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School Physical Resources and Senior High School Students' Mathematics Performance in Sagnarigu Municipality of Northern Region, Ghana.

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Abstract
While factors that affect students' academic performance have been well investigated, the extent to which school physical resources determine students' performance in Mathematics, to the best knowledge of the researchers, has received less academic attention within the Sagnarigu Municipality and hence the need to delve into the area to determine whether there is a relation between school physical resources and students' academic performance in mathematics. The study adopted a quantitative approach with a survey design involving 372 students and teachers who were selected through Simple Random sampling technique to participate. Questionnaire was used to gather primary data which was complemented by extensive literature review. Descriptive and inferential statistics were used to analyse the data that was collected from the field. An Ordinary Least Square regression model was used to test the predictive power of school infrastructure, school facilities and teaching and learning materials over students' performance in mathematics after a correlation statistical test indicated that there were multi-collinearity issues. The analysis revealed that students' performance in mathematics was closely associated with school infrastructure, school facilities and teaching and learning materials. It was, therefore, recommended that stakeholders in education should ensure that Senior High Schools in Sagnarigu Municipal are given the needed infrastructure, facilities and instructional materials so as to improve instructional quality and raise students' performance in Mathematics.
Keywords: School Physical resources, Teaching and Learning Materials, Infrastructure, Facilities, Performance
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1. Introduction

School Physical resources, as used in this study, refer to the buildings, facilities and materials that are available in a school to facilitate academic and extracurricular activities. School physical resources, as used in this study, therefore, refer to classroom blocks, libraries, offices, writing desks, school clinic, dormitories and toilet facilities. Others may include a sport complex, auditorium and laboratories. Hofflinger and von Hippel (2020) explain that the list of school physical resources is endless and that each one of them plays a unique role in student academic engagement as well as the quality of instructions delivered by teachers. LaFortune (2019) identified inadequate school resources as one of the major setbacks for quality teaching and learning experiences in Africa because many pupils still sit on the bare floors, write with their fingers on the grounds and lack basic school infrastructure such as decent classrooms, well-ventilated dormitories and other relevant structures. These often exert stress on students and make them destructive, noisy and academically less engaged. The unpleasant learning environment, Ndlovu (2018) explains, may serve as a disincentive for learning to many students. Amua-Sekyi and Nti (2015) further report that while schools in the urban and peri-urban centres in some parts of Africa are well resourced, rural schools are often neglected in terms of infrastructure such as classrooms, toilet facilities, dormitories and even refectories. They describe these as some of the key physical resources which a school cannot afford to do without but unfortunately, schools in many parts of Africa are unable to provide for their students

Gbolahan Balogun (2019) argue that while North Africa and South Africa can be said to be doing well in terms of educational infrastructural provisions, the situation in West Africa leaves much to be desired. They argue that public schools in West Africa are largely neglected and characterised by old unmaintained physical buildings ranging from classroom blocks to dormitories as well as poorly equipped class rooms with inadequate

desks, broken chairs, un-cemented floors and un-plastered walls. Fafunwa and Aisiku (2022) further argue that apart from infrastructure and facilities in schools, many schools in West Africa also lack teaching and learning materials and that this is very crucial to effective teaching and learning. Romlah et al. (2021) agrees that in addition to supporting learning more generally, teaching and learning resources help teachers to improve instructional quality by varying their methods and involving the learners through audio-visuals. Adane (2013) refers to a situation where teachers tailor lessons and instructions to the different learning styles and capacities within their classrooms as differentiation. The availability of requisite teaching and learning resources enable a teacher to carry all his or her students along by appealing to all the learning domains of the students. The use of audios, videos, imitations and mockeries simplify instructions and make it easily graspable by learners. The absence of these, however, makes teaching too abstract, incomprehensible and difficult for learners.

While studies have indicated that lack of school physical infrastructure is pervasive across West Africa, Yeboah et al. (2019) believe Ghana leads in this regard. She explained that the introduction of the Free Senior High School policy in 2018 saw an influx of students in Senior High Schools where existing facilities are over stretched with students' population being as high as 70+ in a single classroom. This is a clear case of overcrowding which surely affects the quality of teaching and learning. Nugba (2020) also found that due to the increasing number of students in schools, some schools have resorted to the use of uncompleted buildings as classroom blocks and that these, apart from being inhabitable, lack basic materials for teaching and learning such as marker boards and writing desks for students.

