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Research Article

Predicting Physics Students' Academic Performance: The Impact of Attitude, Self-Efficacy, and Personality Traits

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Abstract
The study examined the predictive impact of attitude, self-efficacy, and personality traits on the academic performance of high school students in physics. A multistage random sampling technique was used to select 210 research subjects between the ages of 16 and 22 (SD=1.80) from three high schools in the Berekum East Municipality of Ghana. Three standardised questionnaires as primary data sources, namely: Attitude Toward Physics Learning (ATPL), Physics Learning Self-Efficacy (PLSE), and Students' Personality Trait Inventory (SPTI), and additionally, Students' Physics Mock Examinations scores as a secondary data source, were used for data collection and analysis through multiple regression. Data collected from respondents were compiled, sorted, edited and coded into the Statistical Package for the Social Sciences (SPSS) version 23. The results revealed a joint impact of 21.100% of the variance in attitude, self-efficacy, and personality traits in predicting the academic performance of students in physics. Furthermore, the multiple regression analysis revealed that student attitudes, self-efficacy, and personality traits significantly impact student academic performance in physics. The analysis further revealed that students' personality traits best explained students' academic performance in Physics ($\beta = 0.232$, $t = 3.423$; $p < 0.050$), followed by self-efficacy ($\beta = 0.192$, $t = 2.738$; $p < 0.050$), and attitude ($\beta = 0.121$, $t = 2.011$; $p < 0.05$). Based on the results obtained, the study recommended that physics students in the Berekum East Municipality's attitudes, self-efficacy, and personality traits should be given greater attention by physics teachers, and other stakeholders because of their positive impact on students' academic performance in physics.

Keywords: Academic Performance, Attitude, Impact, Personality Trait, Physics, Self-Efficacy

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1. INTRODUCTION

Academic performance, which is impacted by students' traits, is one of the factors in quality education. Thus, students' academic performance in schools has been demonstrated to be impacted by many psychosocial factors such as motivation, attitude, self-efficacy, family, personality qualities, and others, as supported by dozens of theoretical and empirical shreds of evidence (Li, 2012). This suggests that student academic performance is a dynamic construct, as different variables relate to it (Rashid & Zaman, 2018).

According to UK Essays (2018), the emphasis on factors impacting students' academic performance continues to change and shift from one variable to another from time to time. Kapngero (2018), as well as Olojo et al. (2022), argued that poor student performance in physics could be due to several fundamental causes, which may be due to a shortage of qualified physics teachers in quality and quantity, as well as inadequate laboratory logistics and facilities. Bamidele, cited by Baran (2016), stated that the lack of students' interest in physics, due to the perceived idea that physics is difficult, has dramatically affected students' enrolment and academic performance in physics. Admittedly, some physics concepts and theories

are perceived as abstract and appear difficult for students to comprehend. For example, Guido (2013) acknowledged that physics is considered the most problematic area within science and may attract fewer students than other scientific disciplines such as chemistry and biology. Guido concluded that most of the students perceived physics as a complicated subject during their high school days, and it becomes more problematic when they are in college or graduate school. According to George (2006), students often have a positive attitude towards studying science in the early stages of their studies. However, George said that their attitude towards science declines as they progress through the higher stages of education, which may have an impact on their academic performance.

Researchers have been exploring the impact of students' attitudes towards learning physics, and some study authors, including Mekonnen (2014) and Ijeh et al. (2021), disclosed that the decrease in students' academic performance in physics is wearisome. Of these poor students' academic performance in physics, Mabee et al. (2021) detailed the outstanding factor as their attitude towards the learning of physics. Consequently, some studies have shown a close relationship between students' attitudes toward physics and their academic performance (Guido, 2013; Arandia et al., 2016). For example, Ibrahim et al. (2019) observed that students who have a negative attitude towards physics learning also lack motivation for class participation. Veloo et al. (2015) stated that students' negative attitudes towards any subject make learning difficult, while students' positive attitudes stimulate students to make efforts, which consequently leads to high academic performance. Some relevant studies have established a relationship between students' attitudes toward the study of sciences and their academic performance. For example, Ballah and Okoronka (2015) concluded that students' positive attitudes towards science are highly related to their academic performance in science. Therefore, Jean de la Croix and Xavier (2016) recognise that determining students' attitudes toward a subject is a valuable task if one wishes to improve students' academic performance.

