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Influence of Students, Teachers and Learning Facility Factors on Senior High School Students' Physics Learning Interest in Accra Metropolis, Ghana

***Godwin Kwame Aboagye, PhD**
ORCiD: https://orcid.org/0000-0002-2268-8649
Department of Science Education, Faculty of Science and Technology Education, University **Email:** aduaboagye@ucc.edu.gh

Isaac Newton Avor
ORCiD: https://orcid.org/0000-0001-7930-7395
Department of Physics, Adisadel College, Ghana

***Corresponding author:** aduaboagye@ucc.edu.gh

Abstract: The aim of this study was to explore the influence of students, teachers and learning facility factors on senior high school students' physics learning interest in Accra Metropolis, Ghana. The study used the cross-sectional survey design and included 498 second-year science students from six senior high schools in the Accra Metropolis of the Greater Accra Region. A questionnaire was utilized as the research instrument to collect data. The results of a standard multiple regression analysis indicated that both student and teacher-related factors significantly supported students' interest in learning physics, whereas learning facilities did not have any significant impact. To enhance students' interest in physics, it was recommended that stakeholders pay particular attention to student and teacher-related factors. Additionally, the Ghana Education Service should enhance Teacher Professional Development programs to equip teachers with innovative strategies that engage students' curiosity in physics and promote collaborative learning, fostering deeper interactions with the subject.

Keywords: Student interest; Student-related factors; Teacher-related factors; Learning facilities; Physics.

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Introduction

Unlike biology and chemistry, physics is considered the most problematic subject and so traditionally attracting fewer students (Strogatz, 2018). Students who do not like a subject, do not express interest in learning it (Siregar et al., 2023). The study of physics is very important because it is essential for innovative advancement in any country, and so students' interest in it cannot be overemphasized. Literacy in this subject is fundamental for heightening economic affordability (Zollman, 2012), particularly in the 21st century globalized market, where new advancements are expected to emerging needs and to handle natural issues, such as global warming.

Interest reflects a person's inclination and passion for a particular subject (e.g., physics as a discipline or related activities, such as problem-solving in various fields) and involves cognitive and emotional processes (de Brabander & Martens, 2014; Sharpe, 2012). By and large, students see science as modestly fascinating, yet contrasted with other school disciplines, the sciences are seen as less fascinating (Archer et al., 2015; Bathgate et al., 2014). According to Tytler and Osborne (2012), physics, although considered valuable, is the least intriguing for students, contrasted with chemistry and biology. This is because physics helps individuals relate scientific principles to everyday experiences, such as walking and the functioning of household appliances, making it a logical and relatable field of study. However, within the typical pattern of declining interest in high schools (Plenty & Heubeck, 2013), a significant decrease is typically observed in the case of physics and chemistry (Potvin & Hasni, 2014a; Tröbst et al., 2016).

According to Azevedo (2011), the term 'interest' usually alludes to an inclination to take part in certain kinds of exercises as opposed to others. At the point when we are keen on a specific occurrence, we are well persuaded to take care of it and make time for it. Osborne et al. (2003) conducted a study to distinguish between 'scientific attitudes' and 'attitudes to science'. Scientific attitudes center on the qualities and behaviors crucial for scientific inquiry while attitudes to science revolve around public or individual perspectives and emotions regarding science as a subject and its societal significance. They found that a blend of variables deciding interest in learning physics as an academic discipline differs starting with a student and then onto the next. These comprise the students' factors, teachers' factors, mathematics anxiety, class size, government factors, infrastructural problem and instructional strategies (Anigbo & Idigo, 2015; Opara et al., 2017).