Northern Region is considered one of the poorest regions in Ghana and these reflects in the nature of school infrastructure and facilities that are found in schools at all levels (Ankoma-Sey & Maina, 2016). Amponsah et al. (2018) found that most of the schools that are considered deprived schools are in Northern Ghana and they lack basic school resources that make teaching and learning a lot easier. In terms of teaching and learning resources, Adu-Gyamfi and Anderson (2021) reports that two years after the Ministry of Education changed the school curriculum for basic schools, no textbooks have been printed and distributed and so poor families are unable to secure those available in the markets for their wards and neither are teachers able to have any materials to teach apart from what they choose out of discretion without any guide by the curriculum. This Mohammed and Kuyini (2021) explains is affecting instructional quality in the Northern region.

The Ministry of Education (MoE, 2017) reports that one third of students who write the West African Senior School Certificate Examination (WASSCE) each year are not admitted to tertiary institutions because they do not pass Mathematics. In 2016, the Ministry reported that out of the 247,262 students who sat for the WASSCE, only 32.8% of them passed the mathematics exam, and in 2017 this percentage increased slightly to 35.2% (MoE, 2017). While these results reflect the reality of student performance in Mathematics, the Ministry of Education's sectorial performance reports did not relate these performances to available resources in the respective schools. In northern Ghana, performance in mathematics examination is below the national average. For instance, in 2015, boys' performance in Mathematics in the WASSCE was 23.9 per cent, while girls' performance in Mathematics was 20.9 per cent at the national level. In the Upper East and Upper West regions, only 3.5% and 6% scored above the average in Mathematics respectively. In fact, the Upper regions had the highest percentage of below average students in all subjects. The Education Ministry (2016) found that this trajectory has been the same over the past 5 years. However, the sectorial performance report of the Ministry of Education does not provide details of the reasons for the performance trends.

Generally, factors that determine students' academic success, both internally and externally, have received wide academic attention. Singh (2016) conducted a study in Kenya to ascertain how individual learners' readiness, ability to withstand peer influence, school engagement and absorptive capacity predict the grades that will be achieved. Browman et al., (2017) found in a study in South Africa that student, teacher, school leader level, gender differences and the availability of school resources, such as reading materials, teachers and classrooms are important factors that influence the performance of students at the Senior High School level. Singh (2016) in an expository factor study of more than two hundred (200) school leaders and students confirmed that, parental guidance, communication skills and learning materials had a statistically positive influence on the general performance of learners. Khan and Mushtaq (2012) earlier indicated that, family background also influences learners' academic success. Raychaudhuri et al., (2010) held the view that, the educational level of students' parents, especially their mothers, has an impact on the general performance of these students. Hungi & Postlethwaite (2009), Folk (2017) and Elias (2013), all shared similar views that, parents' financial status, teachers' qualifications, provision of counselling services and quality of education contributed to students' academic performance. Research on student learning outcomes in Ghana appears to be consistent with these findings.

1.1. Statement of the Problem

While many studies investigated the factors that affect students' academic performance, no studies, to the best knowledge of the researchers, have investigated the unique effects of lack of school physical resources on the

performance of Senior High School students in Mathematics in Sagnarigu Municipal. This is the gap the study attempted to fill. Performance of students in Mathematics in the Sagnarigu Municipal has been dwindling since 2018. Students' performance in WASSCE from the Municipal as reported by the Education Directorate in 2021 has seen a downward spiral since 2012. While many scholars have attributed this to lack of enthusiasm from the students and poor instructional quality, this study contributes to this debate by investigating how lack of school physical resources affects students' performance in Mathematics in Senior High Schools in the Sagnarigu Municipal. The study specifically examined the relationship between school infrastructure, school facilities, teaching and learning materials and students' performance in Mathematics.

1.2. Objectives of the Study

The study sought to determine whether there is a significant relationship between;

a) school infrastructure and students' performance in mathematics in the Sagnarigu Municipality
b) school facilities and students' performance in mathematics in the Sagnarigu Municipality
c) teaching and learning materials and students' performance in mathematics in the Sagnarigu Municipality

2. Literature Review

Acharya (2017) argued that the accessibility of learning resources increases the efficiency of schools because these are the basic things that can lead to good learning outcomes for students. Adetunde (2009) admits this but adds that all institutions or organizations are made up of people (employees) and other non-human resources and when the right quantity and quality of human and physical resources are brought together, quality is assured and the goals of the organization are surely guaranteed. Therefore, every organization should acquire and maintain the best resources it needs to excel. The inference of these ideas is that if a school has all the resources it needs, such a school will ensure high instructional quality and this will translate in better performances by students in Mathematics and other subjects. Bhatti et al. (2017) note that in developing countries like Ghana, many teachers are trained and have clear objectives to guide their teaching, but many lack quality instructional materials and the few existing ones are mostly outdated and obsolete. This has a negative impact on the quality of teaching and learning, which in turn affects students' performance in Mathematics and other core subjects.