The second variable perceived to impact students' academic performance in physics in this study is student self-efficacy. The assertion that one can effectively meet demand is what Albert Bandura calls self-efficacy. As a basis for Albert Bandura's social cognitive theory (SCT), Bandura theorised that unless people believe they can produce anticipated outcomes, they have little motivation to act. Thus, self-efficacy is one of the essential aspects of SCT because most of the level of self-efficacy comes from students' external experiences and self-perception, which determine the results of tasks and circumstances they have encountered, as well as how students act (Bandura, 1986, 1997). Self-efficacy and past performance are related. For example, Tenaw (2013) noted that self-efficacy is better related to student academic performance than skills alone and directly influence student academic performance through cognition. Tenaw furthered that although past performance relates to students' self-efficacy, students' interpretation of past accomplishments and failures is responsible for successive accomplishments. Thus, perceived self-efficacy is related to future performance better than past achievement (Bandura, 1986; Hwang et al., 2016). Tenaw (2013) again stated that students' academic performance might vary because of their varying beliefs in self-efficacy, which depends on the performance outcome of the experience.

The third variable considered in this study that impacts students' academic performance in physics is the students' personality traits. The construct of personality traits may be used to describe differences in people's behavioural patterns and provide the basis for studying daily behaviour and performance across domains of people (Poropat, 2016). However, Downey et al. (2014) contended that intelligence explains the variance in academic performance to a greater extent than the variance in student personality traits, such as the Big Five personality traits. However, some researchers, such as Bate et al. (2022), found that personality traits, gender, and IQ are related to student academic performance. Consequently, Stankov et al. (2012) claimed that when it comes to physics teaching and learning, it is essential to emphasise the cognitive trait of intelligence and non-cognitive variables such as personality traits and motivational variables because of their relative impact on student's educational outcomes. Conversely, even if intelligence is a critical factor for a student's academic performance in any subject, including physics, other variables should be considered to predict students' academic performance and wealth in physics education research.

Some studies have found that difficulties in the academic performance of students in school subjects are believed to be related to several factors, such as the attitude of students (Mekonnen, 2014; Poultsakis et al., 2021; Sofiani et al., 2017), student self-efficacy (Alrabai, 2018; Ramnarain & Ramaila, 2018; Rosales-Ronquillo & Hernández-Jácquez, 2020), and student personality traits (Tomšik, 2018; Anderson et al., 2020). However, despite numerous studies attempting to provide a definite pattern regarding the impacts

of attitude, self-efficacy, and personality traits on physics students' academic performance, the debate over the nature of the relationship is far from conclusive.

Ozel et al. (2013) stated that most researchers tend to analyse each variable separately, thus preventing researchers from getting a broader picture of how these variables impact students' academic performance in physics. In the absence of any such analysis in a single study as noted by Ozel et al. (2013), this study is intended to provide a broader understanding of the joint and comparative impact of attitude, self-efficacy, and personality traits on students' academic performance in physics. Therefore, the study sought to answer the following questions:

1. What is the joint impact of attitude, self-efficacy, and personality traits on the academic performance of high school students in physics?
2. What are the comparative impacts of attitude, self-efficacy, and personality traits on students' academic performance in Physics?

2. METHODS

2.1. Research Design

This study, premised on a positivist approach, took place between April and August 2021, and adopted a descriptive correlational survey design. According to Cohen et al. (2018), in descriptive correlation research, researchers collect data to describe the current status or characteristics of variables of interest. The primary goal is to examine the correlation or relationship between two or more variables, as reflected in the focus of this study.

2.2. Participants

The study respondents were Senior High School (SHS) science students from the Berekum East Municipality, Ghana, who pursued physics as one of their elective subjects for the academic year 2021-2022. A total of 210 SHS physics students voluntarily participated in the study and expressed their opinions via the research instruments used for data collection.

The literature recommendation on the sample size for multiple regression analysis is mixed. However, researchers can use Harris' rule of thumb (cited by Van Voorhis, 2007) to select the minimum number of research subjects. Harris proposed that the number of research participants should exceed the number of predictors by at least 50. Harris added that in regression equations using six or more predictors, the minimum sample size of 10 participants per predictor variable is suitable. Therefore, since the study had three predictors, 200 or more samples were appropriate for the study. In this study, 210 samples of a population of 306 were selected using multi-stage random sampling. The Creative Research System (2012) recommends that samples of 210 be appropriate for a population size of 306, based on confidence levels of 99% and error margins of 5%. The sample used in this study was 16 to 22 years old, with a standard deviation of 1.80.

