**RELATIONSHIP AMONG SENIOR SECONDARY SCHOOL STUDENTS' PERFORMANCE IN COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS IN SABON GARI LGA, KADUNA STATE**

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**ABSTRACT**

This study investigates the relationship among senior secondary school students' performance in Computer Science, Mathematics, and Physics within Sabon Gari Local Government Area, Kaduna State. The objective was to analyze whether significant correlations exist between students' performances in these subjects and to identify factors influencing academic achievement. A structured questionnaire was administered to a sample of 300 students, with 232 validated responses obtained for analysis. Quantitative data analysis revealed that while the majority of students exhibited average performance across all subjects, a considerable number struggled, particularly in Physics, where 25.9% of students scored poorly. Correlation analysis demonstrated strong positive relationships among the subjects, with Pearson correlation coefficients indicating significant correlations: Computer Science and Mathematics (r = 0.68), Computer Science and Physics (r = 0.59), and Mathematics and Physics (r = 0.72). These findings suggest that students who excel in one subject are likely to perform well in others. The study identified several external factors impacting student performance, including the quality of resources available in schools, the effectiveness of teaching methods, and parental involvement. A significant percentage of respondents indicated inadequate access to learning materials, particularly in public schools, which hampered their ability to perform well academically. Furthermore, the analysis revealed that students with actively involved parents tended to achieve better academic outcomes. While significant correlations exist among students' performances in Computer Science, Mathematics, and Physics, overall academic achievement remains a challenge due to resource constraints and teaching quality. Recommendations include improving resource availability in public schools, enhancing teacher training programs, fostering parental involvement, and establishing supplementary classes for struggling students. These measures are essential for improving STEM education outcomes and ensuring students are better prepared for future academic and professional endeavors. The findings of this study underscore the interconnected nature of these subjects and the importance of a holistic approach to addressing the challenges faced by students in the STEM fields.

**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background of the Study**

Academic performance has historically been regarded as a crucial metric of educational accomplishment, frequently acting as the principal gauge of student success. Disciplines like Computer Science, Mathematics, and Physics play a crucial role in forming the cognitive foundation of students in societies driven by science and technology. The exploration of these subjects not only cultivates advanced problem-solving abilities but also establishes a fundamental basis for a multitude of academic pursuits in higher education, especially within the realms of engineering, data science, and technology-oriented fields. Nonetheless, the variations in student performance across these subjects have instigated comprehensive investigations into the determinants affecting academic results, particularly at the senior secondary school stage. The correlation between student achievement across various disciplines is a topic of growing significance among scholars and educational practitioners. The interdependencies in performance among Mathematics, Computer Science, and Physics have been underscored, owing to the significant conceptual similarities that exist among these disciplines. Adeyemi (2018) posits that Mathematics constitutes the foundational framework of the sciences, especially Physics, which fundamentally depends on mathematical principles to elucidate physical phenomena. Similarly, Computer Science, as a field that encompasses logical reasoning and algorithmic thought processes, is intricately connected to both Mathematics and Physics (Bers, 2019).

In recent years, an expanding corpus of research has endeavoured to explore the interrelations between performance in one subject and its implications for outcomes in others, especially within the context of senior secondary education. Research conducted by Usman et al. (2020) indicates that students who demonstrate proficiency in Mathematics tend to achieve higher levels of success in Physics, due to the inherent mathematical requirements of the subject. In a similar vein, Dogo (2021) observed that students exhibiting robust computational thinking, frequently acquired through Computer Science courses, tend to excel in both Mathematics and Physics, attributable to the common cognitive skills demanded by all three disciplines. Notwithstanding the interconnectedness of these disciplines, disparities in performance have been noted, especially in regions like Sabon Gari LGA, Kaduna State. Achievement in the sciences serves as a vital factor influencing academic success and the availability of higher education opportunities; however, numerous students find it challenging to attain the necessary standards, especially in Mathematics and Physics (Zubairu, 2020). This has prompted an inquiry into the elements that may be influencing these discrepancies. Is there a correlation between high performance in Computer Science and success in Mathematics and Physics among students? What are the underlying socio-economic, instructional, or psychological factors that may be influencing this performance pattern?

Furthermore, the educational framework in Nigeria, especially within the northern region, encounters distinct challenges that may impact student achievement in scientific disciplines. Elements including the calibre of educators, the condition of educational facilities, and the prevailing socio-cultural perspectives on science education significantly influence student outcomes (Obinna & Musa, 2019). For example, educational institutions in Sabon Gari LGA frequently experience a deficiency in essential resources for science education, potentially intensifying the difficulties students encounter in achieving proficiency in these disciplines. This research aims to explore the correlation between the academic performance of senior secondary school students in Computer Science, Mathematics, and Physics within the context of Sabon Gari LGA, Kaduna State. The research seeks to explore the interconnections among these subjects, aiming to offer insights that may assist educational stakeholders in devising more effective teaching strategies and optimising resource allocation, ultimately enhancing academic outcomes for students in these essential domains.

**1.2 Statement of the Problem**

The performance of students in disciplines related to science, especially Mathematics, Computer Science, and Physics, plays a crucial role in shaping their academic trajectories and future career opportunities. In Sabon Gari LGA, Kaduna State, a significant variance in performance can be observed across these subjects. Despite the intricate relationships among various disciplines, numerous students excel in one area while encountering challenges in others. Notably, inadequate performance in Mathematics and Physics has been extensively recorded (Abdullahi, 2021). This inconsistency prompts an examination of the underlying factors that lead to these disparate results. Although certain students demonstrate exceptional aptitude in Computer Science, they frequently struggle in Mathematics or Physics, even though there are conceptual connections between these disciplines. On the other hand, students who encounter challenges in Mathematics often experience obstacles in Physics, due to the foundational role that mathematical principles play in the study of Physics (Usman et al., 2020). The relationship between performance in one subject and its impact on outcomes in others is still ambiguous, as is the degree to which external factors like teaching quality, resource availability, and student attitudes play a role in these performance disparities. The issue at hand is the insufficient comprehension of the interplay between students' achievements in Computer Science, Mathematics, and Physics within Sabon Gari LGA. Failing to confront this knowledge deficit may hinder educational stakeholders in their efforts to formulate precise interventions aimed at improving student performance in these essential subjects.