Although very little research has been conducted to identify factors that influence students' interest in learning physics, the variables such as teacher-related factors, student-related factors and learning facilities, appear not to have been examined to determine, collectively, their influence on students' interest in learning physics. For example, in Israel, Trumper (2006) found that the most compelling variable hindering students' interest in learning physics is their unfortunate feelings concerning science lessons in junior high school. Students have been found to possess a very positive attitude, as well as a significant passion for science, when they start junior high school in certain countries (Porter-Stransky et al., 2024). However, these attitudes tend to diminish as they experience school science, and this happens mostly for girls (Makelele, 2024). Trumper (2004) reported that self-concept or confidence in succeeding in physics class is the strongest predictor of interest in physics among students. Girls tend to have a weaker physics-related self-concept in general (Häussler & Hoffmann, 2002). Osei (2006) underlines the growing need from both the Ghanaian government and the general public for more teacher responsibility, acknowledging teachers' critical role in THE national development. Given teachers' direct influence on their schools and students' academic success, some argue for adopting standardized student evaluations to assess teacher effectiveness (Koretz, 2002).

When schools and the subject teachers are rated highly or exceptionally, they receive praise and remuneration. In Ghana for instance, teachers who exceed expectations in their teaching subjects are remunerated during the National Teachers' Day celebration held annually nationwide. While acknowledging the benefits of remunerating teachers who achieve better outcomes, it is also essential that they do not evade some responsibility when their students perform poorly. Research has shown that teachers have a central influence on students' interests (Hoffmann, 2002). Ballou et al. (2004) found that the most significant factor impacting students' learning is the teacher.

It is noteworthy that the use of appropriate instructional approaches by qualified physics teachers can spark students' interest in learning the subject and ensure success in doing so. Thus, involving qualified physics teachers who are furnished with a variety of teaching techniques in physics teaching increases students' interest in learning physics (Adeyemo, 2010). This ought to be feasible through the teacher's effective teaching methods, well-prepared mind and skills that consistently wipe out nervousness in students' study of the subject. Kimani et al. (2013) discovered that teachers' understanding and instructive capabilities were the prime indicators of students' interest.

Teaching techniques were defined by García et al. (2017) as the teacher's action in the classroom that includes students in the subject and calls for them to take part in learning exercises, share similarities with other students and respond to the learning experience. The teacher must collaborate with the students to improve the learning environment, design lessons and increase students' interest in the subject by implementing distinctive teaching techniques. The teaching objectives must be adjusted to address the issues and premiums of students while teaching strategies ought to be deliberately used to improve learning and make topics valuable. For this purpose, teaching/learning aids should be employed by the teacher in the teaching-learning process. Teaching and learning aids are tools or systems designed to make teaching and learning more efficient, effective and enjoyable while also simplifying and organizing complicated materials and connecting new and old ideas (Dixon-Krausse, 2006).

Haque and Rao (2018) suggested that teachers employ various teaching techniques in the classroom to capture students' attention and keep them engaged. They argued that differentiating instructional strategies is essential for effective teaching and learning. The lesson should be well structured, encompassing a variety of elements: explanation, modelling, demonstration, practice and critique (Krepf & König, 2023). This approach is grounded in the best practice pedagogy, where students are provided with different strategies to learn the material and the content is varied to maintain students' engagement (Barkley & Major, 2020) along with ways to demonstrate that learning. For instance, understanding lesson goals can help align students, but allowing some flexibility during the teacher's modelling is encouraged for deeper learning. Colella (2000) further suggests that interactive and collaborative learning enhance engagement through the use of simulations, alternating individual and group challenges and discussions surrounding the outcomes of investigations. Teachers might also incorporate short lectures between activities, add brief readings or multimedia materials, and facilitate quick peer discussions and writing. These strategies create an interactive learning environment that caters for a variety of learning styles, thereby promoting content understanding (Haque & Rao, 2018; Sharma, 2024). In the long run, this approach will boost students' interest in learning physics.

According to Darling-Hammond (2000), teachers exert an enormous influence on students and hence determine, to a very great extent, the interest of the students in the subject matter. Some researchers (Klassen & Chiu, 2010; Iqbal & Ali, 2024) contend that aspects like qualification, ways of instruction, communication skills, sexual orientation and age can contribute significantly in the development of students' academic interests. Teachers' attitudes significantly increase students' learning interest. When teachers encourage and supportive, students are more likely to cultivate a keen interest in the material being presented (Kpolovie et al., 2014). On the other hand, a negative or indifferent attitude could result in disengagement and apathy.

