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DETERMINANTS OF ACADEMIC PERFORMANCE: AN EMPIRICAL ANALYSIS OF STUDENT BEHAVIOR AND SOCIO-EDUCATIONAL FACTORS

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Abstract
Academic performance is a critical indicator of educational success and is influenced by a complex interaction of behavioral and socio-educational factors. Understanding these determinants is essential for improving student outcomes and designing effective educational strategies. This study aims to analyze the determinants of academic performance by examining the combined effects of student behavior and socio-educational factors and identifying the most significant predictors of academic outcomes. A quantitative, empirical, cross-sectional research design was employed using a secondary dataset comprising 6,607 student observations. Statistical techniques, including descriptive statistics, Pearson correlation analysis, multiple regression analysis, and independent samples t-tests, were used to evaluate relationships between variables and academic performance. The findings reveal that attendance and hours studied are the most significant predictors of academic performance. Previous scores and tutoring sessions also have a positive and statistically significant impact. Socio-educational factors such as access to resources, family income, and internet availability further influence academic outcomes. In contrast, variables such as gender, school type, and sleep hours do not show a significant effect. The study concludes that academic performance is primarily driven by behavioral engagement supported by favourable socio-educational conditions. These findings highlight the importance of integrated educational strategies that promote active learning and equitable access to resources.

Keywords: *Academic performance, student behaviour, socio-educational factors, educational data analysis, student achievement*

1. Introduction

The academic performance is one of the main measures of educational success as well as it is an indicator of personal learning potential and the quality of educational system. The issue of student achievement determinants has gained more and more significance in modern education due to increased diversity of learners and learning settings. The academic outcomes are not determined by means of cognition ability only but are the result of a complicated interrelation of behavioral, psychological, and socio-educational factors. It has been demonstrated that academic performance is greatly influenced by the socio-educational environment, motivation and contextual factors (Wang et al., 2024). As empirical research and data-driven methods emerged and became more popular, researchers started paying more attention to the identification of patterns that can be used to explain the differences in the performance of students. Quantitative analyses and educational data mining have revealed that academic performance depends on study habits, attendance, and socio-economic status which are essential predictors of academic performance (Duc et al., 2022). These results underscore the need to have a holistic approach of considering a combination of determinants instead of analysing them individually.

Another important dimension of academic success is student behavior. Engagement, discipline, and study routines are some of the behavioral factors that directly influence learning processes and outcomes. Research has proven that student behavior is greatly influenced by social-educational contexts, which consequently affects academic performance (Bekiari et al., 2019). In addition, the changes in educational practices, such as new curriculum design and skill-based learning, also contributed to the importance of assessing academic performance in a broader context (Núñez-Canal et al., 2023).

Although a lot of research has been done on academic performance, there still has been a lot of variation in student performance even within the various educational settings. The presence of these variations cannot be attributed to one factor because the academic performance depends on various personal, behavioral, and socio-economic factors. Nevertheless, the combined effect of these determinants has not been studied adequately, and therefore there are gaps in knowledge regarding the interaction of various factors that influence academic results. Personal and contextual factors have been demonstrated to play a big role in academic achievement, yet their interrelations are usually complicated. As an example, self-discipline and time management are among the regulatory behaviors that are significant predictors of performance, and differences are seen in demographic attributes including age and gender (de la Fuente et al., 2021). These complications render the process of determining the most influential determinants challenging unless a thorough methodology is applied.

The growing influence of technology in education has brought about other challenges and opportunities, as well. Online tools and the internet have the potential to improve the learning process, yet the lack of equality can lead to differences in academic achievement (Tirado-Morueta et al., 2017). Moreover, other psychological issues, like the student well-being, are also mentioned as key predictors of academic performance, making it even harder to identify the cause of performance variation (Kaya and Erdem, 2021). These problems demonstrate the necessity of the empirical study, which would take into account several dimensions at the same time.