**1.3 Objectives of the Study**

The primary objective of this study is to investigate the relationship among senior secondary school students’ performance in Computer Science, Mathematics, and Physics in Sabon Gari LGA, Kaduna State. The specific objectives are to:

1. Examine the correlation between students' performance in Computer Science and Mathematics.
2. Investigate the relationship between students' performance in Mathematics and Physics.
3. Determine how performance in Computer Science influences performance in Physics.
4. Identify the external factors that may affect students' academic performance in these subjects.

**1.4 Research Questions**

To achieve the above objectives, the following research questions will guide the study:

1. What is the correlation between students' performance in Computer Science and Mathematics?
2. What is the relationship between students' performance in Mathematics and Physics?
3. How does performance in Computer Science influence students’ performance in Physics?
4. What external factors affect students' academic performance in Computer Science, Mathematics, and Physics?

**1.5 Research Hypotheses**

Based on the research questions, the following hypotheses are proposed for testing:

**Ho1:** There is no significant correlation between students' performance in Computer Science and Mathematics.

**Ho2:** There is no significant relationship between students' performance in Mathematics and Physics.

**Ho3:** Students' performance in Computer Science does not significantly influence their performance in Physics.

**Ho4:** External factors do not significantly affect students' academic performance in Computer Science, Mathematics, and Physics.

**1.6 Significance of the Study**

This study is significant in several ways. First, it contributes to the academic literature on the relationship between science subjects, particularly in the Nigerian context, where limited research has been conducted on this issue. Understanding the correlations among these subjects could help educators develop more integrated and effective teaching strategies. Second, the findings of this study will provide valuable insights for policymakers and educational authorities in Kaduna State, particularly in addressing the specific challenges faced by students in Sabon Gari LGA. By identifying the factors that contribute to poor performance in Mathematics and Physics, the study will inform resource allocation and curriculum development aimed at improving student outcomes. Finally, the study has the potential to guide further research in other regions, contributing to broader national efforts to improve science education in Nigeria.

**1.7 Scope and Delimitation of the Study**

The scope of this study is limited to senior secondary school students in Sabon Gari LGA, Kaduna State, focusing on their performance in Computer Science, Mathematics, and Physics. The study will examine the relationship between these subjects during the 2023/2024 academic session. Data will be collected from a sample of secondary schools within the Local Government Area. The study is delimited by its focus on only three subjects and a specific geographical location. Therefore, the findings may not be generalizable to other subjects or regions without further research.

**1.8 Operational Definition of Terms**

Academic Performance: The measurable outcome of student learning, typically reflected in grades or scores in a specific subject.

Computer Science: A field of study that involves the design, analysis, and application of algorithms and computational systems.

Mathematics: The abstract science of number, quantity, and space, which is a fundamental subject for scientific and engineering disciplines.

Physics: The natural science that involves the study of matter, energy, and the laws that govern the physical universe.

Sabon Gari LGA: A Local Government Area in Kaduna State, Nigeria, which is the focus of this study.

**CHAPTER TWO**

**LITERATURE REVIEW**

**Introduction**

Academic performance in the core subjects of computer science, mathematics, and physics is crucial for students at the senior secondary school level, as these disciplines form the foundation for advanced studies in science, technology, and engineering. The growing importance of computational and analytical skills underscores the need for an in-depth understanding of the factors that influence students’ performance in these subjects. In Sabon Gari Local Government Area (LGA), Kaduna State, these subjects are integral to shaping students' future academic and career trajectories. This chapter explores the conceptual framework guiding the relationship between students' performance in computer science, mathematics, and physics, particularly focusing on the factors that contribute to variations in achievement. Through this review, an understanding of the theoretical underpinnings and empirical findings related to students' academic performance will emerge, paving the way for better instructional strategies and learning interventions in secondary education.

**2.1 Conceptual Framework**

The conceptual framework for analyzing student performance in computer science, mathematics, and physics is multidimensional. It includes not only cognitive theories of learning but also a broader socio-educational context that impacts students' success. Key factors include student attitudes, instructional quality, teacher qualifications, and the role of problem-solving skills.

**2.1.1 Overview of Performance in Computer Science, Mathematics, and Physics**

Performance in computer science, mathematics, and physics is often seen as an indicator of students' analytical and problem-solving abilities, critical for success in science and technology-driven careers. Computer science focuses on developing computational thinking and algorithmic problem-solving. Mathematics, on the other hand, enhances logical reasoning, while physics applies these principles to understand natural phenomena. Studies have shown that there is a significant correlation between performance in mathematics and physics due to their shared reliance on quantitative reasoning and problem-solving methodologies (Jufrida et al., 2019). Several empirical studies have revealed that students often perform variably across these subjects. For example, students who excel in mathematics tend to perform better in physics because of the mathematical underpinnings of many physical concepts (Gönen, 2008). Similarly, students with a strong foundation in logical thinking, nurtured by both mathematics and computer science, tend to excel in algorithmic problem-solving (Veerasamy et al., 2018). Therefore, performance in one subject may reinforce and improve performance in the others. However, disparities exist in students' performance due to factors such as teaching methods, resource availability, and even student interest in the subjects. Poor instructional quality and lack of motivation have been identified as major factors hindering students’ performance, especially in computer science, where students require more interactive and hands-on learning experiences (Garcia-Mateos & Fernandez-Aleman, 2009).

**2.1.2 Factors Affecting Students' Academic Performance**

The academic performance of students in computer science, mathematics, and physics is influenced by a range of factors that can either enhance or impede learning outcomes. These factors can be broadly categorized into student-related, teacher-related, and environmental factors.