2.3. Research Instruments

2.3.1. Attitude towards Physics Learning (ATPL)

Students' attitudes toward the learning of physics were measured by an index of an attitude instrument called "Attitude toward Physics Learning" (ATPL). The ATPL research instrument is composed of four (4) subscale items designed to assess the physics students' attitude towards the study of Physics. In this research instrument, the following areas were highlighted as important to assessing physics students' attitudes towards physics: Attitude toward learning physics, physics outside the classroom, future participation in physics, and the Physics Teacher. All the attitude items listed were adapted from Anwer and Bhutta (2014).

The first section of ATPL included five questions (LP1-5), focusing on students' attitudes toward physics learning. The second sub-scale of the ATPL was also composed of four items (FP1-4) which addressed the issue of the willingness of physics students to engage in physics-related activities outside the classroom. Also, the third sub-scale assessed the SHS students' willingness to take vocations in physics-

related fields and was constituted from FP1-4 of the ATPL. The last sub-scale included three items (TPT1-3) which assessed the SHS Physics students' attitudes towards their Physics teachers.

2.3.2. Physics Learning Self-Efficacy (PLSE)

An instrument called the Physics Learning Self-Efficacy (PLSE) was used to assess students' self-efficacy in learning physics. Adapted from Suprapto and Chih-Hsiung (2017), the PLSE research instrument consists of four (4) subscales designed to assess the self-efficacy of physics learning by students. Physique Practical (PP), Everyday Application (EA), High Order Thinking Skill (HOTS) and Physics Content were the four subscales of the PLSE (PC).

The first subscale of the PLSE featured five questions (LS1-5) and focused on the practical physics of the students, as presented in Table 2. In addition, the PLSE's second sub-scale has four questions (EA1-4) that address the topic of SHS physics students' capacity to apply physics principles in everyday circumstances. Similarly, the PLSE's third subscale (HOT1-4) has four items that evaluate SHS students' high-order thinking skills when it comes to Physics-related subjects. The PLSE's fourth sub-scale consists of three items (PC1-3) that test students' physics content.

2.3.3. Student's Personality Traits (SPT)

Students' Personality Traits (SPT) is a 15-item standardised adapted questionnaire on the Five-Factor Model, otherwise known as the Big-Five Personality Model by Lang et al. (2011). The SPT items assess the personality traits of the students expressed as positive or negative statements. The SPT contains five subscales, one for each Big Five inventory under review (Table 1). The SPT contains three items in each of the personality traits. The researcher ensured that adequate adjustments were made to some of the items to suit the research subjects for this study. This was achieved by simplifying some of the words used without necessarily distorting the meaning to suit Ghana's SHS educational context.

2.3.4. Reliability of the Research Instruments

The expert group was consulted to measure the validity of the scale's content. Adjustments were made after the evaluation by the expert group. After the content validity assessment, the research instruments were tested. The results of the pilot study were used to determine the reliability of the research instruments. The internal consistency reliability approach (Cronbach's alpha) was employed to evaluate the reliability of the research instruments. Because each test item is considered an independent test, this method is commonly referred to as an item-level approach (Leech et al., 2011). Tables 1 through 3 provide the results of the reliability assessments.

Table 1. Internal Consistency of Attitude towards Physics Learning Items

Sub-scale	Corrected Item-total Correlation	α if the Item Deleted
Learning Physics (LP)	0.356	0.812
Future Participation (FP)	0.627	0.762
Physics Outside Classroom (PC)	0.391	0.701
The Physics Teacher (TPT)	0.401	0.761
Total Items' α = 0.759*		

Table 2. Internal Consistency of Self-Efficacy of Learning Physics Items

Sub-scale	Corrected Item-total Correlation	α if the Item Deleted
Physics Practical (PP)	0.661	0.812
Everyday Application (AE)	0.501	0.762
High-order thinking skills (HOT)	0.732	0.791
Physics Content (PC)	0.672	0.801
Total Items' α = 0.792*		

As presented in Table 1, α= 0.759 (> 0.700) represents the attitude towards physics items. Table 1 further shows that the Corrected Item-total Correlation (CIC) ranged from 0.356 to 0.627. Because all of the items had a score greater than 0.300, they were kept.