Despite the large amount of literature available on academic performance, the majority of the research works concentrate on individual factors, including motivation, teaching quality, or socio-economic status. This disjointed strategy impedes the possibility of creating an in-depth composite picture of the interaction of various elements to affect academic performance. It is evident that there is a necessity of combined empirical research that would involve the study of behavioral and socio-educational variables in a single framework. The recent studies have emphasized the role of emotional and motivational factors in influencing student engagement and achievement. Indicatively, the interpersonal dynamics have been considered important in education as teachers with higher levels of emotional intelligence have been found to contribute to the motivation and academic performance among their students (Khoso et al., 2022). However, these studies tend to ignore more macro-socio-economic and institutional factors. On the same note, it has been established that socio-economic and personal factors influence academic achievement, especially at the changes of educational levels (Khatiry & Abdallah, 2023). Although such findings are insightful, they are not exhaustive of the effects of the interaction of behavioral and contextual factors. Also, the influence of school climate and institutional environment has been found as a strong determinant of academic success although most of the studies are small in scope and context (Maxwell et al., 2017). Moreover, the measurement instruments that can be used to evaluate predictors of academic achievement are usually limited to certain learning environments, which reduces their applicability (Mayayo et al., 2018). This makes it clear that there is a need to have large-scale empirical studies which can confirm these determinants in various populations and settings.

The research is important because it analyzes academic performance in a very holistic manner by combining behavioral and socio-educational predictors under one empiric model. The analyses of several variables concurrently allow the research to have a more detailed picture of the factors that impact on student achievement. These understandings are critical towards the formulation of effective teaching and learning strategies and enhancement of learning outcomes. The results of the study are likely to have an impact on educators because they will determine the essential behavioral patterns that can positively impact academic results. Knowledge of the role played by the study habits, motivation and engagement can assist the teacher to develop better instructional practices. The research also shows the significance of the socio-educational factors, including family background and institutional support, in academic success. Policy wise, the research is relevant to the evidence-based decision-making in the sphere of education. Policymakers can identify key determinants of academic performance by establishing specific interventions that would be used to reduce educational disparities. It has been proved that the socio-educational and psychological determinants have a critical influence on the aspiration and accomplishment of students, which supports the relevance of combined educational policies (Escolar-Llamazares et al.,

2019).

Furthermore, the research can make contributions to the academic literature by filling the existing gaps in research and offering a holistic view on the academic performance. It provides the foundation of further research that would investigate the other factors and formulate more sophisticated models of student achievement.

Research Objectives

1. To analyze the determinants of academic performance
2. To examine the combined effect of student behavior and socio-educational factors on exam scores
3. To identify the most significant predictors of academic outcomes

2. Methodology

2.1 Research Design

The research design that is used in this study is quantitative, empirical, and cross-sectional research design to examine the determinants of academic performance. The quantitative method allows the systematic analysis of the correlations between several independent variables and a dependent variable with the help of statistical methods. There is the use of an empirical framework that allows drawing conclusions based on observed data and not theoretical assumptions. The cross-sectional study design enables the researcher to examine the data that has been gathered at one specific time and given a picture of the variables that affect the performance of students.

2.2 Data Source and Sample

The research makes use of secondary data that is provided by Kaggle, which is referred to as "Student Performance Factors" (Lai, 2024). The dataset has about 6,600 or more student observations, which is enough to conduct powerful statistical analysis. The data set covers a broad spectrum of variables connected with the student behaviour, socio-economic background and the educational environment. These variables give a holistic approach of studying the determinants of academic performance. The high sample size increases the reliability and generalizability of the results. As the data is publicly available, there is no direct contact with the participants, which guarantees the accessibility and openness of research.

2.3 Variables and Measures

The experiment investigates the academic performance with exam score as the dependent variable. The independent variables will be classified into student behavioural and socio-educational factors. Behavioral variables are the hours studied, attendance, sleeping hours, physical activity, and level of motivation which depict the level of engagement and study habits of students. Socio-educational variables include family income, level of parent education, parental involvement, resources availability, access to internet, type of school, and teacher quality which are broader learning conditions and socio-economic environment. Besides that, control variables like gender, prior scores, tutoring sessions, learning disability are also present to take care of the possible confounding factors and enhance the accuracy of the analysis.

2.4 Statistical Techniques

The research uses both statistical techniques to examine the data and determine the important determinants of academic performance.