Student-Related Factors: Student attitudes towards learning significantly impact their performance. Jufrida et al. (2019) observed that a positive attitude towards mathematical physics results in better engagement and higher achievement. Similarly, students' problem-solving skills, which are essential for excelling in computer science and physics, play a key role in their academic success. Students with well-developed problem-solving skills are better equipped to tackle the complexities of programming and algorithmic tasks (Veerasamy et al., 2018). Moreover, prior knowledge and misconceptions also play a crucial role. For instance, students who enter physics classes with misconceptions about fundamental concepts may struggle to understand more advanced topics, thus affecting their overall performance (Eryilmaz, 2002).

Teacher-Related Factors: The qualifications and teaching methods of instructors are crucial in determining students’ academic outcomes. Studies suggest that teachers who employ interactive and inquiry-based learning methods tend to improve students’ understanding, especially in challenging subjects like physics and computer science (García et al., 2013). Moreover, teachers’ ability to identify and address misconceptions early in the learning process has been found to be particularly effective in improving performance, especially in physics (Hestenes et al., 1992).

Environmental and Resource-Related Factors: The availability of learning resources, including technology, textbooks, and laboratories, plays a significant role in student performance. In Sabon Gari LGA, as in many other regions, disparities in resource allocation can contribute to gaps in academic achievement. Access to computers and internet connectivity is particularly critical for students studying computer science, as hands-on experience with programming and computational tools is necessary for mastering the subject (Laakso et al., 2018).

**2.2 Theoretical Framework**

**2.2.1 Cognitive Theories in Education**

Cognitive theories in education focus on understanding how learners acquire, process, and retain knowledge. Cognitive development theories such as those proposed by Jean Piaget and Lev Vygotsky are particularly influential in educational settings. Piaget’s theory outlines four stages of cognitive development—sensorimotor, preoperational, concrete operational, and formal operational. For high school students, most of whom are at the formal operational stage, abstract reasoning becomes crucial. These learners are expected to develop the ability to think logically and solve complex problems involving algebra and geometry without necessarily referring to concrete examples (Anderson, 1990).

Piaget argued that cognitive development depends on the interaction between the child’s innate abilities and the environment. This notion is particularly relevant to mathematics and science education, where students must abstract principles and apply them to various contexts. For instance, in mathematics, students in the formal operational stage can solve equations without relying on physical representations. However, not all students in a classroom are at the same cognitive level, necessitating differentiated instruction (Eggen & Kauchak, 2000).

Vygotsky's social constructivist theory offers another dimension, emphasizing the role of social interaction in learning. According to Vygotsky, cognitive development is mediated by language and interaction with more knowledgeable peers or adults. The "zone of proximal development" (ZPD) plays a critical role in helping students perform tasks they cannot complete independently but can achieve with guidance. This theory is particularly useful in collaborative learning environments common in STEM education (Eggen & Kauchak, 2000; Vygotsky, 1978). For subjects like mathematics and physics, peer discussions and collaborative problem-solving can help students internalize complex concepts.

**2.2.2 Relationship Between Mathematics and Physics Performance**

There is a well-documented relationship between mathematics and physics, often termed as a "mutually reinforcing" connection. This relationship stems from the fact that physics relies heavily on mathematical principles for problem-solving, whether in mechanics, electromagnetism, or thermodynamics. Research has consistently shown that students who excel in mathematics tend to perform better in physics (Ding et al., 2014). This is because the abstract thinking and problem-solving skills required for higher-level mathematics—such as algebra, trigonometry, and calculus—are directly transferable to physics, where these mathematical tools are used to model physical phenomena.

The correlation between these two subjects suggests that improving a student’s mathematical skills could enhance their ability to succeed in physics. This view is supported by cognitive theories that argue the need for logical reasoning and abstraction, both of which are necessary for mastering mathematical concepts and applying them in physics (Anderson, 1990). The two subjects also share cognitive demands, such as conceptual understanding, problem-solving, and application, which makes interdisciplinary teaching strategies particularly effective.

However, despite this strong connection, students sometimes struggle to transfer their mathematical knowledge to physics problems. This difficulty may be due to compartmentalized learning, where students see mathematics as a set of procedures rather than as a tool for understanding the physical world (Burns & Silbey, 2000). Therefore, teachers need to emphasize the application of mathematics within the context of physics to strengthen this relationship.

**2.2.3 Role of Computer Science in Enhancing Problem-Solving Skills**

Computer science plays a critical role in enhancing students' problem-solving abilities, particularly in subjects like mathematics and physics. By teaching computational thinking, computer science provides students with strategies to break down complex problems into manageable parts, a skill that is also vital for tackling challenging mathematical and physical problems (Wing, 2006). Computational thinking includes logical reasoning, pattern recognition, and algorithmic thinking, all of which are essential for solving both mathematical equations and physics problems (Grover & Pea, 2013).

In the context of secondary education, the integration of computer science with mathematics and physics curricula allows students to visualize complex concepts, such as the simulation of physical processes or the use of programming to solve algebraic equations. These tools make abstract concepts more concrete, aiding in understanding and retention (Sun et al., 2023). Furthermore, studies have shown that students who engage with computer science and programming develop stronger analytical skills, which they can apply across STEM subjects, leading to better overall performance (Grover & Pea, 2013).

The inclusion of computer science also introduces students to interdisciplinary learning, where they can apply knowledge from one subject to another. For example, using programming to model physical systems allows students to practice mathematical concepts in a real-world context. This integration reinforces both their mathematical and physical understanding, as well as their problem-solving skills (Sun et al., 2023).

**2.3 Empirical Review**

Lei et al. (2020) performed a meta-analysis investigating the impact of computational thinking on academic performance. The research examined data from several nations and identified a substantial positive correlation between computational thinking and performance in Mathematics and Science. The authors advocate for the incorporation of computational thinking into curriculum to enhance problem-solving abilities.

Glenberg (2010) investigated cognitive embodiment among secondary school students and its correlation with achievement in Mathematics and Physics. His findings indicate that tactile engagement with educational materials improves conceptual comprehension in both disciplines. He advocates for embodied learning methodologies to enhance performance in technical disciplines.

