Journal of Education, Society and Behavioural Science

Volume 36, Issue 3, Page 54-67, 2023; Article no.JESBS.96685
ISSN: 2456-981X
(Past name: British Journal of Education, Society & Behavioural Science, Past ISSN: 2278-0998)

Students' Characteristics and Academic Performance in Mathematics

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JESBS/2023/v36i31214

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/96685

Original Research Article

Received: 11/12/2022
Accepted: 15/02/2023
Published: 02/03/2023

ABSTRACT

Many researchers have investigated the causes of students' poor academic performance in general. However, the extent to which students' individual characteristics affect their academic performance in mathematics has received little academic attention. This was the gap in literature

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the study sought to fill. The study adopted a convergent parallel mixed methods design involving three hundred and seventy-two (372) respondents in Sagnarigu Municipality of Northern Region, Ghana who were sampled through Simple Random Sampling and purposive sampling techniques. Questionnaire and interview guides were used to collect primary data. The analysis of the collected data revealed that: willingness to learn mathematics, perceptions that mathematics is a difficult subject, readiness for the use of mathematics teaching and learning materials available, relationship with mathematics teachers and attentiveness in mathematics lessons all affected students' academic performance in mathematics. It is therefore recommended that the various school management bodies could work with the Guidance and Counselling units to provide some form of support for students who are fearful of mathematics.

Keywords: Students; academic performance; mathematics; characteristics.

1. INTRODUCTION

Many scholars such as [1] and [2] share the view that Mathematics is the foundation of modern scientific and technological development. [3] further explains that Mathematics as a discipline is fundamental to science and technology and its functional role for science and technology is multifaceted and as such, no field of science, technology or business in the world can be separated from its application. Almost everyone uses some form of Mathematics in their daily lives. This suggests that learning of Mathematics is not something to be taken for granted. [4] argues that the main purpose of teaching Mathematics is to develop students' ability to solve a range of complex mathematical problems through the application of Mathematics to real-life situations.

In Ghana, the Mathematics curriculum encourages the use of Mathematics in everyday life by identifying and applying appropriate strategies to solve mathematical problems [5]. [6] finds that many Mathematics education programmes in Ghana emphasise the development of problem-solving skills and competencies that enable students to function both in and out of school. Thus, the Mathematics curriculum in Ghana requires students to learn how to relate their knowledge to practical situations, build critical thinking skills, make strategies, spawn ideas and imaginative solutions, and decipher every day scientific problems [7].

[8] find that most students believed that good performance in Mathematics is mainly due to skill rather than effort. Prior to this study, [9] also investigated the causes of poor student performance in Mathematics in Ghana and found that teacher effectiveness, home environment, school environment and staff strength were high predictors of student success in Mathematics, but the association between students' perceptions of Mathematics and students' performance in Mathematics was low. In addition, [10] found that student and teacher involvement were statistically significant in forecasting the mathematics achievement of Senior High School students in the Greater Accra Region. [11] also found a statistically significant association between students' background and their Mathematics achievement. [12] further found that many students see poor performance in Mathematics as a situation which they have little control over. [10] also finds that students' attitudes towards Mathematics significantly determine their Mathematics achievement. [13] discussed 'meta-belief system activity' based on a learning experiment and found that students' belief systems about Mathematics were strong predictors of learning outcomes.

1.1 Statement of the Problem

Although some researchers have examined the impact of teaching and learning materials, teacher qualifications and teachers' mastery of instructional content on students' achievement in Mathematics [9,7,11], they failed to examine the extent to which students' characteristics such as students' willingness to learn mathematics, students' perception about mathematics being a difficult subject, students' readiness to use available mathematics teaching and learning materials, students' relationship with their mathematics teachers and students' attentiveness in mathematics lessons affect students' performance in mathematics in Sagnarigu Municipality. While few studies investigated the effects of students' unique qualities on students' academic performance; [14,15,16], such studies were not specifically focused on performance in mathematics and,