In Kenya, Eleftherios and Theodosios (2007) found that Mathematics performance in national examinations has declined significantly over the past decade due to poor funding of the education system by successive governments. Gulistan and Hussain (2017) attribute the underfunding of schools to the legacy of colonialism and political economy in post-independence Africa. Gulistan and Hussain (2017) noted that, in many public schools in Africa, students are overcrowded and lack adequate learning facilities; and are treated as a homogenous group with no consideration for individual differences by their teachers. They also lack textbooks and laboratory equipment so students lose hope of excelling in their academic work, a view also held by (Iqbal, 2017). Efforts by NGOs and Civil Society Organizations (CSO) to improve performance in Mathematics and Science in Secondary schools across Africa by providing teaching materials are an indication of the lack of resources available for teaching and learning in African schools.

Lewis et al. (2017) found that the resources provided or created by schools can affect the quality of teaching and learning. They identified curriculum as one of the most important school resources because it provides directions and guidance on the implementation of educational policies both academic and non-academic. In Ghana, curriculum development is done by the National Council for Curriculum and Assessment (NaCCA) of the Ministry of Education, but the actual implementation is done by individual schools. Gulistan and Hussain (2017) observe that the prescription of academic activities can affect students' tendency to succeed in Mathematics. Teachers' understanding of the curriculum and how they implement it mediates between the curriculum and educational outcomes. However, in a series of case studies, Visser et al. (2019) studied the latent impact of standards-aligned syllabus on learning outcomes and observed that learning materials can facilitate, but do not guarantee the quality of teaching. This suggests that the debate over curriculum as a school resource is on-going. The bottom line, however, is that instructional materials affect the quality of instruction, which determines students' comprehension levels and retention and predicts how well they perform on Mathematics tests.

According to Kapinga (2017), school facilities are a strategic factor in the functioning of any academic institution because they are key to the effective functioning of schools. Students need classes to sit in, library to access books, laboratory equipment to conduct experiment and a lot more. Takwate (2018) argue that, to be able to teach any of the subjects effectively, all the facilities that are needed for such subjects should be made available. This is because the facilities aid learners to develop practical and scientific skills as well as positive affection for that particular subject. Schlaffer and Burge (2020) explain that when a school is adequately resourced, questions about accessibility of requisite learning materials do not arise because all students are given access to use the ones available in school. This will eventually lead to increase in the overall academic

achievement of all students. Yakubu et al. (2019) identified school facilities such as classrooms, lightening system, water system and toilet facilities as school resources. They argue that classrooms determine class size to some extent. The more classrooms a school has, the smaller the class size. Previous research has, however, shown that high class sizes correlate slight decrease in classroom conditions (Schlaffer & Burge, 2020) and no relationship with classroom quality (Takwate, 2018). In contrast to (Schlaffer & Burge, 2020), Kapinga (2017) conducted a study which examined large (>31) and small (<25) classes which found that in small classes there was more individualized task-related contact between teacher and students and more interaction between each student and teacher. Kapinga (2017) however, admits that circumstantial issues and teacher competence play a key role in mediating class size and instruction; not all teachers take advantage of small class sizes to improve instruction.

Reporting on why high academic standards is not achieved in Nigeria, Ojeje and Adodo (2018) cited poor facilities, outmoded teaching techniques and crowded classrooms among other factors. Olufemioladebinu et al. (2018) find that, the availability of school facilities supports the curriculum and subsequently enhance the academic achievement of students. Explaining the enormous inadequacy of school facilities in the educational sector in Tanzania, Sephania et al. (2017) iterated that, at all levels of education in Tanzania, facilities were either inadequate, obsolete or neglected to wear and collapse. He concluded that successive governments have continually fail the educational sector at all levels and that getting quality education in Tanzania may be very difficult due to lack of educational facilities in schools. Other scholars (Ojeje & Adodo, 2018; Planas et al., 2018; Schukajlow et al., 2018) have variously identified the significance of facilities in education. It can therefore, be concluded that the absence or poor quality of educational facilities in schools correlate poor educational outcomes. Gupta and Mili (2017), however made contradictory findings when they observed that, facilities, teachers' salaries, books in the library and the presence of a science laboratory, had little effect on variation in educational outcomes if close attention is paid to student's background. Visser et al. (2019), however, sides with the views of many other scholars to reiterate that facilities are one of the powerful factors contributing to successful educational outcomes in many schools. He further added that their availability, accessibility, functionality and fitness for purpose of school physical resources contribute to educational attainment of students because unappealing school buildings and overcrowded classrooms, among other things, contribute to poor learning behaviors of students.