As shown in Table 2, α = 0.792 (> 0.700) represents the self-efficacy of the physics learning items. The CIC, as shown in Table 2, ranged between 0.501 and 0.732. All items were > 0.300 and met the minimum threshold, so they were kept.

Table 3. Internal Consistency of Students' Personality Traits Inventory

Sub-scale	Corrected Item-total Correlation	α if the Item Deleted
Neuroticism	0.623	0.716
Extraversion	0.501	0.689
Openness to Experience	0.722	0.703
Agreeableness	0.671	0.711
Conscientiousness	0.377	0.760
Total Items' α =0.716*		

As revealed in Table 3, α= 0.716 (> 0.700) represents the traits of the Five Big personalities. The CIC, as shown in Table 3 ranged between 0.377 and 0.722. All items were > 0.300 and were therefore retained.

The reliability of the instruments was deemed acceptable because their alpha values were significantly higher than the minimum threshold of 0.700. Acceptability of instrument reliability was based on the literature (Abel et al., 2016; Taber, 2018). The authors claim that an alpha value of 0.900 and above is considered excellent, 0.800 and above is considered very good, and that 0.700 is considered acceptable. Similarly, according to Cristobal et al. (2007), a subscale with a CIC lower than the cut-off value of 0.300 is not acceptable. As a result of the reliability assessments and findings presented earlier, it was concluded that even after the research instruments were adjusted from previous studies, they could still maintain a sufficient degree of acceptance reliability in the context of Ghanaian SHS.

2.4. Procedure for Data Collection

In this study, driven by the focus of the investigation, a questionnaire-in-person procedure was used for data collection. This data collection method helped the researcher to collect quantitative raw data on attitudes, self-efficacy, personality traits, and mock exam scores in physics in person with a high degree of confidence in the data using the three sets of questionnaires.

2.5. Data Analysis

To process, manipulate and analyse the joint and comparative impact of attitude, self-efficacy, and personality traits on the academic performance of physics students, several statistical techniques were used via SPSS version 23. These statistical techniques include descriptive (skewness and kurtosis) and multiple linear regression analysis at the 0.05 level of significance. Skewness and kurtosis were used to test the assumptions for multiple linear regression. The results revealed a skewness of 0.170 (SE = 0.630) and a kurtosis of 0.920 (SE = 0.630) for attitude. In the same way, the evaluation of the normality of self-efficacy revealed a skewness of 0.100 (SE = 0.770) and a kurtosis of 1.410 (SE = 0.770). Similarly, 0.180 skewness of 0.180 (SE = 0.670) and kurtosis of 0.960 (SE = 0.630) for personality traits. This indicates that the assumption of normality as revealed by the skewness and kurtosis values was met (Cramer & Howitt, 2004; Razali & Wah, 2011). Further regression analysis assumptions tested include collinearity statistics, including estimation of variance inflation factors (VIF) and tolerance values (T), as shown in Table 5.

3. FINDINGS

3.1. The Joint Impact of Attitude, Self-Efficacy, and Personality Traits on Students' Academic Performance in Physics

The result of the analysis, as presented in Table 4, shows the joint contribution of the independent variables to students' academic performance in physics. These yielded a coefficient of regression, R = 0.458, and a multiple R2 = 0.211, predicting about 21.100% of the variance in the independent variables. The regression analysis given in Table 6 further shows that the joint contribution of personality traits, attitudes, and self-efficacy of students to the academic performance of students in physics was significant (F (3,209) = 1.253, p < 0.500). The results indicate that the joint impact of the independent variables was meaningful and accounted for 21.10% of student's academic performance in physics.

Table 4. Regression Analysis

Regression Analysis	Analysis of Variance	Sum of Squares	Df	Mean Square	F	Sig.
R= 0.458[a]	Regression	207.481	3.000	69.160	1.253	0.000[b]
R^2= 0.211	Residual	11370.143	206.000	55.195		
SE= 5.473	Total	1157.624	209.000			

a. Dependent variable: Academic Performance in Physics
b. Predictor (Constant): Personality traits, Attitude and self-efficacy

3.2. The Comparative Impact of Attitude, Self-Efficacy, and Personality Traits on Students' Academic Performance in Physics

This research question sought to examine the comparative predictive impacts of students' attitudes, self-efficacy, and personality traits on the dependent variable, thus physics students' academic performance, with the regression model: $Y = \beta o + \beta 1X1 + \beta 2X2 + \beta 3X3 + e$. Table 5 presents a summary of the multiple regression analyses that were applied to answer this research question.