methodologically, they adopted a qualitative approach. This paper examined the extent to which Senior High School students' characteristics predict their mathematics performance in the Sagnarigu Municipality using a mixed methods approach. The study raises a number of questions: What is the effect of students' willingness to learn mathematics on their performance in mathematics in the Sagnarigu Municipality? What is the effect of students' perception about mathematics being a difficult subject of their performance in mathematics in the Sagnarigu Municipality? How does students' readiness to use available mathematics teaching and learning materials affect their performance in mathematics in the Sagnarigu Municipality? How does students' relationship with their mathematics teachers affects the students' academic performance in mathematics in the Sagnarigu Municipal? How does students' attentiveness in mathematics lessons affects their academic performance in mathematics in the Sagnarigu Municipality? Answers to these questions will inform policy formulation in addressing student-related factors of poor students' academic performance in mathematics.

1.2 Objectives of the Study

The objectives of the study were to:

a. determine the impact of students' willingness to learn mathematics on their academic performance in mathematics in the Sagnarigu Municipality of Northern Region, Ghana.
b. ascertain the impact of students' perception of mathematics being a difficult subject on their mathematics performance in the Sagnarigu Municipality of Northern Region, Ghana.
c. determine the extent to which students' readiness to use available mathematics teaching and learning materials affects their mathematics performance in the Sagnarigu Municipality of Northern Region, Ghana.
d. research whether students' relatedness with their mathematics teachers in the Sagnarigu Municipality of Northern Region, Ghana affects the students' mathematics performance.
e. research the impact of students' attentiveness in mathematics lessons on their mathematics performance in the Sagnarigu Municipality of Northern Region, Ghana.

2. LITERATURE/THEORETICAL UNDER-PINNING

Central to Bandura's theory of self-efficacy is the influence of individual cognitive factors which suggests that cognition influences attitudes and behaviour, while behaviour, attitudes and environmental events influence cognition [17]. Self-efficacy theory states that all processes of emotional and behavioural alteration occur through variations in an individual's sense of mastery [17]. Self-efficacy was initially restricted to a fairly specific type of expectation involving one's beliefs about one's capability to carry out a particular activity or set of activities required to produce an outcome [17]. However, the definition of self-efficacy has been stretched to refer to people's confidence about their capability to control the activities or issues that impact their being and their capability to self-motivation and problem solving [17]. Thus, self-efficacy is not adjudged by concentrating on the abilities one possesses, but by concentrating on self-confidence and the belief that one can successfully carry out an activity using the skills he or she possesses.

According to [17], individuals take into account their abilities before embarking on any tasks they wish to perform and many select tasks they feel they are capable of performing. Self-efficacy theory is therefore centred on people's perceived abilities and their perceived chances of succeeding at selected tasks. Self-esteem beliefs influence people's perceptions in four main ways [17]. First, they determine the target people set to achieve. This is because people who have more confidence in their strengths to achieve goals will set higher targets for themselves as compared to those who may have lower-self-esteem at performing same tasks. Secondly, self-confidence also determines the extent to which one can hit a set target.

Thirdly, self-efficacy determines the kind of principles and rules that are set by individuals and the kind of events one will choose to be part of. Finally, the kind of confidence people have in their ability to excel at certain tasks and events determines the effectiveness of their decision making. Applying this theory to this study, it is believed that students who have confidence in their ability to solve mathematical problems will more likely perform better in Mathematics than students who have less confidence in their ability to solve complex mathematical problems. This theory is therefore suitable for this study because

it explains how students' perception of their abilities to perform well in Mathematics affects their attitude towards Mathematics and their performance in Mathematics. It also explains how students' previous good performance in Mathematics may increase their confidence and make them develop positive attitudes towards Mathematics.