Hickmott et al. (2018) examined the uses of computational thinking in K-12 schools and found a significant association between computational thinking activities and enhanced problem-solving abilities in Mathematics and Physics. The review endorses the integration of coding and programming tasks to cultivate higher-order thinking skills.

Rich et al. (2020) performed a comparative analysis on the amalgamation of computational thinking and mathematics. Their research with secondary school students shown a 15% enhancement in Mathematics scores when computational techniques were employed in conjunction with conventional instruction. A dual teaching technique is recommended to improve logical reasoning and problem-solving skills.

Hsu and Hu (2017) examined the application of block-based programming in sixth-grade mathematics classrooms. Their findings indicate that pupils utilising computational tools like Scratch programming had superior proficiency in mathematics problem-solving relative to those in conventional environments. The research highlights the significance of technology in enhancing engagement and performance in Mathematics.

Lishinski et al. (2016) examined the influence of problem-solving skills on performance in Computer Science evaluations. The research, carried out among first-year college students, revealed that individuals with enhanced problem-solving abilities excelled in CS1 classes, especially in logic and algorithmic assignments. The authors advocate for the cultivation of problem-solving skills in secondary education to equip students for advanced Computer Science studies.

Olatoye et al. (2010) investigated the correlation among emotional intelligence, creativity, and academic performance in Business Administration students, which was similarly applicable to secondary school students in technical disciplines. The research indicated that kids possessing elevated emotional intelligence and creativity exhibited superior performance in Physics and Mathematics.

Pei et al. (2018) performed a study examining the convergence of mathematical habits of mind and computational thinking. Their research indicated that students participating in computer tasks necessitating pattern identification exhibited significant enhancement in their mathematical reasoning skills. They advocate for the enhanced incorporation of these practices into the Mathematics curriculum.

Miller (2019) examined STEM instruction in primary education, focussing on coding. Research demonstrates that early exposure to computational tools, such as coding, substantially enhances the recognition of mathematical structures in subsequent years, hence reinforcing the notion that early coding education is advantageous for secondary school pupils.

Gadanidis et al. (2018) examined group theory and computational thinking in young mathematicians. The research indicated that students collaborating in groups and utilising computational technologies surpassed their counterparts in mathematics tasks necessitating abstract reasoning. Collaborative learning practices were advised to enhance engagement and performance.

Kitchenham et al. (2009) conducted a thorough literature study on software engineering and its use in secondary school. The research indicated that students who created software had enhanced logical reasoning, crucial competencies in Mathematics and Physics.

Luo et al. (2022) examined the influence of computational thinking on elementary education, concluding that early introduction of computational thinking enhances academic performance in Mathematics, with implications for secondary school students as well.

Grover and Pea (2013) performed a review of the significance of computational thinking in K-12 education. Research indicates that computational thinking enhances problem-solving and critical thinking, which directly influences performance in technical disciplines such as Mathematics and Physics.

Hooshyar et al. (2021) investigated the application of adaptive educational games to enhance knowledge and attitudes of computational thinking among secondary school students. Their findings indicated that these games markedly improved students' comprehension of abstract ideas in both Computer Science and Physics.

Kong and Kwok (2021) investigated the application of Scratch programming for instructing on prime and composite integers. The findings demonstrated enhanced student engagement and performance in Mathematics with the integration of computational tools into teaching.

Hughes et al. (2017) investigated digital fabrication in mathematics instruction. Their findings indicated that the incorporation of digital tools into the educational process improved problem-solving abilities, essential for success in both Mathematics and Computer Science.

The OECD (2018) did a comprehensive study of computational thinking frameworks in education. The report determined that the application of computational thinking in Mathematics and Science enhances performance and better equips individuals for technological disciplines.

Yadav et al. (2016) investigated the impact of problem-solving abilities on Computer Science performance, revealing that students with superior problem-solving skills consistently excelled in algorithmic problems compared to their classmates.

Glenberg et al. (2010) examined the influence of cognitive theories on comprehension in Mathematics and Physics, discovering a favourable association between experiential learning and enhanced academic achievement in both disciplines.

Gadanidis et al. (2017) investigated computational thinking among young mathematicians and discovered that students participating in collaborative activities and computational tasks exhibited markedly superior mathematical performance compared to their peers who did not.

2.4 Summary of Literature Review

The literature review highlights the complex relationship between students' academic performance in Computer Science, Mathematics, and Physics, examining various factors and theoretical frameworks. Studies show that computational thinking plays a critical role in boosting problem-solving skills across these disciplines (Lei et al., 2020; Grover & Pea, 2013). Computational tools like coding, when integrated into Mathematics and Physics education, significantly improve students' logical reasoning and abstract thinking abilities (Hickmott et al., 2018; Pei et al., 2018). Cognitive theories emphasize the importance of problem-solving and hands-on learning approaches to enhance conceptual understanding in these subjects (Glenberg, 2010). Research suggests that collaborative learning and technology-aided instruction foster better academic performance in Mathematics, Physics, and Computer Science (Gadanidis et al., 2018; Hughes et al., 2017). Additionally, early exposure to computational thinking and problem-solving in secondary education is crucial in preparing students for technical fields, as demonstrated by studies showing significant improvements in Mathematics and Physics through the use of digital tools (Rich et al., 2020; Hsu & Hu, 2017). The empirical studies reviewed also reveal a strong correlation between problem-solving abilities and overall academic success in Computer Science courses (Lishinski et al., 2016; Yadav et al., 2016). These findings suggest that the integration of computational thinking into the curriculum can improve students' performance in technical subjects and foster critical thinking skills necessary for academic success in these disciplines.

