Factors affecting high school students' academic performance: a case study in Vietnam

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Article Info	ABSTRACT
	This study investigates the factors that influence academic achievement among Vietnamese high school students, with an emphasis on a case study conducted at a specific school. To identify key determinants of students' academic success, a quantitative survey comprising questionnaires was distributed to 438 high school students. Exploratory factor analysis (EFA) was utilized, followed by Pearson correlation coefficient and regression analysis to assess the relationships between independent variables (school-related and student-related factors) and the dependent variable (student performance). The data show that teacher competency has the greatest influence on students' academic success, closely followed by students' learning techniques. In addition, student motivation has a significant impact on their success. The results underscore the importance of a supportive home and school environment in fostering student achievement. The results highlight the need for enhanced teacher training to improve educational quality. It is also essential to promote students' effective learning techniques, and ensure consistency in their study. This research contributes to a deeper understanding of the complex interplay of factors impacting academic performance and offers insights for educators and policymakers aiming to enhance educational outcomes in Vietnam. Recommendations for future research and practical interventions are discussed.

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1. INTRODUCTION

Academic performance is a critical indicator of educational success and future opportunities for high school students. In Vietnam, where the educational landscape is rapidly evolving, understanding the factors that influence students' academic achievement has become increasingly important. Research on what influences academic performance is always interesting [1]. Academic performance is the consequence of a learning process students attain during a specific period, reflected in the assessment score [2]. The learning results are expressed in terms of accumulated points or academic grade point average (GPA) [3]–[5] or scores acquired from the results of tests, which assist in assessing the general knowledge and abilities that students learn during their studies at the school [6]. Students' future careers and income directly relate to academic success [7]. In recent years, Vietnam has made substantial investments in its education system, yet challenges remain, particularly in ensuring equitable access to resources and support for all students.

Under the rapid advancement of science and technology, educational technologies, and cultural diversity, changes in the learning environment have kept research on factors influencing students' learning

and performance relevant [8]–[10]. Numerous factors can impact academic performance, ranging from individual characteristics, such as motivation and learning strategies, to external influences, including parental involvement and socio-economic status. Moreover, the quality of educational institutions, teacher effectiveness, and the overall school environment play significant roles in shaping student outcomes. Recognizing these interconnected elements is essential for developing effective strategies to enhance educational quality. This study aims to identify the key determinants affecting high school students' performance, and seek to address the challenges by examining how various factors contribute to academic performance among high school students. It not only enriches the understanding of academic performance in Vietnam but also offers practical suggestions and theoretical insights that can guide educators and policymakers in similar educational contexts. To achieve the study's objective, a research question has been formulated: What are the primary factors influencing high school students' academic performance, and how do these factors interact to affect their overall educational outcomes? This question facilitates a thorough exploration of various variables while emphasizing their interconnections, offering a clear focus for the research. The theoretical framework for this study was grounded in Vygotsky and Cole [11] constructivist theory. Additionally, the framework was enriched through a comprehensive review of key concepts from related studies. The findings and conclusions were analyzed and interpreted within the constructivist approach and relevant literature.

As discussed, the academic performance of high school students is influenced by a myriad of factors, which can be broadly categorized into individual, familial, and institutional influences. Hóa et al. [6] revealed that academic performance is a general assessment of student's knowledge and skills acquired while learning subjects at school. Numerous factors, both internal and external, might have an impact on academic achievement. Previous studies [3], [4] emphasized student cumulative points when judging that the learning outcomes match students' learning and training process. The authors also identified two key factors that positively impact students' academic performance: those related to the students themselves and those concerning teacher capacity. Thuy [12] and Hoc [13] determined that academic performance is the outcome that a person obtains after a specific period of study, as stated through GPA. The student's assessment represents their learning and training process [3]. According to this principle, students' academic performance is evaluated using accumulated points. Meanwhile, Hóa et al. [6] argued that academic performance is a general assessment of the information and abilities students develop while learning certain subjects in school. As noted by Munir et al. [7], academic performance plays a crucial role in shaping students' future job prospects and earning potential. Several factors impact student performance, including internal aspects related to the individual and external influences outside their control [14]. Evans [15] identified five categories of factors affecting academic performance: i) demographic characteristics; ii) psychological traits; iii) past academic achievements; iv) social influences; and v) organizational aspects. Tam [16] concluded that learning motivation, consistency, competition, perceptions of the institution, and learning techniques account for about half of the variations in students' academic outcomes, with learning methods having the most significant effect. Additionally, a study by Lastri et al. [17] outlined four key elements affecting student learning: i) motivation to learn; ii) interest in learning; iii) family environment; and iv) learning models (including student capabilities, teacher qualifications, and teaching methods).