Differentiating students' attitudes and students' beliefs, [18] argue that, students' attitudes are more emotional and less rational in nature than beliefs or values. Simply put, attitudes are focused on something-in this case, Mathematics-and are seen as positive or negative based on individual experiences. Adding to this, [19] noted that, though explanations of attitudes differ, attitudes are basically learned and become evident in people's response to persons, objects or events around them. [20] see beliefs on the other hand to be convictions of persons about events, people or objects around them.

Regarding mathematical beliefs, [21] found that, students see Mathematics as a static field of human endeavour that requires high cognitive ability. [21] suggested that this perspective is not exactly true because it is inconsistent with the nature of Mathematics which is quite dynamic and evolving. [22] and [23] all reported from New Zealand, found that, many students are moving away from this static perspective of mathematics to accepting that mathematics is instrumental, dynamic and essential in this communication age; but there appeared to be few findings that demonstrated a problem-solving perspective on Mathematics among school children.

The association of feelings, attitudes and beliefs of learners towards the subject mathematics and their actual success in mathematics has been the subject of discussion in a number of research studies. Largely, these studies report close association between beliefs about Mathematics and Mathematics achievement. For example, [24] in a correlational analysis, observed a strong association between students' attitudes towards mathematics and their performance in Mathematics. [25] reported a close association between perceived usefulness of Mathematics and Mathematics performance of students.

[26] observed that, although many studies have reported correlations between the attitudes of students towards mathematics and their mathematics achievement, such association appeared less linear and could be mediated by so many variables. They observed a cyclical relationship among attitudes, Mathematics and success in Mathematics. Students who pass Mathematics have positive attitude towards Mathematics and so continue to perform better in Mathematics. They concluded that success in learning Mathematics seems to lead to more positive attitudes and beliefs about Mathematics, which then lead to more success in learning Mathematics, and so on, with the opposite also being true.

Research has shown that student's belief about their ability to succeed in mathematics determines their achievement in mathematics at the senior high school levels. In a study conducted by [27], the findings showed that, student' self-belief in their ability to solve mathematical problems positively correlated with high performance in Mathematics. [27] also found that, the effect of self-belief of students on Mathematics achievement was as strong as the effect of teacher professional qualification. Some researchers have also reported that high-achieving students are more confident and have a more accurate self-image [28,29]. [28] reported that levels of positive self-perceptions are related to academic success.

[30] also reported that self-efficacy is a stronger predictor of Mathematics achievement than general intellectual ability. [29] found that, although Mathematics ability had a direct effect on Mathematics achievement, it also had an indirect effect through Mathematics self-capability judgments.

Many studies found strong association of students' relatedness with their teachers and their academic achievements. [31] found that, the closeness of students with their teachers in Malaysia affected student achievement in science related subjects within schools. Similarly, [32] showed quantitatively that those students who were always on the neck of their teachers for clarification of concepts taught improved their success in mathematics at the basic school level but was less at the senior high school levels. A general review of literature on this topic shows that students who relate closely with their teachers experienced improved academic performance at all levels compared to their colleagues who do not.

[33] found that, the readiness of students to make good of the available learning materials in the schools was a determinant of their academic achievement in general but found a weak correlation between the teachers' choice of

teaching methodology and the performance of the students. The schools may have all the requisite teaching and learning materials, once the students are not ready to put them into good use, their academic performance will not receive any significant improvements [33]. Children from good socioeconomic background have earlier access to quality education by attending a better kindergarten, primary school or even secondary school [33]. [34] also found a positive association between the socio-economic background of parents and the results of their children from national entrance examinations conducted for primary school graduates seeking entrance to junior high school in India.

In a longitudinal study by [35], four hundred (400) Senior High School students were examined. The results showed that family socio-economic background as indicated by family income levels, parents' education and occupational status, had a strong link, not only with the development of pupils' intellectual skills but also with the expansion of pupils' attitude and interest in mathematics. Another longitudinal study which was conducted by [36] also found that, the socio-economic background of students as measured by the index of household prosperity such as learning and living facilities was significant in predicting pupils' achievement in mathematics. [36] again made an interesting observation that, the association between socio economic background of students and their achievement in mathematics stabilises as the ages of students increases.