Erdemir (2009) identified several factors influencing students' interest in physics, including their attitudes toward achievement in the subject, self-confidence in learning, perceptions of teachers' attitudes and anxiety related to physics. A lack of interest in the subject can stem from fear and distractions caused by devices students bring into classrooms, leading to a diminished reading culture, particularly concerning physics textbooks. Scholars, such as Scholastica (2020) and Wigfield and Cambria (2010) have linked poor performance in physics with lack of enthusiasm. Tuaundu (2013) emphasised the importance of connecting physics materials with students' daily experiences, suggesting that exposure to advanced toys and games fosters greater interest in mathematics and sciences due to their enriched background knowledge.

Physics, despite its significance, often induces anxiety among senior high school students (Akinoso, 2013). This anxiety manifests as reduced confidence and negative attitudes toward the subject, potentially leading to poor performance. Anigbo and Idigo (2015) suggested that a student's interest is crucial for adapting to advanced learning in the subject. This indicates that foundational skills acquired in junior high school integrated science are pivotal for cultivating interest in physics at the senior high level. Hazari et al. (2010) proposed that fostering interest in integrated science can predict success in subsequent science courses, including physics. Research indicates that secondary school students perceive physics as challenging and uninteresting (Abraham, 2011; Bøe et al., 2011; Keller et al., 2017; Potvin & Hasni, 2014b; Thorley, 2014). Academic interest, as noted by Ackerman and Beier (2003), directs effort toward learning within a specific domain.

The rapid expansion of education in Ghana has significantly increased the demand for adequate learning facilities. A school's capacity to provide essential resources for teaching and learning profoundly impacts educational outcomes. These facilities encompass not only physical structures but also various systems, such as mechanical, electrical, security and fire suppression frameworks. Additionally, they include libraries, laboratories, stationery, workshops, textbooks, exercise books, and well-equipped classrooms. Well-maintained educational environments directly and indirectly influence the teaching and learning process (Woolner et al., 2007).

The availability of learning facilities is positively correlated with the quality of teaching and learning activities within a schools, thereby facilitating the achievement of educational objectives. Such facilities, as defined by Akomolafe and Adesua (2016), include materials that enhance effective learning, such as computers, libraries, internet access, microscopes, projectors and video CD players. Mwalyego (2014) emphasized that these resources are vital for classroom management. The dynamic environment created by the strategic use of learning facilities can lead to increased students' engagement, despite potential commotion from movement and interactions.

Despite the recognized importance of physics education for national development and technological innovation, there is a notable decline in students' interest in the subject, particularly during the transition to higher grade levels. While previous studies have identified various factors influencing this trend, such as teacher-related aspects, student-related factors and learning facilities, there is a paucity of research examining the collective impact of these variables on students' interest in learning physics. Understanding how these factors interact to affect students' engagement in physics is crucial in developing effective educational strategies. Therefore, this study sought to examine the collective influence of teachers, students and learning facilities-related factors on senior high school students' interest in learning physics in Ghana.

Theoretical Underpinning

The social cognitive theory of Bandura (1986), cited by Schunk and Usher (2012) is the foundation for this study. This theory views humans functioning as a series of reciprocal contacts between personal influences (such as thoughts and beliefs), environmental features (such as classrooms) and behaviors (such as self-regulation). This theory describes human learning in terms of the interactions with the environment as shown in Figure 1. The perspective of human agency, which holds that people are agents who are actively concerned with their turn of events and can make things happen by their actions is what supports the social cognitive theory (Velayutham, 2012). The fact that people have self-beliefs that provide them the ability to practice a certain behaviour is essential to this sense of agency. What people think, believe and feel influences how they behave (Velayutham, 2012).