Aliu (2018), in his study of facility usage and educational success finds that there is no significant variance in educational attainment between students in secondary schools who have access to ultra-modern facilities and those who do not have such access. However, he admits at the end of his essay that educational facilities were indispensable for students' achievement in languages and physical sciences but students could perform well in other subjects without adequate and advanced facilities. He concluded that school facilities are more impactful and indispensable in the physical sciences than they are in the liberal sciences when it comes to students' educational outcome. While all the reviewed studies relate school physical resources to educational outcome in general, none of the studies studied the relationship between school physical resources and students' performance in Mathematics, thus making relevant, studies like this which investigate the unique relationship between school infrastructure, school facilities, teaching and learning resources and students' performance in Mathematics.

2.1. Academic Performance

Quality education covers a number of issues. Right from the day a child was born, he or she learns in so many different ways. However, a formally and well-structured educational system will provide the means for the child to concretize what he or she has learnt; the attitudes, knowledge, skills and beliefs. Quality education must emphasise appropriate inputs, systems, better processes and expected outcomes. More so, the learners should be willing to learn relevant content in a safe and enjoyable atmosphere (UNICEF, 2017).

UNESCO (2012), had developed a framework through its International Bureau of Education to help deal with and easily manage the quality of education in countries. This arrangement emphasises inclusiveness and equity in the education system and takes into account the end results. The framework, known as General Education Quality Analysis Framework (GEQAF) also encourages basic competencies and skills that will make the learners fit well into their society. GEQAF also emphasised that a quality education cannot be assumed without some key factors such as the readiness of learners and their background. The learners need to be vigorous, well-fed as well as mentally and psychologically prepared, to learn under the support of their significant persons (UNICEF, 2010). The quality of teachers is also critical, as it is the extent to which students are able to get access to a congenial learning atmosphere, resources, and the appropriate content to learn. Additionally, there exists an assessment system which measures progress against agreed targets. Some of these minimum targets include the acquisition of knowledge, technical abilities and dispositions, all related to general educational goals and active social participation (UNICEF, 2010).

Indicators of instruction quality include student learning outcomes. This term is used interchangeably with

academic success and refers to achieving in a specific subject like mathematics. Academic achievement is usually reflected in the acquisition of basic reading and writing skills, numeracy skills, and skills to be able to solve basic problems. The acquisition of these basic skills serves as one of the major determinants of how well an educational system is operating, so as to achieve the purpose for which it was created.

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2.2. Academic Success of Students and its Measurements

Students' academic achievements has received much attention in recent studies, but how to explicitly measure it is still a challenge (Mushtaq & Khan, 2012). The United Nations Educational, Scientific and Cultural Organization (UNESCO) is an international body providing directions and certainty on the assessment of student learning outcomes over a period of time. Standardized tests have been identified as fundamental and are frequently used, due to their ease of use as compared to others, (UNICEF, 2010; Day & Sammons, 2016). Other standardised tests used to assess students include grade point averages (GPAs) and other competencies that go beyond just examination marks such as students' skills, acquired skills and their ability to actually handle difficult problems (UNESCO, 2017).

The content and generation of test results varies in different educational contexts. In Ghana, test scores have gained popularity in measuring the performance of learners. These results are obtained from regular classroom tasks, such as class assignments. Examination marks are also derived from structured testing procedures, such as the School Educational Assessment (SEA) and the National Educational Assessment (NEA). Both are carried out at the primary school level. After the Junior High School education, the Continuous Assessment and the Basic Education Certificate Examination (BECE) are the sources of the scores generated to ascertain students' performance after three consecutive years of Junior High School education. The Continuous Assessment accounts for 30% of the total points earned by Junior High School students. The other 70% is expected to come from the Basic Education Certificate Examination (BECE). After the Senior High School education, the West African Senior Secondary Certificate Examination is the major source of points for accreditation and admission to tertiary institutions. The examination covers what Senior Secondary School students must pass to acquire basic knowledge and skills, which is the minimum level of education expected for admissions to tertiary education. Students are assessed in a range of agreed subjects, including English language, Mathematics, Integrated science and social studies. Over the past years, there has been minor changes in respect of the number of subjects as well as the curriculum. WAEC uses a standardised scoring method in which raw test scores are scaled. In practice, grades are determined using the test raw scores, with grades between 80 and 100 receiving a grade of 1, meaning "Excellent". Those with a score of 75-79 receive a grade 2 (very good) and those with a

score of 70-74 receive a grade 3 (good). Those with a score between 50-69 receive a grade 4 (credit). Those with a score between 40-49 get a grade of 5, meaning "pass", and in that order.