These findings generally suggest that students' personal qualities are impactful on their academic performance, although the mechanisms by which students' personal qualities explain educational outcomes may be complex and require further research. These studies also did not pay particular attention to how students' personal dispositions such as their attentiveness in Mathematics lessons affects the students' Mathematics success. They also failed to consider other characteristics of students such as students' willingness to learn Mathematics and students' perception of Mathematics being a difficult subject as predictors of students' academic performance in Mathematics. All these, therefore, made this study even more necessary and relevant.

3. METHODOLOGY

The study was conducted using a mixed-method approach so that it could make use of any research tool or technique as needed without being constrained by one particular methodology. This study made use of the convergent parallel mixed methods design. This design was chosen because it allowed the researcher to gather both qualitative and quantitative data almost simultaneously, analyse them, and combine them when interpreting the findings. Cross-validating the data was made possible by this method. There were no notable discrepancies between the outcomes of the quantitative and qualitative data. The quantitative data were collected via questionnaire. This offered the study more statistical power and enabled the researcher to collect data from a broader group of students and teachers. To collect the qualitative data, key informant interviews with management employees were done. This made it possible to get thorough data regarding the effects of students' characteristics on students' Mathematics performance in the Sagnarigu Municipality.

The four public senior high schools in the Sagnarigu Municipality were the focus of the study. Because they are important school stakeholders and have pertinent knowledge about students' Mathematics performance, the students and academic staff (teachers and management staff) were chosen as the target population. Their experiences would have given them in-depth knowledge of the learners' unique qualities such as students' willingness to learn mathematics, their perception about mathematics being a difficult subject, their readiness to use available mathematics teaching and learning materials, their relationship with their mathematics teachers and their attentiveness in mathematics lessons.

The target population for the study was made up of the twelve thousand, eight hundred and eighty (12,880) students and academic staff in the study schools as a whole. Three hundred and seventy-two (372) respondents were chosen for the study using Cochran's technique for determining sample size. The Nominal Rolls of each school were used to create a list of all students for selection of the sample. All students were included in the final sample at a 90% representation rate because they made up of about ninety percent (90%) of the target population. Therefore, three hundred and thirty (330) students were ultimately chosen at random from the created lists using Microsoft Excel.

All the mathematics teachers and academic management staff members who had some background in mathematics in the various 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.

Thirty (30) mathematics teacher were selected in all. Twelve (12) key management staff members, who had background in mathematics were also selected to participate in the study. This gives a total sample size of three hundred and seventy-two (372) participants.

Questionnaires and Interviews were used to collect data for the study. Questionnaires were used to gather quantitative data from respondents where they were required to show their levels of agreement or disagreement with statements provided in a Four-Point Likert Scale. There were two sets of the questionnaires. There was questionnaire for students and questionnaire for academic staff. Sections A of the questionnaire for both students and academic staff gathered data on the demographic characteristics of the respondents such as age, gender, years of stay in the school, and level. Items in this section were adapted from [37] and [38]. Sections B and C of the questionnaire for both students and academic staff respectively gathered data on students' characteristics such as students' willingness to learn mathematics, students' perception of mathematics being a difficult subject, students' readiness to use available mathematics teaching and learning materials, students' relationship with their mathematics teachers, students' attentiveness in mathematics lessons and academic performance of students in mathematics including students' math test results from the preceding two semesters, the researcher's math test results, and overall school success in the West Africa Senior School Certificate Examination (WASSCE) over time. The contents for these sections were adapted from [39]. Sections B and C of the questionnaire for students and academic staff responses were scored on a Four-Point Likert Scale, with Strongly Disagree receiving a score of 1, Disagree receiving a score of 2, Agree receiving a score of 3, Strongly Agree receiving a score of 4. According to [40], a researcher can code and transform the data into numerical values for simple analysis using the Statistical Package for Social Sciences (SPSS). The Cronbach Alpha reliability measure was used to check the reliability of the items from scores of a pilot test. This gave an alpha level of 0.86 and 0.82 for the students' questionnaire and staff questionnaire respectively.

