on the demographic information of the students and section B presents seventeen (17) items. The instrument was subjected to face and construct validity. The estimated reliability coefficient using Cronbach Alpha was 0.80

Assessment Competent Inventory (ACI) was used to collect information for the study. This instrument was adapted by the researcher from Adeleke, Awuse, and Mitee. (2017), in which it was designed to assess teacher assessment competences. It comprises of two sections, section A dealt with the demographic information of the students and section B presents seven (7) items. The instrument was subjected to face and construct validity. The estimated reliability coefficient using Cronbach Alpha was 0.71.

Mathematics Achievement Test (MAT) was constructed by the researcher. Each of the items consists of a stem and four options (A, B, C, and D). The items covered the entire theme in senior secondary school two (2) Mathematics curriculums. The instrument was subjected to face and content validity. The instrument presents fifty (50) items. The psychometric property was determined by Cronbach alpha and this gave a reliability coefficient of 0.87. Correct response attracted a score of 1, while incorrect response attracted a score of 0.

Procedure

The researcher and five (5) trained research assistants were used for the study. All selected school heads and teachers were adequately informed for their permission for administering the questionnaires to the students. The researcher administered the instruments (questionnaire) to the respondents with the help of the research assistants alongside the Mathematics teachers. The

researcher and research assistances explained the various sections of the instruments to the subjects who were instructed not to leave any of the items unanswered.

Data Analysis

Correlation and Multiple regressions were used for the study.

Results and Findings

Research Question 1

What is the strength and direction of relationship between value-added measures and students achievement in Mathematics?

Table 1: Relationship between Value-added Measures and Students' Achievement in Mathematics

	Assessment	Attitude	Pedagogical	Achievement
Assessment	1			
Attitude	.098	1		
Pedagogical	.940**	.306	1	
Achievement	.005	.310**	.915**	1

** represent Correlation is significant at 0.00, * correlation is significant at 0.05

Table 1 shows the relationship among value-added measures and secondary school students' achievement in Mathematics. The result revealed that there is a significant relationship between assessment and pedagogical skills ($r=0.94$, $p<0.05$). A significant relationship also exist between teachers' attitude and students' achievement ($r= 0.31$, $p<0.05$). Also, pedagogical skill was significantly related to students' achievement in Mathematics. Inference could be made that among all the value-added measures, it is only teachers' attitude and pedagogical skills that have significant relationship with students' Mathematics achievement. Thus pedagogical skills and teachers' attitude could influence students' achievement in Mathematics to some extent.

Research Question 2

Is there significant joint contribution of pedagogical skills, student perception of teachers' attitude towards student learning and assessment competencies to students' achievement in Mathematics?

Table 2: Joint Contribution of Value Added-Measures to Students' Achievement

ANOVA

Model		Sum of squares	Df	Mean Square	F	Sig.
1	Regression	234.162	3	78.054	14.709	.004[b]
	Residual	31.838	6	5.306		
	Total	266.000	9			
Model Summary						
Model		1				
R		.938[a]				
R Square		.882				
Adjusted R Square		.820				
Std. Error of the Estimate		2.30356				

The result of Table 2 revealed that value-added measures namely, teacher attitude, assessment and pedagogical skill taken together jointly correlate positively (R = .938) with students' achievement in Mathematics. This implies that the three variables have a positive multiple relationship with students' achievement. Hence, they have the potential of explaining change in achievement to a certain extent. Also the three variables could explain 88.2% of total variance in observed in students' mathematics achievement (R^2 = 0.882). This leaves the remaining 11.8% to other factors that were not considered in the study and to error. The level of significance of the joint contribution of all independent variables were presented in the ANOVA Table, the table shows that R value of .938 was significant (F = 14.709, P < 0.05). This implies the three variables jointly contributed to produce change in students' achievement in Mathematics. Hence, there is significant joint contribution of teachers' assessment, attitude, and pedagogical skills to students' achievement in Mathematics.

Research Question 3

What is the relative contribution of pedagogical skills, student perception of teachers' attitude towards students learning and assessment competencies to student achievement in Mathematics?

Table 3: Relative Contribution of Value-Added Measures to Students Achievement.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-11.055	7.696		-4.436	.001
	Pedagogical	.102	.086	.500	2.185	0.032
	Attitude	.153	.197	.492	2.007	0.004
	Assessment	.682	.744	.202	.918	.394

a. Dependent Variable: Achievement

Table 3 shows the Coefficient Table for the regression analysis of three variables, the result revealed that pedagogical skills made the highest contribution to students' achievement (β = 0.500, $p < 0.05$) which was significant, followed by teachers' attitude (β = 0.492, $p < 0.05$) which was also significant and then teachers' assessment pattern which was not significant (β =0.20, $p > 0.05$). This implies that a unit change in teachers' pedagogical skill, attitude and assessment method will cause a corresponding change of 0.50, 0.492 and 0.202 in students' mathematics achievement respectively. Thus, there is significant relative contribution of teachers' pedagogical skills and attitude whereas teachers' assessment pattern made no significant relative contribution.