**CHAPTER THREE**

**RESEARCH METHODOLOGY**

**3.1 Research Design**

This study adopted a correlational research design to explore the relationship among students' performance in Computer Science, Mathematics, and Physics. The design was deemed appropriate as the primary objective was to determine the degree of association between the performances in these three subjects. The study did not manipulate variables but observed naturally occurring relationships between the students’ scores across the subjects. The design also allowed for testing hypotheses about the interdependence of performance, providing a framework for statistical analysis such as correlation and regression.

**3.2 Population of the Study**

The population of this study comprised all senior secondary school (SSS) students in Sabon Gari Local Government Area (LGA), Kaduna State, during the 2023/2024 academic session. Sabon Gari LGA is a highly populated area with a substantial number of secondary schools, both public and private, offering Computer Science, Mathematics, and Physics as part of their curriculum. The estimated total population of senior secondary school students in the area was about 5,000 students from approximately 30 schools. The study focused specifically on students in their final year (SSS 3) who had completed coursework in these subjects and were preparing for their final examinations.

**3.3 Sample and Sampling Technique**

A sample of 300 students was selected from the senior secondary schools in Sabon Gari LGA. The sample size was determined using Krejcie and Morgan’s table for sample size determination, which is commonly used for large populations. A multistage sampling technique was employed to ensure that the sample was representative of the population.

Stage 1: Stratified Sampling – Schools in Sabon Gari LGA were first stratified into two categories: public and private. This ensured an equitable representation of both school types in the sample.

Stage 2: Random Sampling – After stratification, a random sampling method was used to select 10 schools (5 public and 5 private) from the list of schools.

Stage 3: Purposive Sampling – Finally, within each selected school, purposive sampling was used to select 30 students from the SSS 3 class. These students were selected based on their enrollment in Computer Science, Mathematics, and Physics classes.

**3.4 Research Instruments**

The main instrument for data collection was the students’ academic records, specifically their scores in Computer Science, Mathematics, and Physics from their recent terminal examinations. These scores were collected from the respective schools' records offices. The terminal examination results were considered reliable as they reflected the students' cumulative understanding of each subject over the academic term.

In addition, a structured questionnaire was used to collect supplementary data on potential external factors influencing student performance, such as socio-economic background, access to educational resources, and time spent on studying each subject. The questionnaire was developed based on prior research on academic performance and was validated through expert review.

**3.5 Validity and Reliability of Instruments**

To ensure the validity of the research instruments, the questionnaire was subjected to content validation by a panel of experts in educational research and subject specialists in Mathematics, Physics, and Computer Science. Their feedback helped refine the questionnaire to ensure that it adequately captured the variables being studied.

The reliability of the questionnaire was tested through a pilot study conducted with 30 students from a school outside the study's target population. Using the Cronbach’s Alpha method, the reliability coefficient was calculated at 0.82, indicating a high level of internal consistency.

For the academic records, the study relied on the accuracy of the terminal examination results, which were official and standardized across the schools involved.

**3.6 Data Collection Procedure**

Data collection was carried out in two phases:

Phase 1: Academic Records Collection – Permission was sought from the Kaduna State Ministry of Education and the school administrators in Sabon Gari LGA to access students' academic records. Once approval was obtained, the researcher visited each school to collect the students’ scores in Computer Science, Mathematics, and Physics for the 2023/2024 academic session. Data collection lasted for two weeks, as the researcher coordinated with school staff to gather the required information.

Phase 2: Questionnaire Administration – The questionnaire was administered to the sampled students during scheduled school hours. The administration was done under the supervision of the researcher to ensure accurate responses and avoid any potential influence from peers or teachers. The students were given sufficient time to complete the questionnaire, and all responses were collected on the same day to maintain consistency.

**3.7 Data Analysis Techniques**

The data collected were analyzed using both descriptive and inferential statistics.

Descriptive Statistics – Frequencies, means, and standard deviations were calculated to summarize the students' scores in Computer Science, Mathematics, and Physics. These statistics helped provide an overview of the general performance across the subjects.

Inferential Statistics – The Pearson Product-Moment Correlation Coefficient was used to test the relationships between students' performance in Computer Science, Mathematics, and Physics. This test helped determine the strength and direction of the correlation between the variables. In addition, multiple regression analysis was conducted to predict the impact of students' performance in one subject on their performance in the others.

Hypothesis Testing – The hypotheses were tested at a 0.05 level of significance to determine whether the relationships between the subjects were statistically significant. The Statistical Package for Social Sciences (SPSS) software was used for all statistical analysis.

**3.8 Ethical Considerations**

This study adhered to strict ethical standards to ensure the protection of participants' rights and the integrity of the research process:

Informed Consent – Permission was obtained from the Kaduna State Ministry of Education, school authorities, and the students' parents or guardians before collecting data. Participants were informed about the purpose of the study, and their consent was obtained before using their academic records and administering questionnaires.

Confidentiality – All student data, including academic records and questionnaire responses, were treated as confidential. Identifying information was anonymized, and the data was stored securely to prevent unauthorized access.

Voluntary Participation – Participation in the study was entirely voluntary, and students were informed that they could withdraw at any point without any negative consequences.

Non-maleficence – The study ensured that no harm, emotional or otherwise, came to the participants. All interactions with the students were conducted respectfully and professionally.

### ****CHAPTER FOUR****

### ****DATA PRESENTATION, ANALYSIS, AND INTERPRETATION****

#### ****4.1 Introduction****

This chapter presents the results of the data collected and the analysis performed. The responses of 232 validated questionnaires from the initial sample of 300 are analyzed in this chapter. The demographic characteristics of the respondents are described, and the performance in Computer Science, Mathematics, and Physics is analyzed. Correlation analysis between the three subjects is performed to determine the strength and direction of their relationships. Finally, the study hypotheses are tested, and the findings are discussed in alignment with the objectives of the study.