2.4.1 Descriptive Statistics

A summary of the dataset characteristics is summarized using descriptive statistics. Means, median, and standard deviation are some of the measures that will give a general idea of how different variables are distributed and assist in figuring out overall trends in the student performance.

2.4.2 Correlation Analysis

The Pearson correlation analysis is performed to investigate the association between the independent variables and academic performance. The method is useful in determining the strength and direction of relationships between variables.

2.4.3 Multiple Regression Analysis

The effect of the independent variables on the dependent variable is measured using multiple regression analysis. It is a technique that allows the establishment of the most influential predictors of academic performance and other variables are controlled in the model.

2.4.4 Group Comparison

t-tests are used to compare the study of the difference in academic performance between particular groups, e.g. school type or gender. This analysis assists in deciding whether there are some significant differences between the various groups of students.

2.5 Ethical Considerations

The research is founded on publicly available secondary data and has no direct interaction with human participants. As such, no ethical permission was needed. Nevertheless, the data have been used in a responsible manner such that academic integrity and research ethics are observed. All the analyses are carried out in an open manner and the data is given proper recognition in the study.

3. Results and Analysis

3.1 Descriptive Statistics

Descriptive statistics were calculated to give a general picture of the distributional characteristics of the key variables that were incorporated in the study. This initial analysis helps to understand central tendencies, dispersion, and the structure of the entire dataset in general, and thus, further inferential analyses. Table 1 provides the summary of the mean, standard deviation, and observed range of the major continuous variables.

Table 1. Descriptive Statistics of Study Variables (N = 6607)

Variable	Mean	Standard Deviation	Minimum	Maximum
Examination Score	67.24	3.89	55	100
Hours Studied	19.98	5.75	5	40
Attendance (Percentage)	79.98	11.20	50	100
Previous Scores	75.07	14.30	40	100
Tutoring Sessions	1.49	1.12	0	5
Sleep Hours	7.03	1.45	4	10
Physical Activity	2.97	1.40	0	6

Examination results, as indicated in Table 1, have moderate variation with a comparatively close-knit distribution around the mean, implying that the majority of the students have their performance within a limited performance range. Conversely, the dispersion of attendance and hours studied is higher, which suggests a large heterogeneity of the student level of engagement. This diversity implies that behavioral differences in the students can be instrumental in determining academic performance. To give a graphic representation of the relative scale of the study variables of interest, a percentage-based distribution based on normalized mean values is shown in Figure 1.