DISCUSSIONS

The finding reveals that relationship between Value-added Measures and Students' Achievement in Mathematics exists, the result also revealed that among all the value measures, it is only teachers' attitude and pedagogical skills that has significant relationship with students' Mathematics achievement. Thus pedagogical skills and teachers' attitude could influence students' achievement in Mathematics to some extent. This finding is in agreement with Kim (2005) who reveals that students in the classroom where teachers are demonstrating pedagogical skills have higher learning skills in Mathematical computation and improve their academic achievement in Mathematics. Also, the finding is in support of Emenalo (2000) who stressed that since the teaching is carried out by the teacher while the achievement in mathematics concerns the student (learner), it then becomes obvious that the attitude posed by the teacher in the teaching-learning process would influence student achievement in Mathematics.

The finding of this study shows that there is joint contribution of Value-Added Measures to Students' achievement in Mathematics. The result also revealed that value-added measures namely, teachers' attitude assessment and pedagogical skills taken together jointly correlate positively with students' achievement in Mathematics. This implies that the three variables have a positive multiple relationships with students' achievement. And it also implies that the three variables jointly contributed to produce change in students' achievement in Mathematics. Hence, there is significant joint contribution of teachers' assessment, attitude, and pedagogical skills to students' achievement in Mathematics. This finding is in agreement with Goldhaber and Anthony (2003) who revealed that value-added measures refer to the contribution of various factors of teachers towards growth in students' achievement. These various factors can be attributed to teacher factors which determine the growth in students' achievement. This implies that the various factors of Mathematics teachers such as pedagogical skills, assessment competence and teachers attitude contribute positively toward growth in students' achievement of Mathematics in the Senatorial District. They also determine the level of students' achievement in Mathematics in the District.

The finding stresses that there is relative contribution of value-added measures to students' achievement in Mathematics. The result also revealed that pedagogical skills made the highest contribution to students' achievement, followed by teachers' attitude and then teachers' assessment competence. This implies that a unit change in teachers' pedagogical skill, attitude

and assessment method will cause a corresponding change in students' mathematics achievement respectively. Thus, there is significant relative contribution of teachers' pedagogical skills and attitude whereas assessment competence made no significant relative contribution to students' achievement in Mathematics. This result "pedagogical skills made the highest contribution to students' achievement" is in line with conclusion of the findings of Kim (2005) who revealed that students in the classroom where teachers are demonstrating pedagogical skills have higher learning skills in Mathematical computation and improve their academic achievement in Mathematics. Again, this result "assessment competence has no significant relative contribution to students' achievement in Mathematics" is in agreement with Brookhart, (2001) who revealed that research has recognized that teacher's assessment competence is generally weak, and also in agreement with Stinggins (2005) who stated that there are unacceptably low levels of assessment literacy among practicing teachers and administrators in Nigerian schools. The author moves on by stating that assessment illiteracy has resulted into incorrect assessment of students, thereby, preventing them from reaching their full potential. This implies that, low levels of assessment literacy among the mathematics teachers have contributed negatively to students' achievement in Mathematics in Ife/Ijesha Senatorial District.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

- Teachers should be motivated for professional development programme, sandwich courses and seminars in order to increase their knowledge, skills and competences
- Mathematics teachers should be employed based on their skills, competences, and disposition so that these will help in improving students' achievement in Mathematics.
- The condition of service in the teaching profession should be improved to make the profession more attractive and dignify to the teachers so that this can change their negative attitude toward student learning of Mathematics, and it will also help in enhancing students' achievement in Mathematics.

CONCLUSION

From the findings of this study, pedagogical skills, teacher attitude and assessment competence predict students' achievement in mathematics to some extent. This could be applicable to other subjects especially science oriented subject.

REFERENCES

Abbott, S. 2014. Hidden curriculum: The glossary of education reform. Retrieved from http://dglossary.org/hidden-curriculum

Adeleke, J. O, Awuse, J. N. & Mitee T. L. (2017). Teachers' Assessment Competence and Home Support Variables as Predictors of Senior Secondary II Students' Achievements in Mathematics in Rivers State, Nigeria. *Journal of Curriculum and Instruction*, Vol. 10, No.1; 249-263.

Adeleke, J. O**.** & Ogunremi, C. B. (2013**).** Effect of Language of Instruction and Pupils' Attitude on the Performance of Primary School. *Journal of education in developing areas*, Vol .21, No. 1; 244-252.