Learning motivation, interest, and family support are especially influential. Lastri et al. [17] demonstrated that these factors collectively shape students' academic performance, with learning motivation having the most substantial positive impact, followed by interest, learning strategies, and family environment. Furthermore, several studies [18], [19] found that student competence positively affects learning outcomes, indicating that strong teacher expertise and thorough course introductions can enhance students' academic achievements. The school environment, encompassing physical facilities and extracurricular activities, significantly influences academic performance. Rusticus et al. [20] highlighted that a supportive and engaging school atmosphere—characterized by the quality of teachers, classmates, training organizations, facilities, programs, and administrative tasks—leads to improved student outcomes. Hanaysha et al. [21] categorizes the factors affecting academic performance into three groups: i) learners (knowledge, skills, and attitudes); ii) teachers (knowledge, teaching methods, communication and motivational skills, and classroom management); and iii) facilities (resources, supporting equipment, and classroom layout). Among these, teachers exert the greatest influence, followed by students and then facilities, with communication skills being particularly impactful. Additionally, Kyriakides et al. [22] analyzed 195 studies and found eight factors that affect student performance: i) management-related issues (overall management, financial resources, human resource management, training programs, and outcomes); ii) accountability measures (assessment and evaluation of teachers and schools); iii) the school learning environment (enrollment rates, discipline, attendance), iv) human resources (student-to-teacher ratios, class sizes); v) time resources (teaching hours per year, average study time per subject); vi) learning opportunities (homework, extracurricular activities); vii) teacher capacity (experience, qualifications, skills); and viii) school facilities. These characteristics primarily involve teacher capacity, training programs,

management of training, assessment of learning outcomes, and school infrastructure. Notably, the study found that schools offering a variety of extracurricular activities not only boost student engagement but also enhance academic performance. Similarly, previous research [6], [23] identified factors influencing students' academic success: classroom interaction, learning techniques, persistence, motivation, facilities, school impressions, knowledge, and the way teachers structure their subjects. Davaatseren *et al.* [24] highlighted the impact of attitudes, family support, career choices, institutional environment, and peer characteristics on academic achievement. Meanwhile, Hieu *et al.* [25] revealed four major factors affecting learning performance: family and societal influences, academic support, institutional factors, and motivation, emphasizing that family and social contexts significantly contribute to educational success.

The authors suggest that integrating family and societal issues into academic strategies can enhance student learning outcomes. Al Husaini and Shukor [26] identified several key factors affecting students' academic achievement, including low entry grades, family support, housing conditions, student gender, previous assessment scores, internal evaluations, GPA, and e-learning activity. Similarly, previous studies [27], [28] found that various student-related variables play a role in academic success. Other researchers have highlighted that time management, self-motivation, engagement, behavior, and attitudes are critical determinants of students' academic performance [29]. Mushtaq and Khan [30] noted that effective communication, learning facilities, and proper guidance positively influence student outcomes, while family stress has a detrimental effect. Their findings indicated that communication is the most crucial factor for student success, though learning facilities and guidance also matter. In their study, Thong and Ngoc [31] identified six factors influencing students' choices between urban and rural secondary schools. They found three categories—educational environment, school reputation, and personal circumstances—had nearly identical mean scores and exerted a stronger influence than social networks, extracurricular activities, and transportation. A case study by Alani and Hawas [32] found that students perceive teachers who possess strong teaching skills and utilize diverse teaching methods as having a more positive impact on their academic performance. Similarly, Atchia and Chinapah [33] indicated that school leadership plays the most significant role in academic achievement, followed by student factors, teacher characteristics, and socio-economic factors. In this context, Ozcan [34] emphasizes that factors influencing student performance include active learning methods, persistence, perceptions of the school, available resources, and motivation, while Tho *et al.* [35] identified students' learning motivation and academic results are significantly impacted by a number of elements, including the training program, family and friends, instructional strategies, facilities, and learning methods. Learning motivation, a crucial mediating component that contributes to better academic achievement, is greatly influenced by the training program. The literature suggests that high school students' academic performance is shaped by a complex interaction of individual, familial, and institutional factors. The findings from these studies are summarized in Table 1.