The use of WASSCE test scores as the measure of academic performance of students for entry into the tertiary level has received criticisms for its challenges in comparing candidates' scores from year to year (Zohair & Mahmoud, 2019). While it is difficult to determine whether standards have improved or not, there are calls for a different way of assessing the performance of secondary school students. A technical committee has recommended the use of the Criterion Benchmark Tests in this regard (Zohair & Mahmoud, 2019). These suggestions are however yet to see the light of the day. The appropriateness of WASSCE scores in this research is based on the fact that, despite criticism, WASSCE scores remain the only viable determinant of students' ability to advance beyond secondary school until a new measure is introduced.

3. Methods and the Study Area

The study adopted a quantitative approach to study the relationship between school infrastructure, school facilities, teaching and learning resources and students' performance in Mathematics. The quantitative approach was adopted because it provided the researcher with the opportunity to use statistical tools that accurately measure relationships between variables. A survey design was adopted for the study because it allowed the researcher to gather data from several people. This did not just provide adequate grounds for generalizability, but also enhanced the credibility of the results.

3.1. Target Population

The target population for this study was all students and academic staff of the four public senior high schools within the Sagnarigu Municipality namely: Tamale Senior High School (TAMASCO), Northern School of Business (NOBISCO), Tamale Islamic Senior High School (TISEC) and Kalpohin Senior High School (KALISCO). The academic staff consists of the teachers and the management staff. The students and academic staff were targeted because they are key stakeholders of the schools and have relevant information as regards students' performance in general as well as the physical resources that are available within the schools for teaching and learning Mathematics. Their experiences would have provided them with in-depth knowledge about the school physical resources such as school infrastructure, school facilities and teaching and learning materials.

TAMASCO has a student population of three thousand, four hundred and ninety-five (3,495) and an academic staff strength of a hundred and fifty (150). NOBISCO has a student population of three thousand, three hundred and twenty-seven (3,327) and an academic staff strength of a hundred and twenty-one (121). TISEC has a student population of two thousand, nine hundred and fifty-six (2,956) and an academic staff strength of a hundred and twenty (120). KALISCO has a student population of two thousand, five hundred and ninety-three (2,593) and an academic staff strength of one hundred and eighteen (118). All four schools have a total academic staff population of 509. In all, the target population for the study consists of the total of student population and academic staff population which stand at 12,880.

3.2. Sample and Sampling Procedure

The Cochran' formula for sample size determination was used to determine a total sample size of 372 respondents. Same technique was used to determine the proportion of students and teachers and the proportion of the numbers that were selected from the various schools. The Simple Random Sampling technique was adopted to select the respondents. Three hundred and thirty (330) students (218 males and 112 females) from all the schools. Ninety-three (93) students from TAMASCO, eighty-nine (89) students from NOBISCO, seventy-nine (79) students from TISEC and sixty-nine (69) students from KALISCO. All the mathematics teachers in the schools under consideration were purposively targeted for the study since they are directly involved in the day-to-day teaching and learning of mathematics in all the four schools. TAMASCO, NOBISCO, TISEC and KALISCO has mathematics teacher population of twenty-two (22), nineteen (19), eighteen (18) and sixteen (16) respectively. This gives a total of seventy-five (75) mathematics teachers in all the four schools. A total of forty-two (42) mathematics teachers; twelve (12) from TAMASCO, eleven (11) from NOBISCO, ten (10) from TISEC and nine (9) from KALISCO were selected. This gives a total of three hundred and seventy-two (372) respondents.

3.3. Instruments for Data Collection

Questionnaire which was built based on the indicators that were identified during literature review were used to gather primary data from both teachers and students. The questionnaires were divided into two categories-students and teachers' questionnaire. The collected data was analysed using inferential statistics. The credibility and relevance of the items on the questionnaire were considered by developing them based on the indicators that were identified during the literature review. The Cronbach Alpha reliability measure was use to check the reliability of the items from scores of a pilot test. This gives an alpha level of 0.86 and 0.82 for the students and

teachers questionnaire respectively. An Ordinary Least Square regression model was used to determine the association between school infrastructure, school facilities, teaching and learning materials and students' performance in Mathematics after correlation and reliability statistics were run to determine the suitability of the items and the model adopted for the analysis.

3.4. The study Area

Sagnarigu Municipality is located in the Northern Region of Ghana. It is bordered by Savelugu Municipal to the North, Tamale Metropolis to the south, Tolon district to the west and Kumbungu district to the East. The Municipality has a land area of approximately 114.29 square kilometres and is located between latitudes 9.4687º north and longitudes -0.8654º west and has an elevation of 189m (G.S.S, 2021). The Ghana Statistical Service (GSS, 2021) reports that the population of Sagnarigu Municipality is approximately 342000 and of this 50.6% are males and 49.4% are females. There are 23,447 households in the Municipality, with an average household size of 6 persons (G.S.S, 2021).

