

Teacher Quality Factors as Determinant of Students' Performance in Mathematics

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Abstract

Aim: This study seeks to determine how students' mathematics achievement is impacted by teacher quality characteristics.

Methods: The study considered the following teacher characteristics: experience, training, motivation, interest satisfaction, and instructional methods. The study used the descriptive survey method to gather data on both teachers and students on how teacher quality could be a determinant factor in students' performance in mathematics. The data gathered were analyzed using regression analysis and analysis of variance (ANOVA).

Results: The analysis's findings indicate that teachers' classroom management skills and instructional methods have an impact on students' academic performance.

Conclusion: The study concludes that teachers' expertise, instructional methods, classroom management skills, motivation, satisfaction, and interest all play a significant role in students' mathematics performance.

Recommendation: In order to obtain appropriate techniques for imparting instruction to pupils, teachers who lack teaching credentials should be encouraged to enroll in education courses.

Keywords: *Teacher quality, achievement, motivation, teachers' qualification, experience*

INTRODUCTION

Mathematics is a subject that everyone should be familiar with because it is essential for both academic success and daily survival. Academic accomplishment, which is a function of teacher quality, reflects the quality of education. According to Zagayvane (2017), attributing teacher traits such as teacher qualifications, teacher certification, teacher education, teacher experience, and teacher evaluation scores significantly impacts educational quality. In the current scientific and technological era, it is impossible to overstate the significance of mathematics and all of its ramifications. According to Abd Algani (2019), mathematics has an influence on every aspect of daily life in addition to the basic sciences, applied sciences, engineering, and technology.

In addition to its usage in the sciences and technology, Odogwu (2002) pointed out that mathematics is used in a variety of applications, including painting, music, management information systems, traffic control, and accounting. He also stated that the national strategy on education (FRN 2004) of the federal government of Nigeria designated mathematics as one of the core subjects to be taught at both the primary and secondary school levels of education in recognition of its value. According to Eraikuemen and Oteze (2008), mathematics has the capacity to maintain students' interest in the formal educational system due to its utilitarian significance in activities like purchasing and selling, record keeping, understanding, and appreciating nature, critical thinking, and logical reasoning.

Similarly, Herborpeters (2001) argued that mathematics is the foundation upon which any real science must succeed through mathematical demonstration. Adegboye (2003) also noted the value of mathematics in other academic disciplines and in the human race, including the arts, social sciences, religions, mysticism, business, conflict, and daily life. The researcher further stated that decorative art has helped people appreciate geometry that trade and religion helped numbers flourish, and that interest in mathematical programming was sparked by conflict. Decorative arts use also extends to the design and construction of bridges, dams, and highways. According to Aremu (1998), mathematics is essential for students' academic success as well as their ability to survive economically and achieve national goals and objectives. Description of the Issue Any academic program's success or failure mostly hinges on the teacher, who is the curriculum's main implementer. According to Adeniyi (2012) and Ayinla (2011), teachers' inability to appropriately transmit mathematics education to pupils is the cause of students' poor math performance.

According to Kasiisa and Bakaluba (2013), there is a considerable correlation between instructors' credentials and students' academic performance in eastern Ugandan primary schools. They suggested that experienced teachers with academic credentials teach social studies in Eastern Uganda in light of their findings. A study was undertaken in Nandi, Kenya to determine the connection between teacher effectiveness and student accomplishment (Kosgei, Jairo, Odhiambo & Ayugi, 2013). They emphasized that teacher experience has a big impact on students' performance, but they also point out that there is not much of a connection between teacher certification and students' academic success.

Therefore, this study looked at aspects relating to teacher quality as they related to students' mathematics achievement in Ghana's upper west. The following teacher quality variables were considered in this study: experience, education, motivation, interest/satisfaction in teaching, instructional methods, and classroom management skills.

Statement of the Problem

Research has shown that underperforming students in mathematics are not limited to Ghana. The average U.S. score in mathematics literacy was 474 on a scale from 0 to 1,000, which is lower than the OECD average score of 498. Baldi et al (2007). According to Mbugua, Kibet, Muthaa, and Nkonke (2012), mathematics achievement in Kenya's Baringo District has consistently been low. One of the factors contributing to poor mathematics achievement was teachers' poor attitudes. Ghana's Vision 2020 programme recognizes that the inadequate quality of instructors has contributed to the decline in educational standards. The performance in primary schools is described in data gathered by Ghana Education Statistics (MOE 2020) with mathematics being the least well-performed subject in 2018 and 2019. While researchers like Nsanzabiga (2013), Mporananayo (2015), and others have studied factors influencing student performance, little is known about the impact of teachers' effectiveness on students' academic achievement in Rwanda. The research issue is therefore an analysis of the impact of teacher effectiveness on students' mathematics performance in SHS1 in Sissala-East, Upper West Region of Ghana.