Table 1. Summary of factors impacting student academic performance

No	Factors related to students	Factors related to teachers	Factors related to the teaching and learning environment	Factors related to the family-society
1	Learning motivation [6], [17], [18], [34], [35]	Teacher competencies [17], [19], [20], [23]	Training organization [20], [23]	Family conditions [17], [34]
2	Learning persistence [6], [18], [34]	Teaching methods [17], [35]	Training programs (including extracurricular activities) [20], [23]	Family - society [17], [35]
3	Learning methods [6], [17], [34], [35]	Communication and inspiration skills, classroom management skills [21], [22]	Facilities of the school [6], [21], [23], [34], [35]	
4	Students (knowledge, skills, attitudes) [17], [21]			

In Vygotsky's theory, it highlights the importance of social interaction and cultural tools in cognitive development. It emphasizes that students can perform certain tasks with guidance that they would not yet be able to accomplish independently. The theory focuses on two key components: scaffolding and collaborative learning [11]. The scaffolding refers to providing temporary support helps students move toward higher levels of understanding. While collaborative learning mentions to peer interaction enhances academic performance by promoting deeper understanding and problem-solving skills. Vygotsky's theory also underscores the pivotal role of teachers in enhancing academic performance by offering appropriate guidance and creating collaborative learning environments. Moreover, the research indicates that various factors related to the student, family, and school impact the student's academic performance. It encompasses the subsequent elements by the following factors: students-related factors: i) learning environment; ii) learning motivation; iii) learning persistence; and iv) learning methods. Furthermore, the following

school-related elements impact the students' academic performance, including: i) teacher competency; ii) school facilities; and iii) school extracurricular activities. Thus, a research model, as shown in Figure 1, was suggested that included the following elements, which were compiled based on studies and affected students' learning performance. Proposed hypotheses derived from this study model are displayed in Table 2. Regression analysis would be used to evaluate the model.
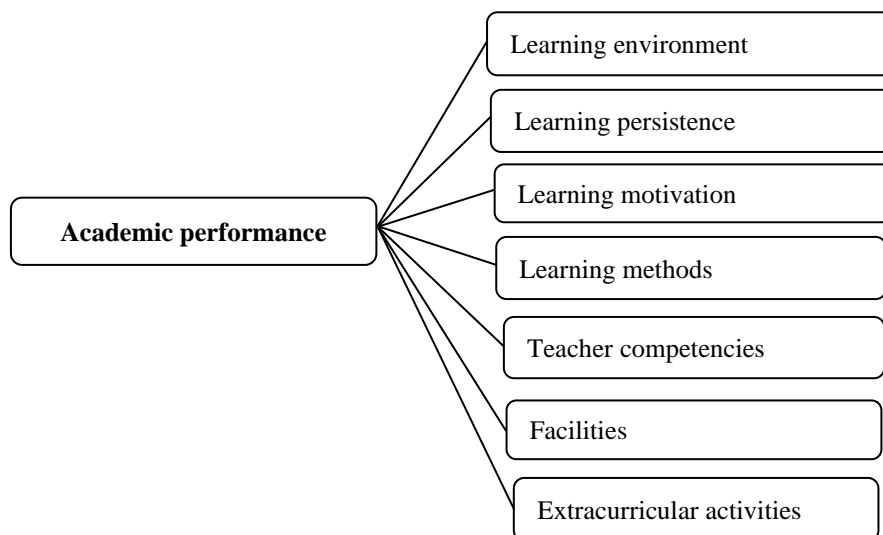