A semi-structured interview was self-constructed to gather data from the sampled key management staff members. [40] defined an interview schedule as a process in which a respondent provides an answer to a question asked by a researcher to record. The interview data in this study was drawn from key management staff members, who had some background in Mathematics to complement the quantitative data.

The interview schedule for key management staff had two sections; sections A and B. Section A captured information on the variables of the study with respect to the research objectives. Section B elicited responses on demographic data of respondents such as gender, position in the school, number of years as a teacher, number of years in the current position, educational level, professional and academic qualifications. Each of the interviews lasted between 30 and 60 minutes.

The research tools were made available to other researchers for peer evaluation in order to ensure the study's dependability, credibility, and reliability. The final development of the instruments took the reviewers' comments into consideration. The eligibility of the questionnaire items for analysis was further determined by running a reliability statistic on them. According to Creswell (2015), questions in a survey are regarded appropriate for analysis if the Cronbach Alpha value in a reliability statistic is not less than 0.5. This means that elements with a Cronbach Alpha value of less than 0.5 do not accurately measure a construct, hence those items would need to be eliminated in order to raise the Cronbach Alpha number.

Students, Mathematics teachers, and administrative staff from the study schools provided the primary data for the study. The necessity of respecting the location of research sites and obtaining permission before visiting them cannot be overstated [40]. Prior to giving out the questionnaires, the researcher interacted with the respondents to build a connection with them, explain the goals of the study, and explain why getting their inputs was crucial to the success of the study. Before giving them the questionnaire, the researcher also requested their informed consent and provided them with assurances regarding the confidentiality of any

information they would be sharing. The researcher carefully vetted and trained research assistants who assisted in the data collection process, to ensure that high quality data was obtained. The researcher chose and trained at least eight (8) research assistants who conducted the data collection in the four schools while the researcher engaged the management staff for the key informant interviews. The researcher and his assistants visited each school at designated times after the distribution of the questionnaire to collect those that were completed and to remind those respondents who had not yet done so of the importance of completing their questionnaire in order to ensure a maximum response rate. A week was devoted to training research assistants and visiting the schools to secure authorization from the Headmaster/Mistress of the Schools for the conduct of the research. The complete data gathering process took two weeks. Each school received two research assistants. For 10 days, research assistants were required to distribute and collect at least five questionnaires each day while the researcher conducted at least two (2) Key Informant Interviews each day. Before leaving the field, two days were devoted to finding and fixing any missing responses. The researcher issued letters of thanks to the schools and any other stakeholder who assisted in any way with the data collection after the exercise.

4. RESULTS

The quantitative data was analysed using descriptive statistics. The Statistical Package for Social Sciences (SPSS) was used to compile and input the respondents' replies. This was utilized to ascertain response frequencies and percentages in a table, as seen in Table 1.

Selecting the student's characteristic that has the greatest impact on student's academic success was the task given to the respondents. According to Table 1, sixty-six (66) students and ten (10) academic staff, or 20.4% of the total respondents, said that students' willingness to learn mathematics was the factor that had the greatest impact on students' mathematics performance. The most important quality of a student that influences his or her mathematics performance, according to 70 students and 7 academic staff, or 20.7% of all respondents, is the " student's attentiveness in mathematics lessons." Sixty-four (64) students and eight (8) academic staff, or 19.4% of the total respondents, said that "Students' Relatedness with Their Mathematics Teachers" was the most important student characteristic that affected students' mathematics performance. 16.9% of the total respondents—fifty-eight (58) students and five (5) academic staff—identified "Students' Perception of Mathematics being a Difficult Subject " as the most important factor in predicting students' success in mathematics. Seventy-two (72) students and twelve (12) academic staff, or 22.6% of the total respondents, said that students' readiness to use the available mathematics teaching and learning materials had the greatest impact on students' performance in mathematics.