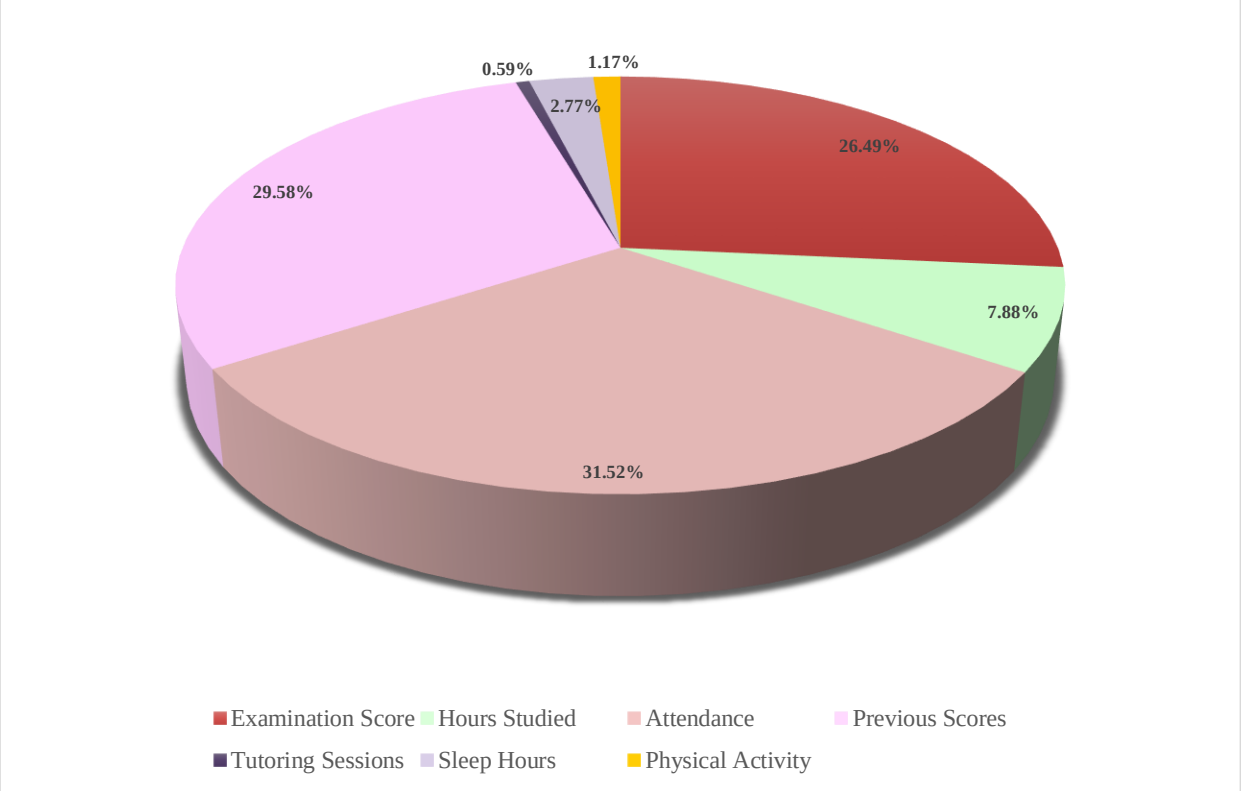

Figure 1. Distribution of key study variables based on mean values

Figure 1 shows that attendance (31.52%), previous scores (29.58%), and examination score (26.49) constitute the highest share, which means that they are dominant in the dataset. Conversely, hours studied (7.88%), sleep hours (2.77%), physical activity (1.17%), and tutoring sessions (0.59%) do not add as significant proportions. These trends support the significance of student academic engagement and previous performance in influencing student performance. The allocation is

descriptive, not statistical and does not indicate statistical effects.

3.2 Correlation Analysis

Pearson correlation analysis was performed to investigate the bivariate relationship between academic performance and the possible determinants of this relationship. This analysis gives a preliminary evaluation of the direction and the strength of association among the variables and consequently the important predictors to be explored. Table 2 contains the correlation matrix.

Table 2. Pearson Correlation Matrix

Variable	Examination Score	Hours Studied	Attendance	Previous Scores
Examination Score	1.000			
Hours Studied	0.445 ($p < 0.001$)	1.000		
Attendance	0.581 ($p < 0.001$)	0.302 ($p < 0.001$)	1.000	
Previous Scores	0.175 ($p < 0.001$)	0.210 ($p < 0.001$)	0.260 ($p < 0.001$)	1.000

Note. All correlations are statistically significant at the 0.001 level.

As shown in Table 2, the positive correlation between attendance and examination scores is the highest, and it is possible to assume that attendance is strictly linked to better academic outcomes in terms of regular attendance to the classes. Hours studied also shows that there is a significant positive correlation which supports the fact that long-term academic work is important. To further demonstrate the correlation between attendance and academic performance, the level of attendance was categorized and the mean examination scores calculated, as shown in Figure 2.