Hypotheses

The hypotheses tested in the study include:

HO1: There is no correlation between teachers' quality factors and students' academic achievement in mathematics

HO2: There is no significant composite effect of the six teacher quality factors on students' achievement in mathematics

HO3: There is no significant relative effect of the six teacher quality factors on students' achievement in mathematics

Significance of the Study

A teacher must have sufficient knowledge of the subject matter of the education he or she must impart to the pupils and must be aware of the most effective teaching strategy in order to be considered the "Master" of the class.

Furthermore, prospective teachers and teachers who are already working in the field should make sure that they enroll in training to become certified and qualified professionals in order for teaching to be rewarding and effective in Ghana. Instead of devaluing teachers' qualifications in terms of the required certificate. The primary significance of teacher qualification to the educational growth of any nation was highlighted by Mamoon-Al-Bashir (2016). Any academic course, in the researcher's opinion, revolves around the teacher. That instance, better student performance would result from teachers with higher qualifications, and it is likely that a positive learning environment and student performance are related.

The results of this study would give information on the variables related to teacher quality that affect students' mathematical achievement. This would make it easier for mathematics teachers to understand their contributions to pupils' success in mathematics. To increase their knowledge and efficacy in teaching mathematics, teachers who do not possess the required academic credentials may also need to pursue further training. Additionally, this study would give the appropriate school authorities the ability to recognize or notice the significance of requiring a minimum level of education for mathematics teachers in their various schools. Additionally, the Ministry of

Education might use the findings of this study to inform policymaking at both the national and regional levels. Finally, this study's results would help the government determine how to effectively support instructors in order to maximize teaching productivity.

LITERATURE REVIEW

According to Benegusenga et al. (2017), teaching experience heavily influences student accomplishment, and there is a need to improve teacher qualification. Since the teacher's comments, enthusiasm, attitude, and teaching methods have an impact on how well pupils perform in class, they have a significant impact on the performance of the students. Semir (2018) contends that for a teacher to be effective in his or her employment, he or she must possess a thorough understanding of all the subject matter, instructional strategies, and environment. The instructor must transmit the curricular content exactly as it is written. As a result, the instructor serves as the foundation for providing students with fulfilling experiences. Therefore, if they want to engage students in meaningful classroom activities, teachers must make it necessary for them to access the principles of teaching.

According to Khan, Zia-ul-Islam, Khan, and Education's (2017) research, ineffective teaching strategies have an impact on students' academic achievement, and pupils are more likely to pick up the wrong information from teachers who are unable to effectively connect with them or use the right channels of communication. Additionally, he discovered that using ineffective teaching strategies and poor instructional language tends to hinder students' academic progress.

Additionally, Benegusenga, Ntawiha, and Nzabairwa (2017) emphasized the significance of utilizing a variety of teaching strategies to spark and maintain students' interest as well as make it easier to accomplish instructional goals. According to Zagvané (2017), teachers must impart knowledge; educate pupils on the fundamental abilities outlined in the curriculum, and offer instructions for efficient classroom instruction. In other words, whether a learning outcome is successful or unsuccessful in a classroom context depends equally on the teacher and the curriculum.

A well-planned curriculum does not ensure learning, according to Ekwueme (2001), unless the teacher is competent and the student is reasonably motivated and prepared to learn. An ineffective teacher might ruin any educational programme. In the interest of instructors in particular and pupils who are constantly on the receiving end, there is a need to emphasize suitable and adequate intellectual training of teachers. According to Justice and Daniel (2015), pupils who are taught physics by trained teachers perform significantly better than those who are taught by inexperienced teachers. The fifteen physics instructors from the chosen institutions make up the study's sample. NCE Math/Physics (10 teachers), B.Sc. (Ed.) in physics (1 teacher), and HND in engineering (four teachers) are the qualifications of the teachers. Education for students is always education for the instructor. In conclusion, it is solely the teacher's obligation to ensure that students receive the materials outlined in the school curriculum. The degree of success a teacher will accomplish is heavily influenced by his or her academic proficiency in the subject. As a result, the teacher must strive to live up to his or her calling and meet the criteria for effective instruction.

METHODOLOGY

Research Design

This study used the descriptive survey method. The researcher employed a questionnaire to get accurate data regarding the attitudes of the teachers towards their jobs, as well as their interests, training, and experience in relation to students' mathematics achievement.