Thematic analysis was used to examine the qualitative information obtained from interviews about how students' unique personal dispositions, termed as students' characteristics affect their academic performance in mathematics. The researcher repeatedly reviewed the transcripts of the data to become comfortable with the material. By underlining, colouring, and creating shorthand labels to explain the contents of the text passages, the

Table 1. Respondents reported effects of students' characteristics on students' academic performance in mathematics

Characteristic of Students	Students' Responses	Teachers' Reponses	Total	Percentages
Students' Willingness to Learn Mathematics	66	10	76	20.4
Students' Attentiveness in Mathematics Lessons	70	7	77	20.7
Students' Relatedness with their Mathematics Teachers	64	8	72	19.4
Students' Perception of Mathematics being a Difficult Subject	58	5	63	16.9
Students' Readiness to Use Mathematics Teaching and Learning Materials Available	72	12	84	22.6
Total	**330**	**42**	**372**	**100**

Source: Field Data, 2022

researcher coded the transcribed data. By using these codes, the researcher was able to quickly summarize the key ideas and recurring meanings in the data. Then, by mixing the codes, themes were created by finding patterns in the resulting codes. Reviewing and mapping these themes against the complete data set was done. A few of the themes were divided into subthemes, and others were blended to provide the themes more depth and use. The concepts were then given names before being ultimately interpreted. Table 2 displays this information.

Table 2. Qualitative analysis for impact of students' characteristics on their academic performance in mathematics

Codes	Basic Themes	Organising Theme
• like • willing • learn • interest • Confidence • important • necessary • eager	• Students develop interest in learning mathematics when they are aware of its importance • Students willingly attempt mathematics trial questions when they are eager to excel in mathematics • The confidence reposed in students improves their willingness to excel in mathematics	The academic performance of students in mathematics is influenced by their willingness to learn mathematics
• Friendly • sleep • questions • attention • stories • peer teaching • Good listener	• A student will pay attention in class when he or she does not sleep during lessons • Students will enjoy learning mathematics when they pay attention during mathematics lessons • Students will not enjoy mathematics when they are not good listeners	The attentiveness of students in mathematics lessons improves their interest in the subject which then translates into good academic performance in the subject.
• experience • simple • love • advice • relationship • Students bond well • Student-centred • Interactive	• Students relate well with their experience mathematics teachers when they want to do well in the subject • Students relate well with mathematics teachers and study mates who show them love and care • Students relate well with instructors who make their lessons interactive • Students develop more interest in mathematics when they see the instructor as one of their colleagues	Students' relatedness with their mathematics instructors and study mates opens their minds about the relevance of the subject and thus translates into good academic performance in mathematics
• difficult • can never pass • big books • hate it • never understand • Extremely good	• Students understand better when they perceive mathematics as a simple subject • Students lose interest when they see big or fat mathematics textbooks • Students enjoy mathematics when they see it as a practical subject which is used in their everyday life	When students feel that mathematics is a difficult subject, they inwardly lose interest in learning the subject, and this greatly impacts their performance in the subject.
• Math textbooks • Math sets • Long rules • Good care • Clean after use • User guidelines	• Students will see the need to use the math textbooks when well oriented • Students enjoy learning mathematics when the right tools are available • Student will be more serious in learning mathematics when lessons are taught with the necessary materials	The readiness of the students to make good use of the available teaching and learning materials for mathematics lessons improves their success in the subject

Source: Field Data, 2022

According to the findings of both the quantitative and qualitative evaluations, students' willingness to learn mathematics, students' perception about mathematics being a difficult subject, students' readiness to use available mathematics teaching and learning materials, students' relationship with their mathematics teachers and students' attentiveness in mathematics lessons all have an impact on students' mathematical performance. In more detail, these are covered in the section that follows.