Figure 1. Proposed research model

Table 2. Hypothesis on factors influencing students' academic achievement

Hypothesis (H)	Hypothesis statement
H1	The learning environment has an impact on students' academic performance.
H2	Learning persistence affects students' academic performance.
H3	Learning motivation affects students' academic performance.
H4	Learning methods have an impact on students' academic performance.
H5	Teachers' competencies have an impact on students' academic performance.
H6	School facilities have an impact on students' academic performance.
H7	School extracurricular activities have an impact on students' academic performance.

2. METHOD

2.1. Instrument

To investigate the factors influencing high school students' academic performance, a structured methodological approach is essential. The key components of the methods used in this study include a quantitative research design was employed to facilitate statistical analysis of the relationships between various factors and academic performance. A Pearson correlational measure was conducted to examine the strength and direction of associations between the independent variables (e.g., learning environment, teacher competencies) and the dependent variable (academic performance). A linear regression technique was applied to identify and quantify the impact of various factors on students' academic outcomes. This approach helps determine the relationships between independent variables, such as socioeconomic status, parental involvement, school resources, and motivation, and the dependent variable, which is academic performance. Prior assumption tests have been made to control normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no violations observed.

A structured questionnaire was developed to gather data on various factors affecting academic performance. The questionnaire consists of three primary sections. Firstly, part 1: students will reply to questions regarding how they feel about their academic performance level and how the factors affect them at school. The Likert scale, which has five levels: 1 for completely disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for completely agree, is used to assess groups of factors based on 35 evaluation criteria. Students give details on their classes and present skill sets in part 2. In part 3, they share some personal information. The questionnaire included sections on learning environment (e.g., classroom conditions, resources); teacher competencies (e.g., teaching methods, qualifications); learning motivation (e.g., intrinsic vs. extrinsic motivation); learning methods (e.g., study habits, strategies); school facilities (e.g., availability of libraries,

labs); extracurricular activities (e.g., participation rates, types of activities. Students' academic performance was measured using their most recent GPA or standardized test scores.

2.2. Sample and data collection

In terms of participants, a representative sample of high school students was selected, ensuring diversity in terms of demographics (age, gender, socioeconomic status). Stratified random sampling was used to ensure that different groups within the student population were adequately represented. The study model consisted of seven independent components, one dependent factor, and 35 observations. The formula states that the number of samples needed for exploratory factor analysis (EFA) discovery factor analysis is N=35*7=245 carry-up observations, or N=35+8*7=91 observations or more for multivariate regression analysis. Accordingly, 500 questionnaires were administered to students from three grades: grade 10, grade 11, and grade 12, at a high school in Northern Vietnam. Ethical approval was obtained from the relevant institutional review board. Participants were assured of their confidentiality, and their right to withdraw from the study at any time was emphasized. After screening, the total number of valid votes suitable for analysis is 438 survey votes (93.5%). Among those, 93 students, or 21.2% of the total, are in grade 10, 113 students, or 25.8%, are in grade 11, and 232 students, or 53%, are in grade 12. Students with average academic ability make up the largest share of the student body (70.1%), followed by good academic capacity (23.7%), weak/poor (3.2%), good (2.3%), and outstanding (0.7%).

2.3. Data analysis

Software SPSS 26.0 is used to analyze survey data with: i) examination of the Cronbach's alpha coefficient to assess the scale's dependability; ii) determination of components that quantify influence, using EFA; and iii) validation of measurement models and ascertain the effects of relationships between influencing factors and learning performance, correlation, and regression analysis are utilized. Regression analysis was performed to assess the impact of each independent variable on academic performance. This involved the descriptive statistics to summarize demographic data. Multiple regression analysis to determine the significance and strength of relationships. Checking assumptions of regression analysis (normality, multicollinearity, and homoscedasticity).