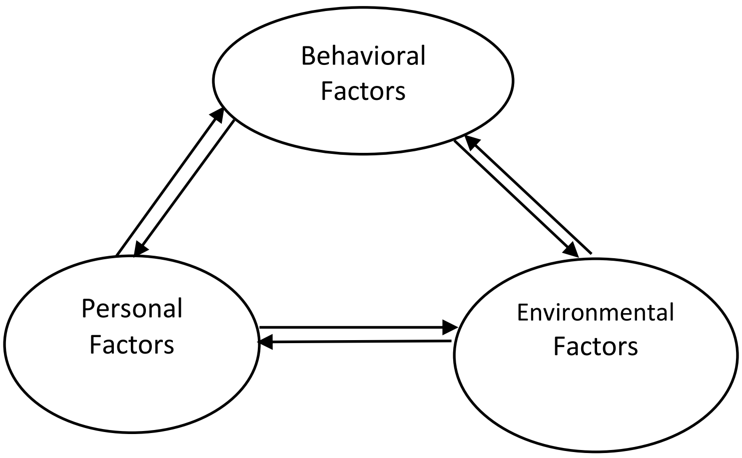

Figure 1. Social Cognitive Theory

Furthermore, as the central premise of social cognitive theory focuses on understanding an individual's reality, it proves especially beneficial when utilized alongside interventions aimed at enhancing personality aspects, such as interests. Utilizing social cognitive theory as a framework allows school administrators to modify school and classroom structures (learning facilities) that may hinder students' success and foster positive states to strengthen students' beliefs about themselves (student-related factors). Additionally, teachers can support students in developing their academic skills and interests in learning (teacher-related factors). Figure 1 presents a model of how teacher, student and learning facility-related factors influence students' interest in learning physics. In the framework, the independent variables include teacher-related factors, student-related factors and learning facilities, whereas the dependent variable is the students' interest in learning physics.

Methodology

This section presents the methodological approach adopted in the study. It explains the research design and provides a rationale for its selection. Additionally, it describes the target population and the sampling strategy used to select participants. The section further outlines the data collection process, detailing the instruments used and the procedures followed to gather information. Lastly, it highlights the data analysis techniques applied to examine the collected data.

Design

This study utilized the cross-sectional survey design. This design was chosen because it effectively analyses the relationships among variables at one point in time, making it ideal for examining how factors related to teachers, students and learning facilities collectively impact students' interest in learning physics (Cohen et al., 2017; Mitchell & Jolley, 2012). Additionally, the design facilitates the gathering of comprehensive data (Creswell, 2012).

Population and Sampling

The study focused on all second-year senior high school students enrolled in the general science program within the Accra Metropolis, located in the Greater Accra Region of Ghana, which had 23 public senior high schools. To select the participants, a stratified random sampling method was employed, ensuring a balanced representation of boys' schools, girls' schools, and mixed schools. The two girls' schools were included using a census while the boys' and mixed schools were selected through simple random sampling with the help of computer-generated random numbers.

In the selected schools, there was a total student population of 679, from which a sample of 498 students was drawn, using simple random sampling based on the Krejcie and Morgan's (1970) sampling size determination table. The study further examined various background characteristics of the students, such as gender, type of school and age. Out of the 482 respondents who participated, 291 were boys, representing 60.4% and 191 were girls. For the school types, 230 respondents (47.7%) were from boys' schools, 159 (33.0%) were from girls' schools and 93 (19.3%) were from mixed schools.

Regarding age distribution, three respondents (0.6%) were aged 13 to 14 years. A total of 186 respondents (38.6%) were in the 15 to 16 age range while the largest group consisting 276 respondents (57.3%) were between 17 and 18 years old. Additionally, 13 respondents (2.7%) fell within the 19 to 20 age range and four (0.8%) were 21 years old or older.

Instrumentation

The study used a five-point Likert scale questionnaire consisting of 62 items. These items were adapted from the works of Cheung (2018), Kivinen (2003) and Tuan et al. (2005) to align with the goals and context of this study. The questionnaire was divided into five sections: background information about the students (3 items), student-related factors (27 items), teacher-related factors (12 items), learning facilities (9 items) and students' interest in learning physics (11 items).

Validity and reliability

The instrument was evaluated by experts in the field to ensure its content validity. Following this, it was pilot-tested with 159 students from three senior high schools in the Cape Coast Metropolis, which were not included in the main study, to further confirm its validity and reliability. The participating schools in the pilot study consisted of one boys' school, one girls' school and one mixed school.