5. DISCUSSION

The study found that students' individual characteristics such as their willingness to learn mathematics, students' perception about mathematics being a difficult subject, students' readiness to use available mathematics teaching and learning materials, students' relationship with their mathematics teachers and students' attentiveness in mathematics lessons affect their academic performances in mathematics. One of the Key Informants who was an assistant headmistress in charge of academic affairs in one of the study schools explained it as follows:

"In fact, let me stress that, willingness of the students to learn the subject is central to everything. Sometimes the teacher could have all the requisite knowledge to make the students enjoy the mathematics lesson, once the students are not willing or do not even see the need to be serious about the lesson, there is no way the lesson will be successful. This will therefore translate into poor performance from the students."

Another Key Informant who was the headmaster in one of the study schools corroborated these findings as this:

"Take it from me, not until we erase or clean the minds of these students of their perception of quantitative subjects such as mathematics as being difficult, their performance in mathematics will continue to dwindle. Once the students continue to perceive the subject mathematics as being difficult, we can solve all the teacher inadequacies, they will still perform poorly in the subject."

Similar findings were made by [41] in Brong Ahafo region when she conducted a study on the factors affecting students' performance in mathematics using a qualitative approach. Her study, like this study, established that students' readiness to use the mathematics teaching and learning materials available and their relationship with their mathematics teachers were strongly associated with their performance in mathematics. [42] also found that student's willingness to learning mathematics affects their performance in mathematics when all other variables are held constant. Learning Mathematics requires determination from the learner, it requires that the learner disabuses his or her mind from any preconceived notions of mathematics being difficult. It requires that students make themselves available to be guided by the principles of solving specific mathematics problems. It requires that students become academically engaged through regular class attendance, participation in class and group discussions, going for preparatory studies, making time to revise mathematics notes and independently attempting to solve some mathematics problems either in textbooks or exercise books, doing assignments and developing passion for the subject [43]. All these are within the students' domain. Students who are academically engaged will certainly see an improvement in their performance in Mathematics [44]. These findings of the study conform to the tenets of the Self-Efficacy Theory which was adopted as an analytical model for this study. Self-Efficacy Theory argues that individuals would do better if they have confidence in themselves and vary their behaviours towards achieving set targets. Students who wish to perform better would surely become more and more academically engaged and nurse the confidence that they can do it and this will surely lead to an improvement in their performance in mathematics.

Another aspect of students' characteristics is their relatedness with their mathematics teachers. [45] find that students who relate very well with their teachers may perform better in science related subjects since they may always feel comfortable and free to get closer and ask questions regarding concepts that are not clear to them than those students who always shy away from their teachers. One of the Key Informants who was a senior housemaster in one of the study schools had this to say:

"Sometimes you will find some students not getting closer to their mathematics teachers and rather see the mathematics teachers as difficult teachers to learn from. It is very worrying. Once the students shy away from the mathematics teacher, then it becomes very difficult for them to seek further clarifications on complex concepts

taught. This will translate into poor academic performance in mathematics on the part of the student"

Again, the attentiveness of the students during mathematics lessons was found to correlate with their performance in Mathematics by [46] in a study of factors of Students' poor academic performance in Gang South district using a qualitative approach. [47] in a quantitative study also found that students' personal discipline and attentiveness in mathematics lessons determine their levels of enthusiasm in Mathematics and subsequently inform their performance in the subject. They concluded that students who are discipline and always pay attention during mathematics lessons would perform better in Mathematics compared to those who do not actually see the need to even listen carefully to the discussions during mathematics lessons.

However, one of the Key Informants in the interviews, who was an assistant headmaster in charge of domestic affairs in one of the study schools was a bit sceptical about all these findings and explained as this:

"For me, I do not really think that the personal characteristics of the students such as their relationship with the mathematics teacher, their willingness to learn the subject and so on do really matter. These students are quite young and so when all the teacher inadequacies are addressed and all the necessary mathematics teaching and learning materials are made available, it will be difficult for the students not to develop more interest in learning the subject and subsequently performing better in mathematics. Since the students are quite young, they can always be moulded to fit where they belong."