3.   RESULTS

The preliminary study sample assesses the reliability of measuring the elements in the proposed research model. Reliability is assessed using the Cronbach alpha, the sum variable correlation coefficient, and the sum variable correlation coefficients. A minimum Cronbach alpha coefficient of 0.6 and a total variable correlation coefficient of the observed variables in a factor that should be more than 0.3 are the selection criteria for assessing the reliability of the scales in the study. In the study scale, questions having a minor total variable correlation coefficient (<0.3) were deemed to be removed. The analysis of the questionnaire's results reveals that:

- Learning environment: the overall variable correlation coefficient for the observed variables (MTHT1–MTHT5) is more than 0.3, and the group's Cronbach's alpha coefficient is 0.847 (excellent).
- Learning persistence: Cronbach's coefficient analysis yielded alpha at 0.814 (excellent), and the observed variables (KDHT1-KDHT3) had a total variable correlation coefficient greater than 0.3.
- Learning motivation: the findings of this group analysis show that Cronbach's coefficient alpha=0.798, and all of the observed variables (DCHT1-DCHT3) have a total variable correlation coefficient better than 0.3.
- Learning methods: Cronbach's alpha coefficient is 0.831, and the observed variables (PPHT1-PPHT6) have a total variable correlation coefficient larger than 0.3.
- Teacher competencies: the group analysis's findings demonstrate that the observed variables (NLGV1–NLGV6) all have total variable correlation coefficients of more than 0.3 and that Cronbach's coefficient of alpha is 0.887 (excellent).
- School facility: the observed variables (CSVC1–CSVC4) all exhibit a total variable correlation coefficient larger than 0.3 and Cronbach's coefficient alpha at 0.764.
- School extracurricular activities: the group analysis's findings indicate that the observed variables (HDNK1–HDNK5) all have total variable correlation coefficients larger than 0.3 and that Cronbach's alpha coefficient is 0.845 (excellent).

The correlation coefficient for the entire variable is more than 0.8, as the results demonstrated. The building scale system, thus, has 35 characteristic variables, five quality assurance levels, and good reliability. The variables of the factor groups are suitable for EFA based on the findings of this confidence analysis.

As shown in the component matrix in the Table 3, the factor load coefficients are more significant than 0.5 to ensure meaning, so no variables are excluded. The eigenvalue coefficient=1.452>1 represents the part of the variation explained by each factor information. The derived factor has the best summaries of information, and the derived factor has the best summaries of information summaries. Total extraction sums of squared loadings (cumulative %)=65.231%>50%. This proves that independent factors explain 65.231% of the research model.

The validation of the hypotheses in this study provides critical insights into the factors influencing high school students' academic performance. Each hypothesis was rigorously tested using regression analysis, allowing for a comprehensive examination of the relationships between various independent variables and students' academic outcomes. Pearson correlation analysis is a statistical method used to measure the strength and direction of the linear relationship between variables. In this research, it examines the relationship between academic performance and all seven categories among students.

Table 3. Results of EFA of independent variables

Item	Factor						
	1	2	3	4	5	6	7
NLGV6	.819						
NLGV5	.795						
NLGV1	.764						
NLGV3	.763						
NLGV4	.752						
PPHT6		.761					
PPHT4		.730					
PPHT1		.701					
PPHT2		.698					
PPHT5		.661					
PPHT3		.610					
MTHT5			.832				
MTHT2			.785				
MTHT3			.762				
MTHT1			.759				
MTHT4			.675				
HDNK5				.836			
HDNK3				.762			
HDNK1				.757			
HDNK4				.740			
HDNK2				.713			
CSVC3					.772		
CSVC1					.724		
CSVC2					.708		
CSVC4					.697		
KDHT3						.859	
KDHT1						.826	
KDHT2						.821	
DCHT3							.847
DCHT2							.798
DCHT1							.725
Eigenvalues=1.452							
Total variance=65.231%							