Table 5. The Relative Contribution of the Variables

Model	Unstandardized Coefficients		Standardised Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	1.438	3.277		0.440	0.662		
Attitude	0.056	0.028	0.121	2.011	0.045	0.464	2.156
Self-efficacy	0.092	0.033	0.192	2.738	0.007	0.463	2.159
Personality	0.171	0.051	0.232	3.423	0.002	0.995	1.005

a. Dependent Variable: Academic performance

According to the requirement, it was first determined that there was no multicollinearity problem between the variables. To determine the multicollinearity problem, VIF and T of the independent variables were examined, and it was determined that the values did not cause any multicollinearity problems. As presented in Table 5, the result shows that the VIFs are all less than 5.000 and T are all greater than 0.200 (Bhandari, 2020; Potters, 2021), indicating no effect of multicollinearity and no violation of the multicollinearity assumption.

As shown in Table 5, the analysis also shows the predictor variables as they regressed against the dependent variable. The relative impact of each of the independent variables on the student's academic performance in physics is as follows: attitude toward learning ($\beta = 0.121$, $t = 2.011$; $p < 0.05$), physics learning self-efficacy ($\beta = 0.192$, $t = 2.738$; $p < 0.050$), and personality trait ($\beta = 0.232$, $t = 3.423$; $p < 0.050$), respectively. The findings further showed that all the independent variables were significant in predicting students' academic performance in physics.

The results further revealed the comparative impact of attitude, self-efficacy, and personality traits; however, it is seen that students' personality traits appear to be the most impactful contributor to students' academic performance in physics than the other variables ($\beta = 0.232$, $t = 3.423$; $p < 0.05$), as also seen in

the generalised hypothetical regression equation: Y = 1.438 + 0.121X1 + 0.192X2 + 0.232X3 + e. (where X1 = students' attitude, X2 = students' self-efficacy belief, and X3=students' personality trait).

4. DISCUSSION

Findings on the joint predictive impact of attitude, self-efficacy, and personality traits revealed a moderate percentage (21.100%) in explaining the proportion of variance in students' academic performance in physics. In particular, as revealed by this aspect of the study, the direction of the impact of attitude, self-efficacy, and personality traits on students' academic performance in physics was positive. This suggests that as students' attitudes towards physics learning, self-efficacy in learning physics, and personality trait scores increase, so does their academic performance in physics.

The findings on the comparative impacts of attitude, self-efficacy and personality traits on students' academic performance in physics revealed that students' attitudes towards physics learning and self-efficacy in learning physics and personality traits all have positive impacts on student's academic performance in physics; however, their comparative impacts differ. The comparative differential impacts can be interpreted as saying that for every unit increase in students' attitude towards physics learning, there is a predicted impact of 0.121 (12.100%) in the academic performance of students in physics, provided that all the variables are held constant. Also, for every unit increase in students' self-efficacy in learning physics, there is a predicted impact of 0.192 (19.200%) in students' academic performance in physics, if all the other variables are constant. Furthermore, for each unit increase in students' personality traits, a predicted impact of 0.232 (23.200%) in the academic performance of the students in physics, provided that all variables are constant. Thus, the results of this study suggest that the magnitude of the contribution of students' personality traits ($\beta = 0.232$, $t = 3.423$; $p < 0.050$) has the highest impact in explaining the predictive strengths of the variables in determining students' academic performance in physics.

Prior to this study, it has been reported that students' attitudes towards physics efficiently predicted academic performance. For example, Murunga et al. (2019) reported that students' attitudes toward physics determine their academic performance in physics and that a positive attitude motivates students to exert more effort in classroom-related activities, leading to high academic performance in that subject. On the contrary, Veloo et al. (2015) stated that a negative attitude towards any subject makes learning difficult. Consistent with this study, students' attitudes should be an extremely crucial factor for physics educators because the affective dispositions of students, such as students' attitudes, are potent predictors of their subsequent behaviour, including their studies, as has been established.