Amoo, S. A., & Rahman, M. A. 2004. Secondary School Students' Attitudes of Learning Mathematics in the World of Information Technology. Implication for Mathematics teachers and teacher preparation. In Proceeding of the 42nd Annual Conference of the Science Teachers Association of Nigeria, 178-182. Ibadan

Black, Paul, & Dylan Wiliam, 2005. "Changing Teaching through Formative Assessment: Research and Practice: The King's-Medway-Oxford shire." Formative Assessment:

Improving Learning in Secondary Classrooms. Paris, FR: OECD Publishing, 223-240 Brookhart, S.M 2001. The stardard framework for the fole of classroom assessment in motivating student effort and achievement. Applied measurement in educative, 10(2), 161-180

Cekolin, C.H. 2001: The effect of self regulated learning strategies on academic achievement. International Dissertation abstract-A 61(12) pp-4656

Emenalo, R.A. 2000. Relationship between students' motivation and their science achievement. Journal of Research in School Teaching 15(3), 10-15.

Folarin T. K. 2014. Instructional Materials Utilization and Teachers' Attitude as Determinants of Students' Achievement in Senior Secondary School in Economics in Osun State

Griffin, C. 1997. Semantic networking: The new kid on the back. Journal of Research on Science Teaching, 27, 1001-1010.

Goldhaber, D., & Anthony, E. 2003. *Teacher quality and student achievement* (Urban DiversitySeries No. 115). New York: ERIC Clearinghouse on Urban Education. Retrieved May 9, 2008, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/1e/03.pdf

Ijaiya, N.Y.S. (2000). Failing school and nation development for reappraisal of school effectiveness in Nigeria. *Nigeria Journal of education research and Evaluation Vol. 2, No 2, 200. 37-44*

Kim, J.K. (2005). The Effect of a Constructivist Teaching Approach on Student Academic Achievement, Self concepts and leaning strategies. Asia Pacific Education Review

Korau, Y.K. 2006. A Systematic Attempt to Establish the Fear and Poor Performances of Senior Secondary School Students in Geometry and Trigonometric Concepts. A case study of WAEC Candidates. A Paper Presented at the 43rd Annual Conference of Mathematics Association of Nigeria Held at A.T.B.U. Bauchi

Loughran, J. 2010. *What EXPERT teachers do: Enhancing professional knowledge for classroom practice*. Crowsnest. Allen and Unwin

Manitoba Education, Citizenship and Youth, 2006. *Rethinking Classroom Assessment with Purpose in Mind, Assessment* for *Learning, Assessment* as *Learning, Assessment* of *Learning*. Winnipeg, MB: Manitoba Education, Citizenship and Youth

Ololube, N. P. 2009. *Understanding teachers professional competencies for EducationEffectiveness*. Owerri: Springfield Publishers Ltd.

Omotayo, S. A. and Adeleke, J. O. (2017). The 5e Instructional Model: A Constructivist Approach for Enhancing Students' Learning Outcomes in Mathematics. *Journal of the International Society for Teacher Education*, Vol. 21, No. 2; 15-26.

Organisation for Economic Co-operation and Development. 2008. *Measuring improvements in learning outcomes: Best practices to assess the value-added of schools*. Paris: OECD

Plake, B.S. 1993. Teacher assessment literacy: Teachers' competences in the educational assessment of students. Mid-Western Educational Researcher, 6(1), 21-27

Popoola B. A. & Adeleke J. O. (2019). Development of Professional Learning Scheme to Improve Teachers' Competence in the Teaching of Difficult Topics in SSCE Mathematics in Abeokuta, Ogun State. *Abacus-The Journal of the Mathematical Association of Nigeria*. Vol. 44, No. 1, 298- 306 pp.

Sabri, A., 2006. Issues in Mathematics Education. Utusan Publications and Distributors, ISBN: 967-61-1783-8, pp: 10.

Stiggins, 2005. Using Student-involved classroom assessment o close achievement gaps. Theory into practice, 44(1) crafts of reading, writing and mathematics. In knowing learning and instruction-essays.

Teacher Advancement Program. 2012. Understanding value-added analysis of student achievement. Retrieved on July 17, 2012

Umoinyan, I.E. 1999. Student Socio-Psychological Factor as Determinants of Achievement in Senior Secondary School Mathematics. Unpublished Ph. D Thesis, University of Ibadan, Nigeria

Yara, P.O. 2009. Relationship between Teachers' Attitude and Students' Academic Achievement in Mathematics in some selected senior secondary schools in Southwestern Nigeria. *European Journal of Social Sciences.* 11(3), 364-369.