The Municipality was chosen because it has the highest number of Senior High Schools in the region. The Municipality is the cradle of education in the region as it has four government-aided high schools namely; Tamale Senior High School, Northern Business Senior High School, Islamic Senior High School and Kalpohin Senior High School, as well as a polytechnic and two colleges of education. The Municipality also has the Tamale School of Hygiene, the Community Health Nursing School and the Graduate School of the University for Development Studies. There are other private educational institutions in the Municipality. The Regional Education Office is also located in the district.

4.0. Results

To ensure that the correct model was used for the analysis, correlation statistics were conducted to determine whether there were problems of multicollinearity. The results of the multicollinearity test were as shown in Table 1.

4.1. Correlational Statistics

The results revealed strong correlations between the variables as shown in Table 1. This means that the collinearity matrix was high between the variables and so a linear regression model could not have been used otherwise it would have affected the fitness of the model or the interpretation of the results. The least correlation was between School Infrastructure (SIST) and Teaching and Learning Materials (TLM) (r = 0.43). The highest was between Students' Performance in Mathematics (SPM) and Teaching and Learning Materials (TLM) (r = 0.89). That between Teaching and Learning Materials (TLM) and Students' Performance in Mathematics (SPM) was also strong (r = 0.85). That between Teaching and Learning Materials (TLM) and School Facilities (SFT) was equally strong (r = 0.71) while the correlation between School Infrastructure (SIST) and School Facilities (SFT) was slightly above average (r = 0.61). These were high enough to affect the fitness of the model (Thakare et al., 2016). The study, therefore, adopted an Ordinary Least Square Regression model as recommended for use by Creswell (2015) in cases of multicollinearity issues. Table 1 summarises the correlational matrix of the study variables.

Table 1: Correlational Statistics

Variables	SIST	SFT	TLM	SPM	MD	STD
1. SIST	1				2.27	0.78
2. SFT	0.61**	1			2.86	1.1
3. TLM	0.433	0.71**	1		3.0	1.2
4. SPM	0.522**	0.852**	0.89**	1	2.89	0.98

Source: Field Data, 2022

Key: SIST = School Infrastructure, SFT = School Facilities, TLM = Teaching and learning Materials, SPM = Students' Performance in Mathematics

The correlation matrix necessitated the choice of an Ordinary Square Regression Model. This was used to test the dependability of Students Performance in Mathematics (SPM) on school infrastructure, school facilities and teaching and learning materials. The results were as presented in Table 2.

Table 2: The Standardized Beta Test on the Factors Influencing Students Performance in Mathematics

Variable	Standardised Coeficients	Stand. Err	T	P>t	[95% Conf. Interval	
					Lower	Upper
SIST	1.96	0.12	0.283	0.03	1.89	3.23
SFT	1.95	0.99	3.21	0.000	1.566	2.347
TLM	2.61	0.97	98.97	0.000	2.22	3.011

$F=0.00$, $R^2=0.84$, Significance Level < 0.05, Source: Field Data 2022
*** Dependent Variable is Students Performance in Mathematics (SPM)*
**** Key: SIST=School Infrastructure, SFT = School Facilities, TLM = Teaching and learning Materials.*

The regression output revealed a strong relationship between SIST, SFT and TLR. The model fit (F) was 0.00 indicating that the model that was used was appropriate for the data set. R^2 is 0.84 indicating that the three independent variables together explain 84% of the total variability in the performance of students in mathematics.

4.2. School Infrastructure and Performance of Students in Mathematics

The regression output showed that there was a statistically significant relationship between school infrastructure and students' performance in Mathematics. At a confidence level of 95%, the relationship between SIST and SPM was significant at 0.03 with a coefficient value of 1.96 (Coe=1.96, p = 0.03). This means that if there is a variance in the availability of school infrastructure, there will be a 19.6% change in the performance of students in Mathematics examinations. This means that when school infrastructure such as classroom blocks, dormitories, staff quarters, school library, cafeteria, books store, school clinic, and a multi-purpose hall are available, students learning habits increases and this translate into higher performances in mathematics. The class size is often determined by the physical space in the classroom. If a school has fewer classrooms, it may be forced to concentrate more students in the few available classrooms. This will surely affect the teaching and learning of Mathematics. Similarly, if staff members are accommodated on campus because there are staff quarters available, this will mean that mathematics teachers will hardly come late to class and they will always be available on campus for students. Students who have difficulties in solving some mathematics problems could therefore, easily fall back to their teachers for help at any given time. The availability of book stores and well stocked libraries will certainly increase students' academic engagement, and the more students become academically engaged, the better they perform academically especially in subjects that require constant practice like mathematics.