The findings of this study validate previous studies by some authors who revealed that students' self-efficacy is a vital indicator of students' academic performance (Yerdelen-Damar & Peşman, 2013; Çapris, 2013; van Rooij et al., 2017; Ayoola, 2019). These authors generally concluded that students' self-efficacy is closely related to their high academic performance. The pioneering work on self-efficacy by Bandura (1997) also observed that students with high self-efficacy would see themselves as achievers who could do it and pursue the course until they experienced the achievement. Such students will achieve better than their peers, who have low self-efficacy.

Also, this study confirms the results of Achufusi et al. (2019), which found a positive correlation between student self-efficacy and student academic performance in physics. Similarly, the study findings support Deniz and Hatice's (2016) findings, who reported a significant correlation between students' self-efficacy and academic performance in physics. The current finding typically validates the pioneering work of Bandura (1997) on self-efficacy, who found that there is a strong relationship between performance achievement and self-efficacy. Consistent with Bandura's assertion, it can be inferred that the self-efficacy of students will positively influence their interest in physics-related activities. Increased interest will lead to the pursuit of more achievement-orientated actions or experiences in the study of physics. In Bandura's description of self-efficacy, supported by the results obtained in this study, it can be inferred that students who have strong self-efficacy in learning physics would most likely spend more time on it, concentrate more on the physics learning, and enjoy it, with a positive consequential impact on their academic performance.

In terms of the predictive impact of student personality traits on academic performance, studies have shown that, in addition to neuroticism, which is associated with emotional instability and anxiety, and has

been found to negatively impact student performance in physics (Deary et al., 2021), other personality traits, viz; conscientiousness, openness to experience, extraversion, and agreeableness, have been found to positively impact student academic performance. For example, Noftle and Robins (2020) found that students who scored high on conscientiousness tended to be more organised and persistent, which helped them grasp complex physics concepts and perform well on assessments. A study by Chamorro-Premuzic and Furnham (2022) also found that extraverted students often excel in collaborative settings due to their assertiveness and ability to communicate effectively with peers. It must be noted that these attributes of the student's personality traits could be extrapolated to explain the predictive impacts of students' personality traits found in this study.

The results of this study have implications for the teaching and learning of physics at the Berekum East Municipality SHS, including focusing on students' academic performance. As revealed by the study, understanding the impact of student attitude, self-efficacy, and personality traits on student academic performance in physics is essential to conceptualise Berekum East physics student academic performance as a complex phenomenon with several variables, such as attitude, self-efficacy, and personality traits, impacting it as predictors for its explanation, as noted by Ozel et al. (2013). Thus, SHS physics educators in Berekum East Municipality should design their lessons to promote a positive attitude toward physics learning, strong self-efficacy in physics, and desirable student personality traits, since these constructs could impact students' academic performance in physics.

5. CONCLUSION AND IMPLICATION

Based on the findings obtained, it can be concluded that attitude, self-efficacy, and personality traits jointly and comparatively impact the academic performance of physics students in the context of Berekum East Municipality SHS physics studies; however, the personality traits of the students have the most impact on academic performance of SHS physics students more than attitude and self-efficacy. The relevance of this study to the field of SHS physics education and pedagogy is significant because the findings on the joint and comparative impact of attitude, self-efficacy, and personality traits on academic performance contribute to a more comprehensive understanding of the factors that influence student outcomes in SHS physics teaching and learning. These insights can inform the development of targeted interventions and support mechanisms that meet the diverse needs of students. Therefore, it follows that SHS physics teachers in the Berekum East Municipality should pay considerable attention to the attitude, self-efficacy, and personality traits of the students, as they have direct and indirect impacts on their academic performance in physics.

6. LIMITATIONS

A critical limitation of this study that came from the selected study design was that the findings obtained could not be used to conclude the causal relationships between the dependent and independent variables measured. Also, with the study limited to only SHS physics students in the Berekum East Municipality, the results of the study cannot be generalised to other physics students at different educational levels and in different geographical settings.

7. RECOMMENDATIONS FOR FURTHER RESEARCH

The study's findings have shown that on the level of prediction of physics academic performance by a joint of attitude, self-efficacy, and personality trait variables, only 21.100 % of the variance of Berekum East Municipality physics SHS students' academic performance in physics was predicted. Therefore, this finding suggests that other variables explaining the remaining 78.900 %, which were not examined in the study model, are worth investigating. Also, other studies could focus on exploring these variables using different approaches to establish causal relations among the study variables. In addition, other researchers should replicate this study with a larger sample size to look at different subscales of students' attitudes toward physics, self-efficacy in learning physics, and personality traits.

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