The reliability of the questionnaire was assessed using the Cronbach's Alpha, resulting in an overall reliability coefficient of .906. Additionally, the alpha coefficients were .897 for student-related factors, .909 for teacher-related factors, .838 for learning facilities and .900 for students' interest in learning physics. These coefficients indicate that the items demonstrate acceptable internal consistency (Cohen et al., 2017). The refined instrument was then distributed to participants at the selected schools for the main study.

Statistical Treatment of Data

Out of 498 questionnaire sheets distributed, 481 were considered valid following data entry and cleaning using the IBM SPSS version 25 software. To achieve the objectives of this study, a standard multiple regression analysis was conducted to examine how teacher-related factors, student-related factors and learning facilities impact senior high school students' interest in learning physics.

Ethical Consideration

The researchers obtained the informed consent. They respected the participants' autonomy while maintaining the anonymity and confidentiality of the information from the field. Participation was voluntary, without coercion. The information collected was used exclusively for academic purposes.

Results and Discussions

This section presents the findings. Initially, parametric assumptions regarding sample size, linearity, and independence of observations, normality, homoscedasticity and absence of multicollinearity were tested and no violations were observed. Again, no abnormalities in the cases were discovered, using the Mahalanobis distance's $p <$ .001 threshold. With N = 482, no cases had missing data and no suppressor variables were discovered. Once these conditions were satisfied, a standard multiple regression was conducted, using students' interest as the dependent variable, with student-related factors, teacher-related factors and learning facilities as independent variables. The model summary is provided in Table 1, and the analysis of variance results are also included in Table 2.

Table 1: Model Summary of the Independent and Dependent Variables

Model	R	R Square	Adjusted R^2	Std. Error of the Estimate
1	.604	.365	.361	.64054

a. Predictors: (Constant), student-related factors (SRF), teacher-related factors (TRF), learning facilities (LF)
b. Dependent variable: students' interest

Table 2: Analysis of Variance Results

Model		Sum of Squares	df	Mean Square	F	*p*
1	Regression	112.596	3	37.532	91.476	.000
	Residual	196.120	478	.410		
	Total	308.715	481			

a. Dependent variable: students' interest
b. Predictors: learning facilities, student-related and teacher-related factors.

Table 3: Standard Multiple Regression

Variable	Student interest (DV	SRF	TRF	LF	B	β	p
SRF	.54				.758	.464	.001
TRF	.39	.25			.280	.263	.001
LF	.20	.20	.21		.050	.055	.149*
Intercept						-.537	
Mean	3.88	4.18	3.96	2.86			
SD	.80	.49	.75	.88			

The study revealed that factors related to students, teachers, and learning facilities work together to influence students' interest in learning physics. These findings match with previous study findings which revealed that students' intellectual abilities, study skills and self-efficacy, combined with a teacher's knowledge of technology and pedagogy create a supportive learning environment that boosts students' interest in physics (Andyani et al., 2020). This further aligns with findings of Noohi et al. (2009), who revealed that students' skills make the learning process more engaging, which in turn increases students' interest and study time. Moreover, the findings echo Tuaundu's (2013) results, showing a strong correlation between physics content and students' everyday experiences. The findings supports Darling-Hammond's (2000) conclusion that teachers significantly influence students and play a crucial role in shaping the learners' interest in a subject.

Conclusions and Recommendations

Conclusions

This study highlights the predominant influence of student-related and teacher-related factors on students' interest in learning physics, revealing that these elements are significant compared to learning facilities. The findings suggest that simply having access to learning facilities does not automatically translate into increased interest. Consequently, the study contributes to the literature by emphasizing the need to understand the nuanced dynamics of students' and teachers' interaction in influencing educational outcomes.

Recommendations

Based on the findings, the following recommendations are suggested: The Ghana Education Service should prioritize the improvement of teacher professional development programs. These programs should equip teachers with innovative teaching strategies, specifically designed to engage students in physics, focusing on approaches that motivate students' curiosity and interest. Teachers should be encouraged to adopt collaborative learning methods in their classrooms. This approach will enable students to work together, exchange ideas and interact with physics concepts in a more engaging and meaningful manner, thereby enhancing their interest in the subject.

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