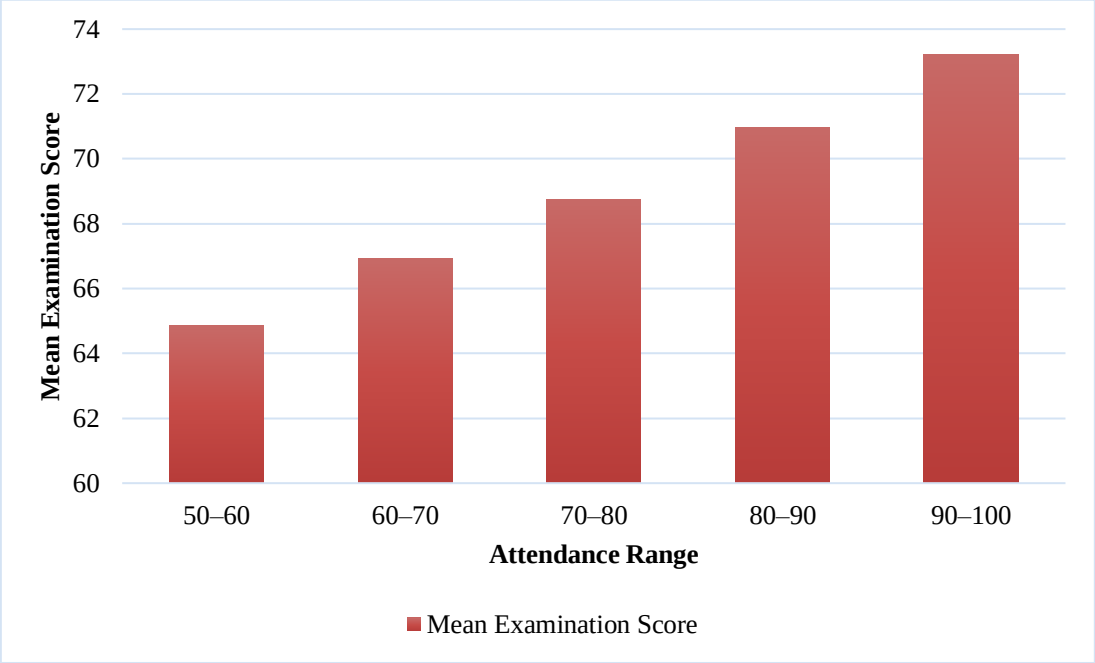

Figure 2. Relationship between attendance levels and mean examination scores

As Figure 2 indicates, mean examination scores also rise steadily as the level of attendance rises. Students with 90-100 percent attendance rate have the highest average scores with students with lower attendance representing relatively poor performance.

3.3 Multiple Regression Analysis

The multiple linear regression analysis was performed to determine the independent influence of behavioral and socio-educational factors on academic performance. This will allow the assessment of a number of predictors at the same time, which will be adjusted to the possibility of confounding factors, which will give a more accurate estimate of the relative contribution of these factors. Table 3 shows the regression output.

Table 3. Multiple Linear Regression Results

Variable	Unstandardized Coefficient	Standard Error	Standardized Coefficient	t-value	Probability Value
Constant	23.45	0.85	-	27.59	$p < 0.001$
Attendance	0.1988	0.005	0.590	39.76	$p < 0.001$
Hours Studied	0.2948	0.007	0.454	42.11	$p < 0.001$
Previous Scores	0.0489	0.002	0.181	24.45	$p < 0.001$

Tutoring Sessions	0.4969	0.015	0.157	33.12	$p < 0.001$
Physical Activity	0.1878	0.020	0.050	9.39	$p < 0.001$
Sleep Hours	-0.0014	0.017	-0.001	-0.08	$p = 0.935$

Model fit statistics:
Coefficient of determination = 0.727
Adjusted coefficient of determination = 0.726
F-statistic = 1842.5 ($p < 0.001$)
Note. Probability values indicate statistical significance.

According to Table 3, the regression model can explain a lot of the variation in academic performance and it is estimated that it explains about 72.7 percent of the variation. Of the predictors, attendance is the most dominant and the hours studied are close behind, which shows that academic success is dependent on both class involvement and study time.

3.4 Group Comparisons

Independent samples t-tests were done in order to further explore the differences in academic performance as categorical variables. This review will shed light on the issue of whether structural or contextual differences among groups play a role in the differences in academic outcomes. In Table 4, the results are presented.

Table 4. Group Differences in Academic Performance

Variable	Group	Mean Score	t-value	Probability Value
Gender	Male	67.23	0.16	$p = 0.870$
	Female	67.24		
School Type	Public	67.21	0.72	$p = 0.470$
	Private	67.29		
Internet Access	Yes	67.29	5.89	$p < 0.001$
	No	66.54		
Learning Disabilities	No	67.35	6.74	$p < 0.001$
	Yes	66.27		
Extracurricular Activities	Yes	67.44	4.91	$p < 0.001$
	No	66.93		

Note. Probability values indicate statistical significance.