Table 4 presents the Pearson correlation coefficients among several variables (MTHT, KDHT, DCHT, PPHT, NLGV, CSVC, and HDNK) along with their significance levels. The values indicate the strength and direction of the relationships between the variables. All correlations have a significance level (Sig. 2-tailed)<0.05 between students' academic performance and variables of learning environment, persistence, motivation, methodologies, teacher capacity, facilities, and extracurricular activities, which indicates that the results are statistically significant at both the 1% and 5% levels. This means that the likelihood of observing these correlations due to random chance is extremely low. It indicates that the highest correlation is between NLGV and DCHT, suggesting that these two variables have a significant positive relationship, indicating that increases in one are associated with increases in the other. The lowest correlation is between KDHT and DCHT, indicating a weaker relationship compared to the others. The results suggest that there are meaningful relationships between the various variables, particularly between NLGV and DCHT, which may warrant further investigation to understand the underlying mechanisms driving these correlations.

Through this analysis, it was determined that all proposed hypotheses were supported, indicating significant influences from key factors such as the learning environment, teacher competencies, learning

motivation, learning methods, school facilities, and extracurricular activities. The regression coefficients revealed the strength and direction of these relationships, highlighting the importance of teacher quality and effective learning strategies in enhancing academic performance. Table 5 summarizes the results of a regression analysis, including both unstandardized and standardized coefficients, along with significance levels and collinearity statistics.

Table 4. Pearson correlation results

Factors	MTHT	KDHT	DCHT	PPHT	NLGV	CSVC	HDNK
Pearson correlation	.374**	.285**	.490**	.468**	.625**	.501**	.378**
Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000
N	438	438	438	438	438	438	438

**significance level 1%

Table 5. Results of regression analysis

Model	Unstandardized coefficients		Standardized coefficients	t	Sig	Collinearity statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant	-1.333	.222		-5.997	.000		
MTHT	.139	.038	.126	3.668	.000	.808	1.237
KDHT	.100	.031	.103	3.197	.001	.911	1.097
DCHT	.220	.040	.193	5.523	.000	.774	1.292
PPHT	.122	.045	.100	2.722	.007	.703	1.422
NLGV	.352	.038	.344	9.212	.000	.680	1.472
CSVC	.257	.039	.225	6.527	.000	.794	1.259
HDNK	.134	.036	.124	3.710	.000	.843	1.186

Table 5 presents a robust regression model where all independent variables significantly influence the dependent variable. These coefficients represent the expected change in the dependent variable for a one-unit change in the independent variable, assuming other variables are held constant. The regression findings in the Table 5 reveal that seven independent variables obtained a significance level of <0.05: MTHT (0.000), KDHT (0.001), DCHT (0.000), PPHT (0.007), NLGV (0.000), CSVC (0.000), and HDNK. All beta coefficients are more significant than zero, indicating that the independent and dependent variables interact positively. That is, increasing any element leads to learning outcomes learning outcomes and vice versa. Among them, NLGV (corrected beta coefficient=0.344) has the most substantial impact, followed by CSVC (0.225) and DCHT (0.193). The results indicate that the model is well-specified, with low multicollinearity, making the findings reliable for further interpretation and application. DCHT variable (0.193), and the MTHT variable (0.126). The HDNK variable (0.124), the KDHT variable (0.103), and the PPHT variable with the corrected beta coefficient (0.100) are the smallest, meaning they have a negligible impact on students' learning performance. Furthermore, the variance inflation factor (VIF) magnification coefficient ranges from 1,097 to 1,472<2 (all tolerance values are above 0.10.10.1 and VIF values are below 555) indicating low multicollinearity among the independent variable. This suggests that the independent variables are not excessively correlated, allowing for more reliable coefficient estimates.