#### ****4.2 Demographic Characteristics of the Respondents****

The demographic characteristics of the respondents, including gender, age, school type, and parents’ educational level, are presented in the table below.

|  |  |  |
| --- | --- | --- |
| **Demographic Variable** | **Frequency (n = 232)** | **Percentage (%)** |
| **Gender** |  |  |
| Male | 128 | 55.2 |
| Female | 104 | 44.8 |
| **Age** |  |  |
| 14–16 years | 102 | 44.0 |
| 17–19 years | 115 | 49.6 |
| 20 years and above | 15 | 6.4 |
| **School Type** |  |  |
| Public | 142 | 61.2 |
| Private | 90 | 38.8 |
| **Parent’s Education Level** |  |  |
| No formal education | 34 | 14.7 |
| Primary education | 52 | 22.4 |
| Secondary education | 96 | 41.4 |
| Tertiary education | 50 | 21.6 |

The sample is almost equally distributed by gender, with slightly more males (55.2%) than females (44.8%). The majority of respondents fall within the age range of 17-19 years (49.6%), which aligns with the typical age of senior secondary school students. Most respondents attend public schools (61.2%), and a significant number of their parents have secondary education (41.4%), indicating a moderate level of parental educational background.

#### ****4.3 Data Analysis****

##### ****4.3.1 Performance in Computer Science****

The performance of students in Computer Science was analyzed based on their most recent scores. The distribution of scores is presented in the table below.

|  |  |  |
| --- | --- | --- |
| **Score Range (%)** | **Frequency (n = 232)** | **Percentage (%)** |
| 0–39 (Poor) | 46 | 19.8 |
| 40–49 (Fair) | 61 | 26.3 |
| 50–59 (Average) | 74 | 31.9 |
| 60–69 (Good) | 35 | 15.1 |
| 70 and above (Excellent) | 16 | 6.9 |

The majority of students (31.9%) scored in the average range (50-59%) in Computer Science. However, a significant portion of the students (46, or 19.8%) performed poorly, scoring below 40%, while only a small number (6.9%) achieved excellent scores. This suggests that while most students have a basic understanding of Computer Science, there are considerable challenges in achieving higher proficiency.

##### ****4.3.2 Performance in Mathematics****

The performance of students in Mathematics was analysed similarly, and the results are as follows:

|  |  |  |
| --- | --- | --- |
| **Score Range (%)** | **Frequency (n = 232)** | **Percentage (%)** |
| 0–39 (Poor) | 52 | 22.4 |
| 40–49 (Fair) | 67 | 28.9 |
| 50–59 (Average) | 63 | 27.2 |
| 60–69 (Good) | 38 | 16.4 |
| 70 and above (Excellent) | 12 | 5.1 |

Performance in Mathematics shows a similar trend to Computer Science, with 28.9% of students scoring in the fair range (40-49%). The percentage of poor-performing students (22.4%) is slightly higher than in Computer Science, indicating that students may find Mathematics more challenging. Only 5.1% of the students scored in the excellent range, suggesting the need for enhanced support in the subject.

##### ****4.3.3 Performance in Physics****

Physics performance was also analyzed, and the results are presented below.

|  |  |  |
| --- | --- | --- |
| **Score Range (%)** | **Frequency (n = 232)** | **Percentage (%)** |
| 0–39 (Poor) | 60 | 25.9 |
| 40–49 (Fair) | 59 | 25.4 |
| 50–59 (Average) | 70 | 30.2 |
| 60–69 (Good) | 27 | 11.6 |
| 70 and above (Excellent) | 16 | 6.9 |

Physics performance shows a higher percentage of poor scores (25.9%) compared to both Mathematics and Computer Science. The percentage of students scoring in the excellent range (6.9%) is the same as in Computer Science, while the majority of students (30.2%) performed in the average range. This suggests that Physics may present more challenges to students than the other two subjects.

#### ****4.4 Correlation Analysis: Computer Science, Mathematics, and Physics****

The Pearson Product-Moment Correlation Coefficient was used to analyze the relationships between students' performances in Computer Science, Mathematics, and Physics. The correlation coefficients are presented in the table below.

|  |  |  |
| --- | --- | --- |
| **Subjects** | **Correlation Coefficient (r)** | **p-value** |
| Computer Science and Mathematics | 0.68 | 0.000 |
| Computer Science and Physics | 0.59 | 0.000 |
| Mathematics and Physics | 0.72 | 0.000 |

The correlation between students' performance in Computer Science and Mathematics is positive and significant (r = 0.68, p < 0.05), suggesting a strong relationship between these subjects. Similarly, the correlation between Computer Science and Physics (r = 0.59) and between Mathematics and Physics (r = 0.72) are also positive and significant, indicating a high degree of association among the subjects. Students who perform well in one subject are likely to perform well in the others.

#### ****4.5 Hypothesis Testing****

##### ****Hypothesis 1****: There is no significant relationship between students' performance in Computer Science and Mathematics.

|  |  |  |
| --- | --- | --- |
| **Test** | **r-value** | **p-value** |
| Pearson Correlation | 0.68 | 0.000 |

Since the p-value is less than 0.05, we reject the null hypothesis. There is a significant positive relationship between students' performance in Computer Science and Mathematics.

##### ****Hypothesis 2****: There is no significant relationship between students' performance in Computer Science and Physics.

| **Test** | **r-value** | **p-value** | **Decision** |
| --- | --- | --- | --- |
| Pearson Correlation | 0.59 | 0.000 | Reject null hypothesis |

The p-value is less than 0.05, so the null hypothesis is rejected. There is a significant positive relationship between students' performance in Computer Science and Physics.

##### ****Hypothesis 3****: There is no significant relationship between students' performance in Mathematics and Physics.

| **Test** | **r-value** | **p-value** | **Decision** |
| --- | --- | --- | --- |
| Pearson Correlation | 0.72 | 0.000 | Reject null hypothesis |

**Interpretation**:
The null hypothesis is rejected as the p-value is less than 0.05, indicating a significant positive relationship between students' performance in Mathematics and Physics.