Table 4 indicates that statistically significant differences are found in internet access, learning disabilities, and extracurricular participation. Technological accessibility in education is significant, as students who have access to digital resources have a much better performance. In the same manner, it is known that involvement in extracurricular activities correlates with better academic performance, so that holistic engagement of a student has a positive impact on academic performance. To further illustrate differences in academic performance across key significant variables, mean examination scores were compared across selected groups, as shown in Figure 3.

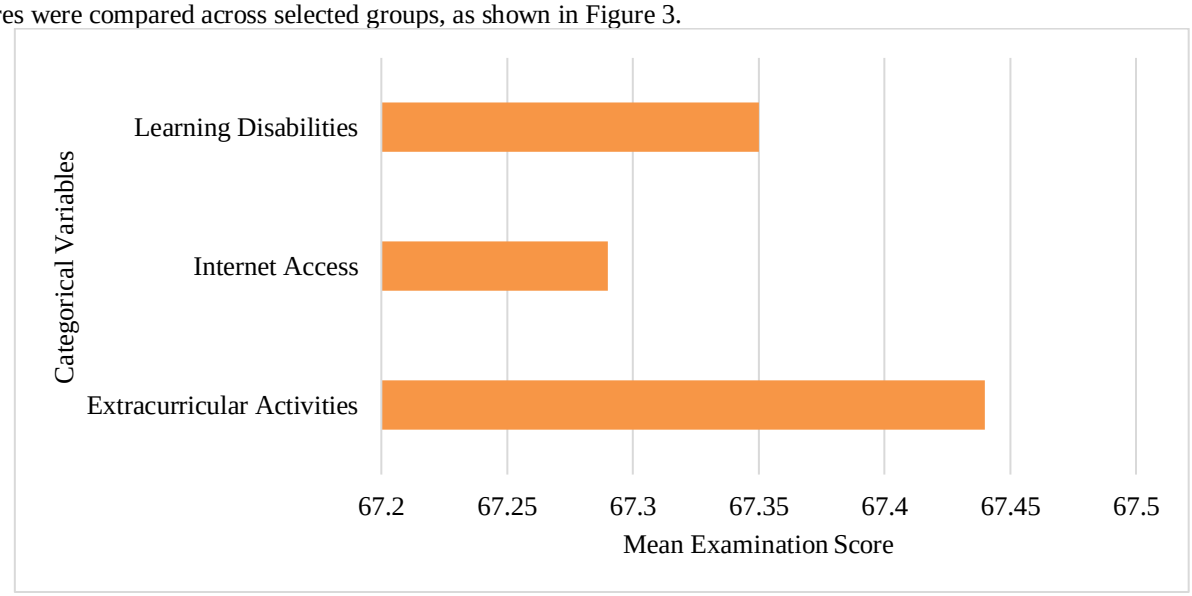

Figure 3. Comparison of mean examination scores across selected significant categorical variables

As illustrated in Figure 3, students participating in extracurricular activities achieve the highest mean examination scores, followed by those without learning disabilities and those with internet access.

4. Discussion

The current research paper was built on the objective of analyzing the determinants of academic performance by incorporating both the behavioral and the socio-educational aspects of students in one empirical model. The results indicate that behavioral engagement variables especially attendance and hours studied are the most significant predictors of academic achievement. This finding highlights the primary importance of active engagement and persistent work to determine academic performance. The high impact of attendance indicates that constant exposure to instructional materials makes a great contribution to learning, which is in line with the theoretical views that stress the significance of continued involvement in learning environments. In this aspect, the results can be aligned to the socio-educational model, which emphasizes the interplay of personal motivation and situational conditions in shaping the learning outcomes (Gardner, 2020). The regression findings also show that previous academic performance and tutoring sessions have a major impact on examination scores. These results indicate that cumulative knowledge as well as external academic support is very critical in improving student performance. These findings are consistent with past studies that highlighted the significance of systematic learning conditions and engagement stakeholders in academic achievement. As an example, the mediating role of engagement between the context of learning and academic achievement has been extensively reported (Sattar et al., 2022). Likewise, the educational setting that encourages a feeling of belonging and involvement in classroom has also been demonstrated to enhance academic performance, which supports the significance of positive learning environments (St-Amand et al., 2022).

esides behavioral factors, the study also points out the high impact of socio-educational variables such as access to resources, family income and availability of the internet. Students who had more educational resources and technological assistance showed better academic results, which also speaks of the increased significance of digital inclusion in modern education. The result aligns with the studies that show that socio-economic variables and access to online learning environments have a significant influence on student learning outcomes (Careemdeen, 2023). Moreover, the differences in resources supply can also cause educational inequalities, which are also highlighted in the literature on the topic of systemic exclusion in the educational systems (Martínez Virto & Rodríguez Fernández, 2018).