[27] also made contradictory findings when they investigated the factors that affect students' academic performance in Mampong Senior High School. They found a weak relationship between students' unique traits and students' academic performance. Factors like, availability of textbooks, student-teacher ratio and intended course of study rather correlated strongly with students' academic performance. [48] also found that the relatedness of students with their mathematics teachers did not affect students' performance in Mathematics when they conducted a study of the influencing factors of students' performance in Mathematics using a qualitative approach that involved 70 students and 15 teachers. The variance of the finding of [27] this and other studies may lie in the sample size and the research approach. [27] made use of a sample size of 15 students and 5 mathematics teachers in a qualitative approach which usually does not provide enough grounds for generalisations. Also, the variance of the study of [48] with this study may also lie in the research approach. They used a qualitative research approach which often make use of small sample sizes and so provided limited grounds for generalizability.

6. CONCLUSION

The study revealed that students' characteristics in terms of their willingness to learn mathematics, students' perception about mathematics being a difficult subject, students' readiness to use available mathematics teaching and learning materials, students' relationship with their mathematics teachers and students' attentiveness in mathematics lessons predict their academic performance in mathematics.

Students who pay more attention in mathematics lessons are more likely to perform well in mathematics because of their higher chances of easily grasping the concepts taught. Once a student is more attentive during a mathematics lesson, he or she will be able to follow the discussions closely and could easily identify clues as to how to better explain many of the concepts taught during the lesson. Also, students who are ready to make good use of the mathematics teaching and learning materials available stand a higher chance of improving their performance in mathematics than those students who really do not see the need to keep visiting the library to use the mathematics textbooks to search for more solved examples of concepts taught in class.

Students who are willing to go the extra mile to learn mathematics and are always more willing to be taught by either their mathematics teachers or even by other colleagues who may have a better understanding of the concepts after class discussions, stand a higher chance of doing very well in mathematics compared with those who really do not care to learn further after class discussions. Again, students who relate very well with their mathematics teachers and are always ready to ask their mathematics teachers further questions even outside mathematics lessons are more likely to improve their performance in mathematics than those students who are fond of

shying away from their mathematics teachers and do not see the need to get closer to the mathematics teacher for further clarification of concepts taught in class.

Above all these, students who see mathematics and all other quantitative subjects as subjects they can learn and understand better stand a greater chance of doing very well in mathematics than those who perceive mathematics and all other quantitative subjects as being difficult to learn and understand. Based on the data collected from the field and the findings of similar studies from other jurisdictions, the study concludes that students' characteristics predict students' performance in Mathematics.

7. RECOMMENDATION

Based on the findings of this study, it is recommended that the school management of each school in collaboration with the teaching staff may pay particular attention to the attributes of students that prevent them from learning mathematics so as to improve their performance in Mathematics. School management could work with the Guidance and Counselling unit to provide some form of support for students who have fears for mathematics. Extra classes could be organised for those who have challenges in mathematics and career guidance could be given to those who feel they are choosing careers that do not require mathematics. These interventions may surely increase performance in mathematics.

8. SUGGESTIONS FOR FUTURE RESEARCH

While the study was quite comprehensive as it covered numerous student related factors that predict students' performance in mathematics, there are other characteristics such as the age and background of the student that the study did not address and these could be considered for further studies by other researchers. The extent to which the individual characteristics of the students moderate the relationship between the content mastery of the teacher and students' performance in mathematics was not considered and this is an interesting area which could be studied. Again, this study was limited to students' academic performance in Mathematics, studies that consider the general factors of students' academic performance in Northern Ghana would provide more data and help address issues of students' academic performances in all subjects.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/96685