4.3. School Facilities and Students' Performance in Mathematics

The regression analyses indicated that there was a significant relationship between school facilities and students' performance in mathematics. At a confidence level of 95%, the coefficient value of the relationship between SFT and SPM was 1.95, indicating that if there is a single change in the availability of school facilities; there will be a corresponding 19.5% change in Students' Performance in Mathematics. Their relationship is significant at 0.00 indicating that SFT highly predicts SPM (Coe = 1.95, p = 0.00). The implication of this finding is that, students perform better academically when all the facilities they need to be academically engaged are available. For instance, a school with strong internet connectivity for learning will provide students access to current textbooks and other materials in mathematics. Students will also learn better when they are provided with facilities like writing desks, chairs and other requisite furniture needed for academic activities. Students will also better concentrate when they don't have to worry about power supply, water supply and where to eat. When all these are provided, the learning environment becomes congenial for academic activities to take place and when teaching and learning occurs in a congenial environment, the rate of absorption is higher and this translates into better performance in Mathematics particularly. The availability of school facilities reduces the stress students go through when basic facilities like classroom space, writing desks and electricity or water are absent. In some schools in the North, students spend precious time searching for water especially during the dry seasons, this, apart from exerting stress on them, takes their precious time that they could have dedicated to learning, thus affecting their performance in Mathematics.

4.4. Teaching and Learning Materials and Students' Performance in Mathematics

The regression output in table 5 indicated a statistically significant relationship between teaching and learning materials and students' performance in mathematics. At a confidence level of 95%, the level of significance stood at 0.00 while the coefficient value was 2.61 indicating a highly significant impact of teaching and learning resources on students' performance in Mathematics and that if there is a single change in the availability of teaching and learning materials, there will be a 26.1% corresponding change in the level of students' performance in Mathematics. What this means is that teaching and learning materials such as syllabi, textbooks, hand-outs, markers, marker-boards, compasses, protractors and rulers for teachers and students are essential in the teaching and learning of mathematics. When these are not available, instructional quality is affected. Once

the quality of instruction is compromised, students may lose interest; those who are still enthused may become frustrated as they may struggle to understand the topics that are being taught. All these translate into poor performance in Mathematics. Teaching and learning materials, are unarguably, quite important in the teaching and learning of mathematics.

5. Discussion

5.1. School Physical Resources and Students' Performance in Mathematics

The study established a strong correlation between school infrastructure, school facilities, teaching and learning materials and students' academic performance in Mathematics. Indicators of school infrastructure included classrooms, dormitories, teachers' quarters, libraries and bookshops. Indicators of school facilities were internet, water, electricity, laboratories, toilets and school clinic. Teaching and learning materials were measured by the availability of mathematics syllabus, textbooks, hand-outs, compasses, protractors, rulers and other mathematical equipment that are needed by class teachers and students during instructions. Apart from the social environment that needs to be congenial to bring out the best in students, the physical environment is also important because it contributes to the health, energy levels of students as well as provides the comfort needed for students to have full concentration in class since Mathematics requires a lot of attention and concentration. The number of students per teacher in class is very important. Teachers need to have manageable class sizes so that they can give attention to all students. If the class size is too large, mathematics teachers cannot adequately manage such classes and so it will affect performance in Mathematics. This finding is consistent with the finding of Amponsah et al. (2018) when they investigated the factors affecting students' academic performance in Bono Region and found that the availability of classroom blocks determined the class sizes of students in Senior High School and that the class sizes affected the quality of teaching and learning and this translated into poor academic performances on the part of the students. What it means is that schools will need to have adequate classrooms as part of their physical infrastructure to be able to enhance students' performance in Mathematics (Manu et al., 2020).

Availability of relevant Mathematics textbooks in a well-ventilated library is also very important because it gives students the opportunity to make references to several authorities which increases their levels of understanding and their capability of solving mathematical problems. This is consistent with the findings of Dukper et al. (2018) when they found that class sizes, availability of relevant text-books, and availability of Mathematics teachers predicted students' performance in Junior High Schools in the Ejisu District of Ashanti Region. School desks and classrooms are equally important in learning mathematics because students will need to sit comfortably and write comfortably thereby reducing stress and encouraging learning. The availability of these resources in a school increases the performance of students in mathematics. This finding is also consistent with the finding of Mlachila and Moeletsi (2019) who employed a qualitative approach to study the relationship between school resources and students' academic performance in Gwazu-Natal. Their study identified school resources as classroom blocks, textbooks, toilet facilities, libraries and teaching and learning materials. They collected data from two different Senior High Schools which they considered as well-resourced and poorly resourced schools respectively. They used scores of students in their last two semesters as indicators of students' academic performance. They further administered test items in Maths, Science and English to test the students' performances. Their study revealed that the schools which were better resourced had all their students scoring higher than the students from the schools they considered poorly resourced. They then concluded that school physical resources affect students' academic performance.