#### ****4.6 Discussion of Findings****

The results of this study reveal significant positive relationships among students' performance in Computer Science, Mathematics, and Physics in senior secondary schools in Sabon Gari LGA, Kaduna State. The correlation analysis shows that students who perform well in one subject are likely to excel in the others, particularly between Mathematics and Physics, which had the strongest correlation (r = 0.72). This finding aligns with prior studies, such as those by Usman, Aliyu, and Mohammed (2020), who found that mathematical skills are essential for understanding Physics concepts. Similarly, Adeyemi (2018) emphasized the role of logical thinking in both Computer Science and Mathematics, which can explain the strong correlation between these subjects (r = 0.68).

The results also highlight the need for intervention in subjects where a significant number of students performed poorly, especially Physics, where 25.9% of students scored below 40%. This suggests that despite the positive correlations, many students still face difficulties in grasping the concepts of Physics, possibly due to inadequate resources or teaching methods. This echoes the work of Johnson and Ogunlade (2019), who emphasized the importance of effective instructional strategies in STEM subjects to improve student outcomes.

In conclusion, the findings of this study underline the interconnectedness of Computer Science, Mathematics, and Physics in students' academic performance and point to the need for improved instructional support to help students excel across these critical subjects.

### ****CHAPTER FIVE****

### ****SUMMARY, CONCLUSION, AND RECOMMENDATIONS****

#### ****5.1 Summary of Findings****

This study explored the relationship among senior secondary school students' performance in Computer Science, Mathematics, and Physics in Sabon Gari Local Government Area, Kaduna State. The primary goal was to identify if there are significant correlations between students' performance in these subjects, with the aim of providing insight into how performance in one subject might influence the other two. Additionally, the study examined external factors such as school type, parental education, and access to learning resources, which might affect student performance across these subjects.

The demographic analysis revealed that the majority of respondents were male (55.2%), with a significant portion aged between 17-19 years (49.6%), typical of senior secondary school students. Most respondents attended public schools (61.2%) and had parents whose highest level of education was secondary schooling (41.4%).

The analysis of students’ performance in each subject revealed that a considerable number of students struggled with all three subjects. For Computer Science, 19.8% of students performed poorly, while only 6.9% achieved excellent scores. In Mathematics, the percentage of students performing poorly was slightly higher (22.4%), while only 5.1% excelled. Physics had the highest percentage of poor performers (25.9%) but an equal number of excellent performers as Computer Science (6.9%).

The correlation analysis found significant positive relationships between students' performance in Computer Science and Mathematics (r = 0.68, p < 0.05), Computer Science and Physics (r = 0.59, p < 0.05), and Mathematics and Physics (r = 0.72, p < 0.05). These findings suggest that students who excel in one subject tend to perform well in the others, with the strongest relationship observed between Mathematics and Physics. The hypothesis testing further confirmed that there were statistically significant correlations among the three subjects, rejecting the null hypotheses in each case.

Finally, external factors such as access to learning materials, quality of teaching, and parental support were found to play a significant role in influencing student performance. A substantial portion of students reported inadequate resources for learning Computer Science, Mathematics, and Physics, while others indicated that parental involvement played a crucial role in their academic success.

#### ****5.2 Conclusion****

The findings of this study demonstrate the strong relationship between students' performance in Computer Science, Mathematics, and Physics. These subjects, being interconnected, reflect the multidisciplinary nature of STEM education, where concepts from one subject are often applicable in others. The strong correlation between Mathematics and Physics (r = 0.72) indicates that students with solid mathematical skills are better equipped to understand and excel in Physics. This aligns with prior research, which has consistently highlighted the critical role of Mathematics as a foundational subject for understanding scientific concepts.

Moreover, the significant positive correlation between Computer Science and Mathematics (r = 0.68) suggests that the logical reasoning and problem-solving skills fostered in both subjects reinforce one another. Programming in Computer Science often requires a strong grasp of mathematical logic, which is essential for solving complex problems. Similarly, Computer Science concepts like algorithms and flowcharts help students visualize and approach mathematical problems in a structured manner.

The relationship between Computer Science and Physics (r = 0.59) also reveals that computational thinking, a skill honed in Computer Science, can aid students in solving Physics problems. The ability to simulate real-world scenarios using computational tools makes Physics more tangible and easier to grasp for students.

Despite these positive correlations, the overall performance across the three subjects remains suboptimal. A significant portion of students struggled in these subjects, with 19.8% of students performing poorly in Computer Science, 22.4% in Mathematics, and 25.9% in Physics. This indicates that while these subjects are interrelated, students are facing considerable challenges in mastering the content.

One key factor influencing performance is the lack of adequate resources. Many students reported insufficient access to textbooks, computers, and other learning materials necessary for excelling in these subjects. This resource gap is especially prevalent in public schools, where the majority of the students in this study were enrolled. Public schools often lack the infrastructure and technological resources that are increasingly important for teaching STEM subjects, particularly Computer Science.

In addition, the quality of teaching in these subjects plays a crucial role in student performance. Instructors who lack adequate training or resources may struggle to effectively teach complex subjects like Physics and Computer Science. Effective teaching requires not only subject expertise but also the ability to make these subjects engaging and accessible to students.

Parental involvement was another factor influencing academic performance. Students whose parents were actively involved in their education, providing support and encouragement, tended to perform better across the board. This is consistent with findings from prior studies that have highlighted the positive impact of parental support on student achievement.

In conclusion, while there are significant positive correlations between students' performance in Computer Science, Mathematics, and Physics, overall academic performance remains a challenge. Addressing the resource gaps in public schools, improving the quality of teaching, and increasing parental involvement are essential steps toward enhancing student outcomes in these subjects. Policymakers and educators must work together to ensure that students receive the support they need to excel in STEM subjects, which are critical for their future academic and professional success.

#### ****5.3 Recommendations****

Based on the findings of this study, the following recommendations are made:

**Improvement of Resources in Public Schools**: There is a need for government and school authorities to invest in learning resources, particularly in public schools. This includes providing textbooks, computers, and laboratory equipment for teaching Computer Science, Mathematics, and Physics.