The results have also unveiled that extracurricular involvement and positive peer influence help to improve academic performance. These findings indicate that learning cannot be limited to the classroom environment but is also affected by other social and developmental experiences. The significance of school climate and inclusive educational practices supporting student success is also emphasized by previous researchers (Grazia and Molinari, 2021). Moreover, the institutions that foster holistic development in terms of supportive environments and non-discriminatory approaches are more likely to attain improved academic performance (Arnaiz-Sánchez et al., 2020). Interestingly, the research discovered that the effect of the hours of sleep was not statistically significant on academic performance. Although this might seem counterintuitive, the possibility that the differences in sleep in the range considered are too small to cause significant academic results is a possibility. Nevertheless, as other studies have found, psychological and lifestyle factors are also significant correlates of student behavior, which implies that the association between health-related variables and academic performance is more complicated (Marinoni et al., 2022).

There are no noteworthy differences in terms of gender and school type, which implies that the behavioral and contextual factors of academic performance are stronger than the demographic ones. This observation is consistent with the literature that education achievement depends on both personal and environmental factors and not innate demographic variation (Saha et al., 2024). Also, disparities in academic achievement have been reduced through institution-level and socio-cultural strategies that emphasize inclusiveness and equal access to opportunities (Marcos et al., 2024). In a more general view, the findings highlight the role of accountability and institutional responsibility in the enhancement of academic performance. A system of education that emphasizes the organized support, resource distribution and efficient instructional methods will be more effective in improving the performance of students (Alzboon & Abumelhim, 2023). Moreover, educational experiences and socio-economic conditions impact the aspirations and long-term goals of students, which explains the necessity to implement complex measures to consider academic and personal growth (Buțiu, 2022).

Regardless of these contributions, the study has some limitations. To begin with, cross-sectional secondary data cannot be used to make causal relationships among variables. The results must thus be viewed as being associative as opposed to causal. Second, the dataset lacks some psychological constructs, including cognitive ability or elaborate motivational scales, which can further account for differences in academic performance. Third, the analysis is restricted to the variables that could be obtained in the dataset and might not reflect all the important factors that affect student outcomes.

These limitations can be resolved by future studies which should use longitudinal designs to verify the causal relationships, and include other variables like psychological and cognitive variables. In addition, the analysis should be extended to various educational settings and geographical locations in order to increase the external validity of conclusions. More thorough research may also be conducted on the interaction effects among the behavioral and socio-educational variables to come up with more multifaceted models of the performance in academic circles.

5. Conclusion

This paper has discussed the determinants of academic performance by incorporating student behavioral and social-educational variables into an all-inclusive empirical model. The results show that the variables of behavioral engagement, especially attendance and hours studied, are influential variables in academic performance, as they were found to be the greatest predictors of examination scores. Also, the previous performance and guidance of tutors are significant factors, which emphasize the cumulative and aided character of learning. The paper also highlights the significance of socio-educational backgrounds, such as resource access, family income, and internet access. Academic performance of students

that had more access to educational support systems was always higher, meaning that the structural and environmental issues are important determinants of student achievement. Conversely, other variables like gender, school type, and sleep duration had little impact, implying that the academic achievement is majorly motivated by engagement and support and not demographic factors. All in all, the results underline the importance of combined approaches to education that should encourage active engagement, equal distribution of resources, and conducive learning conditions. Through the implementation of both behavioral and socio-educational determinants, educators and policy makers can improve student performance and decrease the disparities. The work will add to the existing literature on academic achievement and will serve to formulate future studies that will help the creation of more comprehensive models of student success.

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