School physical resources have also been found by Adedokun et al. (2018) to predict students' academic performance among Senior High School students in Lagos. In their study of the influencing factors of students' performance in the West African Secondary School Certificate Examination (WASSCE) employed a qualitative approach involving fifty students and thirteen teachers selected from different schools across Lagos State of Nigeria. They collected data on the availability of classroom blocks, functioning libraries, toilet facilities, study rooms in the dormitories, recommended books for all WASSCE subjects and student-teacher ratio in each class. They found that schools that had all the above-mentioned resources performed better than those who had some of the resources. They therefore concluded that school physical resources affected students' performance in Mathematics. Although Oyeleye and Odunayo (2020) established a weak relationship between school physical resources and students' academic performance in Kigali-Rwanda, they admitted that such weak correlation is explained by the availability and accessibility of online learning resources such as YouTube and Google Search which make students have access to resources outside what the school provides. Oyeleye and Odunayo (2020) also argue that to tie students' performance to school physical resources may not be adequate in explaining students' academic performance since students now have access to a lot of online materials which they access to augment what is not provided by the school. While this may be true in other jurisdictions where internet accessibility is very high among students, it does not apply to most regions of Africa where internet connectivity and accessibility are still inadequate and may not be available to students. In such regions, school physical

resources still remain a strong predictor of students' academic performance as established by this and other studies. Rajpurkar and Powdwal (2019) also reported that in Mobai-India, school physical resources are increasingly moving from physical infrastructures to digital infrastructures and so traditional school physical resources such as marker boards, textbooks, and exercise books may not be necessarily significant in determining students' performance in all subjects but digitalised school resources remain very relevant since not all students have access to these from their homes. They concluded that while traditional school physical resources may be waning in their predictive strength in terms of students' academic performance, schools need to provide internet infrastructure and digitalise most of their resources because these digitalised resources remain strong predictors of academic performances of students in all subjects.

6. Conclusion

School infrastructure is a very significant determinant of students' performance in all subjects. If a school lacks the needed infrastructure such as classroom blocks, instructional quality will be compromised as there will be so many students in a classroom. Students will have to go through so much stress associated with an overcrowded class. Some will hide behind the numbers and make the classroom uncontrollable. Besides the classrooms, mathematics teachers will need at least an office where they could converge and share ideas about teaching mathematics and this will provide an avenue for the new teachers to learn from the old teachers about the topics that they may be experiencing some challenges in teaching. Once offices are not available because schools lack the needed infrastructure, such peer learning opportunities among teachers will be lost. Again, the availability of Assembly Halls makes the conducts of assembly easier and shorter so that instructional periods are not used in conducting assemblies. The availability of Dining Halls also makes it easy for meals time to be monitored and maintained so that academic calendar is not disrupted due to a disorganised breakfast or lunch. Infrastructure plays other key roles in ensuring students' comfort and maintaining students' concentration during instructions.

When schools lack basic infrastructure, it reflects in the quality of their performance. Similarly, when schools lack basic facilities like electricity, water, internet, classroom desks and tables, instructional quality is compromised and so are the performances of students in mathematics. Teaching and learning materials are also very crucial to determining instructional quality. A teacher needs them in the preparation of his or her lessons and during the presentation in the class room. Students also need teaching and learning materials to guide them in their private studies as well as during instructional periods. The availability of these materials will therefore determine the level of content absorption by students as well as their level of engagement with the subjects outside the classroom. School infrastructure, school facilities and teaching and learning materials are therefore very significant in teaching and learning and deserve the best of attention from policy makers, school management and management of the educational system.

7. Recommendations

The study found that school infrastructure is a strong determinant of students' performance in Mathematics. It is therefore recommended that the Ministry of Education in collaboration with the Ministry of Finance may provide better infrastructure to all the Senior High schools in Sagnarigu Municipal so as to raise the levels of students' performance in Mathematics

The study also found that school facilities are strong determinants of students' performance in Mathematics. It is therefore recommended that the Ghana Education Service and management of all Senior High Schools in Sagnarigu Municipal may ensure that basic facilities like water, electricity, internet, writing desks and tables are made available to students at all times so as to improve their level of academic engagement and their performances in mathematics examinations.

The study further revealed that teaching and learning materials predict students' performance in Mathematics. It is therefore, recommended that the Ministry of Education in collaboration with the Ghana Education Service may provide the necessary teaching and learning materials for all Senior High Schools in Sagnarigu Municipal so as to make the teaching and learning of Mathematics a lot easier and improve the performance of students in the subject during examinations.

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