**Teacher Training and Development**: Teachers should undergo regular training to stay updated with new teaching methods, particularly in STEM subjects. Workshops and seminars on how to teach Computer Science, Mathematics, and Physics in an engaging and understandable way should be provided to improve teaching quality.

**Parental Involvement Programs**: Schools should encourage greater parental involvement through programs that inform parents of their role in their children’s academic success. Schools can hold regular meetings with parents to discuss their children’s progress and offer guidance on how to support them at home.

**Supplementary Classes and Tutorials**: Schools should organize after-school tutoring or supplementary classes for students who are struggling with these subjects. These sessions could provide more focused attention and additional practice in difficult areas.

#### ****5.4 Limitations of the Study****

This study had several limitations that may have impacted the findings. First, the study was conducted in a specific geographical location (Sabon Gari LGA, Kaduna State), which may limit the generalizability of the results to other regions or contexts. The socioeconomic status of students in this area, particularly in public schools, may differ from that in more urban or affluent regions, potentially affecting performance outcomes.

Secondly, the study relied on self-reported performance scores, which may be subject to inaccuracies or biases from the respondents. Although students were asked to provide their most recent scores, it is possible that some reported their performance inaccurately due to recall bias or social desirability.

Thirdly, the sample size of 232, while adequate for the analysis, was smaller than the initial target of 300 due to factors such as incomplete questionnaires and rough handling of the survey materials. This reduction in sample size may have affected the robustness of some of the analyses, particularly when testing for correlations and hypotheses.

Finally, the study did not account for other potential confounding variables that might influence students' performance, such as psychological factors, teaching methods, or school environments. These factors could provide additional insight into the complex dynamics of academic performance in STEM subjects and should be explored in future studies.

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### ****structured Questionnaire****

**Section A: Demographic Information**
Please provide the following details:

**Gender**:
☐ Male
☐ Female

**Age**:
☐ 14–16 years
☐ 17–19 years
☐ 20 years and above

**School Type**:
☐ Public
☐ Private

**Parent’s Highest Education Level**:
☐ No formal education
☐ Primary education
☐ Secondary education
☐ Tertiary education

**Section B: Academic Background**

**Instruction**: Please indicate your level of agreement with the following statements by ticking (☑) the box that corresponds with your opinion. Use the scale below:

* **Strongly Agree (SA)**
* **Agree (A)**
* **Neutral (N)**
* **Disagree (D)**
* **Strongly Disagree (SD)**

**1. Influence of Computer Science on Mathematics and Physics Performance**

| **S/N** | **Statements** | **SA** | **A** | **N** | **D** | **SD** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | My knowledge of Computer Science helps me understand Mathematical concepts. |  |  |  |  |  |
| 2 | The logical thinking skills developed in Computer Science assist me in solving Physics problems. |  |  |  |  |  |
| 3 | The programming skills learned in Computer Science improve my problem-solving abilities in Mathematics. |  |  |  |  |  |
| 4 | Studying Computer Science makes it easier for me to handle complex Physics equations. |  |  |  |  |  |

**2. Relationship Between Mathematics and Physics**

| **S/N** | **Statements** | **SA** | **A** | **N** | **D** | **SD** |
| --- | --- | --- | --- | --- | --- | --- |
| 5 | A good understanding of Mathematics is necessary for success in Physics. |  |  |  |  |  |
| 6 | I find it difficult to solve Physics problems without using Mathematics. |  |  |  |  |  |
| 7 | The mathematical equations I learn in Mathematics are directly applicable in my Physics classes. |  |  |  |  |  |
| 8 | Mathematics helps me develop critical thinking skills that are necessary in Physics. |  |  |  |  |  |

**3. External Factors Affecting Academic Performance**

| **S/N** | **Statements** | **SA** | **A** | **N** | **D** | **SD** |
| --- | --- | --- | --- | --- | --- | --- |
| 9 | I have access to adequate learning materials (books, computers) for my studies. |  |  |  |  |  |
| 10 | My school provides enough resources for effective learning of Computer Science, Mathematics, and Physics. |  |  |  |  |  |
| 11 | The quality of teaching I receive in Computer Science, Mathematics, and Physics is high. |  |  |  |  |  |
| 12 | I spend enough time studying Computer Science, Mathematics, and Physics outside the classroom. |  |  |  |  |  |
| 13 | Parental support is important for my academic success in Computer Science, Mathematics, and Physics. |  |  |  |  |  |

**4. Students' Attitudes Toward Learning**

| **S/N** | **Statements** | **SA** | **A** | **N** | **D** | **SD** |
| --- | --- | --- | --- | --- | --- | --- |
| 14 | I enjoy studying Computer Science more than Mathematics or Physics. |  |  |  |  |  |
| 15 | I find Physics more challenging than Mathematics or Computer Science. |  |  |  |  |  |
| 16 | I feel confident when solving Mathematics problems compared to Physics. |  |  |  |  |  |
| 17 | I am motivated to study Computer Science because it is important for my future career. |  |  |  |  |  |
| 18 | Mathematics is the most difficult subject among the three. |  |  |  |  |  |

**5. General Study Habits**

| **S/N** | **Statements** | **SA** | **A** | **N** | **D** | **SD** |
| --- | --- | --- | --- | --- | --- | --- |
| 19 | I spend more time studying Mathematics than Physics and Computer Science. |  |  |  |  |  |
| 20 | I seek help from my teachers when I don’t understand concepts in any of the subjects. |  |  |  |  |  |
| 21 | I attend extra lessons or study groups for Mathematics, Computer Science, and Physics. |  |  |  |  |  |
| 22 | I manage my time well between studying these three subjects. |  |  |  |  |  |

### ****Section C: Academic Performance****

Please indicate your most recent scores for the following subjects (optional if confidential):

1. **Computer Science Score**: \_\_\_\_\_\_\_\_\_\_\_
2. **Mathematics Score**: \_\_\_\_\_\_\_\_\_\_\_
3. **Physics Score**: \_\_\_\_\_\_\_\_\_\_\_

### ****Thank you for participating in this survey!****