Sample and Sampling Procedure

The participants in the study were all secondary school students and mathematics teachers in Sissala-East in Upper West, Ghana. To choose the schools, the researcher employed stratified random approaches. The schools were chosen in a way that encompasses the entire area. Secondary schools in both urban and rural sections of the region were considered during the selection process. SS1 students and SS1 mathematics teachers participated in the study.

Data Collection

Each school's mathematics teachers received the questionnaire directly from the researcher. The researcher gathered the questionnaires before they left each school. Along with the questionnaire, the final term grades of the students each mathematics teacher had taught were also gathered.

Data Analysis

ANOVA and multiple regression were used to analyze the findings from the data gathered for this investigation. These were utilized to look at the connection between student achievement and teacher quality characteristics. A 0.05 alpha threshold of significance was used for the study's testing of the hypotheses.

Scope of the Study

This study covers secondary schools in the Upper West region of Ghana. 20 schools were randomly selected from the senior secondary schools in the upper west region, of Ghana. All teachers and students in the selected schools were included in the study.

RESULT

Analysis of Research Result HO1: There is no correlation between teacher quality factors and students' academic achievement in mathematics.

Table 1: Summary of regression analysis

R	R. Square	Adjusted R. Square	Std Error of the Estimate
225a	0.051	0.044	16.00

Table 1 shows a good correlation between mathematics achievement and all 6 teacher quality characteristics ($r = 0.22$). They also contribute 4.40% of students' arithmetic achievement, with the remaining 95.60% attributable to variables other than the six teacher quality criteria that were considered in this study.

HO2: The six teacher quality criteria do not together have a statistically significant impact on pupils' mathematical achievement.

Table 2: Analysis of variance

Source of Variance	Sum of Squares	df	Mean Square	F	Sig.(p)
Regression	11869.823	6	1978.304	7.732	0.000*
Residual	221832.0	867	255.862		
Total	233701.8	873			

*Significant at $P < 0.05$

Table 2 shows that the six teacher quality components were significant ($F = 7.732$, $P 0.05$), indicating that all the variables taken together have a composite influence on students' mathematical achievement.

HO3: There is no significant relative effect of the six teacher quality factors on students' achievement in mathematics.

Table 3: Relative effects of six teacher quality factors on students' achievement in mathematics

Variable	Unstandardized coefficients B	Std error	Standard coefficients	Rank	T	S
Constant	14.114	7.900			1.786	0.74
Experience	6.262E-02	259	0.011	6th	0.242	0.809
Qualification	0.534	404	0.062	5th	1.322	0.187
Motivation	1.434	417	0.150	2nd	-3.437	0.001
Interest/Satisfaction	2.803	518	0.224	1st	5.435	0.000
Teacher Techniques	1.706	492	0.128	3rd	3.467	0.001
Classroom Control	0.849	0.362	0.089	4th	-2.346	0.019

*Significant at $P < 0.05$

As summarized in Table 3, instructors' interest and satisfaction rank first in terms of magnitude when it comes to influencing students' mathematics achievement ($\beta = 0.224$, $T = 5.435$, $P 0.05$). Students' success in mathematics is significantly correlated with their contentment with their areas of interest. Teachers' motivation comes in second in terms of relative contribution size ($\beta = 1.434$, $T = 5.435$, $P 0.05$). Teachers' teaching methods rank third on the list of relative contributions in terms of magnitude, although the association is still considerable. β is 0.128, T is 3.467, and P is 0.05. This is important as well. The fourth factor is the teachers' capacity for maintaining control in the classroom ($\beta = 0.089$, $T = 2.346$, $P 0.05$). The connection is also important. Teachers' qualifications rank sixth in terms of the amount of their relative contribution ($\beta = 0.62$, $T = 0.242$, $P 0.05$). This connection is important. Teachers' experience comes in last in terms of relative contribution size ($\beta = 0.011$, $T = 1.76$, $P 0.05$). This connection is also determined to be important.

CONCLUSION

This study concludes that teachers' expertise, instructional methods, classroom management skills, motivation, satisfaction, and interest all play a significant role in students' mathematics proficiency. This might be applied to other subjects, especially ones with a strong scientific component.

RECOMMENDATIONS

1. Government at all levels should be concerned with teachers' observable low morale levels and with the best ways to encourage them to perform well.
2. Ghanaian society should reform and learn how to properly recognize and respect the value of teachers, especially parents, and guardians of students as well as students themselves.
3. The analysis's findings indicate that teachers' classroom management skills and instructional methods have an impact on students' academic performance. In order to obtain appropriate techniques for imparting instruction to pupils, teachers who lack teaching credentials should be encouraged to enroll in education courses.
4. Finally, the government should immediately recognize teaching as a profession. This would improve the caliber of those entering the field. It is necessary to promote the appointment of qualified teachers to positions in government. For example, the director general for education in the country should be a working classroom teacher. Some specific positions should only be open to active teachers.

REFERENCES

- Abd Algani, Y., (2019), Innovative Ways to Teach Mathematics: Are they Employed in Schools? *Journal of Computer and Education Research (JCER)*, 7(14). 496-514. DOI: 10.18009/jcer.612199.
- Adegboye, A. O. (2003). The uses of mathematics in solving man's problem: ABACUS: The *Journal of Mathematics Association of Nigeria (MAN)*, 28 (1) 67 – 77.
- Adeniyi, C. O. (2012). Effects of a personalized system of Instruction on senior school Students' Performance in Mathematics in Kwara South, Nigeria. Unpublished Ph.D. Thesis, University of Ilorin, Ilorin, Nigeria
- Aremu, A. (1998). Effects of land and garboard game based instructional strategies on primary school pupil's achievement in practical geometry. Unpublished Ph.D. Thesis, University of Ibadan, Ibadan
- Ayinla, J. O. (2011), Effect of Teachers' Instructional Strategy Pattern on Senior School Students' Performance in Mathematics Word Problems in Ondo, Nigeria. Unpublished M.Ed. Dissertation, University of Ilorin, Ilorin, Nigeria.
- Baldi, S., Jin, Y., Skemer, M., Green, P.J., and Herget, D. (2007). Highlights from PISA 2006: Performance of U.S. 15-Year-Old Students in Science and Mathematics Literacy in an International Context (NCES 2008–016). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Page 24
- Benegusenga, A., Ntawiha, P., & Nzabaliwira, W. (2017). Teacher Qualification and Teaching Techniques in Nursery Schools in Kicukiro. *Rwandan Journal of Education*, 4(1), 69–79.

- Blömeke, S., & Delaney, S. (2012). Assessment of teacher knowledge across countries: A review of the state of research. *ZDM – The International Journal on Mathematics Education*.
- Eraikuemen, L & Oteze, K. L. (2008). Students' choice of Mathematics as a course of study: Implications for scientific and technological development. *ABACUS: The Journal of Mathematical Association of Nigeria (MAN)*, 33 (1), 64 - 69
- Herborpeters, V. F. (2001). Mathematics language for the new millennium, implication to society. *Proceeding of September 2000 Annual Conference of Mathematical Association of Nigeria (MAN)*.
- Justice Enu&Daniel Nkum. (2015). Factors influencing students' mathematics performance in some selected colleges of education in Ghana. *International Journal*, 3.
- Khan, A., Zia-ul-islam, S., Khan, M., & Education, P. (2017). Communication Skills of a Teacher and Its Role in the Development of the Students' Academic Success. *Journal of Education and Practice*, 8(1), 18–21.
- Kimani.N, Kara. M. & Njagi (2013). Teacher factors influencing Students' Academic Achievement in Secondary Schools in Nyandarua County, Kenya. *International Journal of Education and Research* .1 (3), 1.
- Kosgei.A, Kirwa.M, Odhiambo. O & Ayugi. M (2013) Influence of teacher characteristics on students' academic achievement among secondary schools. *Journal of Education and Practice*. 4 (3), 76-82.
- Mamoon-Al-Bashir. (2016). The value and effectiveness of feedback in improving students' learning and professionalising teaching in higher education. *Journal of Education and Practice*.
- Mporananayo, N. (2015). Career Guidance and Student Performance in Higher Teaching Institutions in Nyarugenge District, Rwanda (Unpublished Master's thesis, Mount Kenya University, Kigali).
- Nsanzabiga, E. (2013). Student Attendance and Student Achievement. *Rwandan Journal of Education*, 1(2), 5-18.
- Odogwu, H. N. (2002). The Mathematics teacher factor in the achievement of the goals of universal basic education (UBE). *ABACUS: The Journal of Mathematical Association of Nigeria (MAN)* 27 (1) 72 – 79.
- Omosewo, E. O. (1998). A proposal for an improved training program for prospective physics teachers in Nigeria secondary schools. *Science education form*, 2, 36 - 41
- Semir, Š. (2018). Quality of communication between students and teachers. *RASPRAVE I ČLANCI*, 343–355.