To test a linear relationship between normalized residuals and normalized predicted values, the scatter plot graphic is used to verify the linear contact assumption. One way to determine if the current data deviates from the linear contact assumption is to look at the scatter plot between the normalized residuals and the normalized predictive values. The unnormalized beta coefficient multivariate regression equation with the suggested hypothesis has the following form, as in (1).

$$KQHT = \beta 0 + \beta 1 * MTHT + \beta 2 * KDHT + \beta 3 * DCHT + \beta 4 * PPHT + \beta 5 * NLGV + \beta 6 * CSVC + \beta 7 * HDNK \tag{1}$$

Where:
B0=constant
β1=unnormalized regression coefficients of the learning environment component
β2=unnormalized regression coefficients of the learning persistence component
β3=unnormalized regression coefficients of the learning motivation component
β4=unnormalized regression coefficients of the learning method component
β5=unstandardized regression coefficients of the teacher competency component
β6=unstandardized regression coefficients of the facility component
β7=unstandardized regression coefficients of the school extracurricular activities

In addition, the (2) expresses the relationship between independent and dependent variables.

$$KQHT = -1,333 + 0,139 * MTHT + 0,100 * KDHT + 0,220 * ĐCHT + 0,122 * PPHT$$
$$+0,352 * NLGV + 0,257 * CSVC + 0,134 * HDNK \qquad (2)$$

Regression standardized residuals require testing because they may not conform to a normal distribution due to factors like using an inappropriate model or having inadequate data for analysis. The two most common methods for this evaluation are the histogram and the normal P-P plot. In this study, a histogram was used for testing. The result is presented in Figure 2.
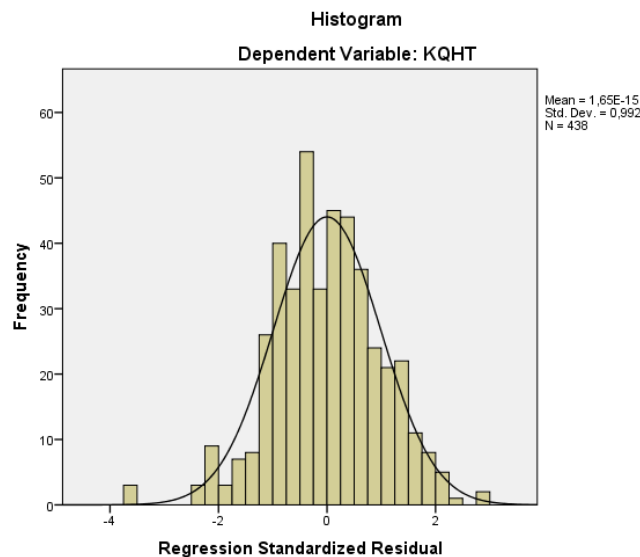
Figure 2. Normalized residual frequency histogram

Figure 2 presents a histogram that displays the frequency of normalized residuals. The bell-shaped curve aligns with the typical form of a standard distribution. The mean is close to 0, and the standard deviation is approximately 0.992, which is close to 1, indicating that the residual distribution closely approximates the standard. This visualization allows us to assess that the residuals meet the assumptions of normality, which is crucial for validating the results of regression analysis. A well-formed bell shape would suggest that the model's assumptions are satisfied, while any significant deviations could indicate potential issues with the model or data.

To assess the linear relationship, a scatter plot can visually display the relationship to see random dispersion if the model is appropriate. Next, calculating the correlation coefficient will provide a quantitative measure of the strength and direction of the relationship. A coefficient close to zero suggests no linear relationship, while values near -1 or 1 indicate strong negative or positive correlations, respectively. Additionally, performing a regression analysis with normalized residuals as the dependent variable and normalized predicted values as the independent variable can help confirm any findings. The significance of the regression coefficients can be tested using hypothesis tests. Finally, assessing the residuals for patterns (using plots like the residuals vs. fitted values) can further validate whether the linear model is appropriate. If patterns appear, it may suggest that a non-linear relationship is present or that the model is not well-specified.

Figure 3 displays that the p-value is above a chosen significance level (e.g., 0.05), it indicates no significant linear relationship exists. The observation that normalized residuals are concentrated around the zero line suggests that the model adequately captures the relationship between the variables. The residuals cluster around zero, it indicates that the predictions are close to the actual values, supporting the assumption of linearity in the regression model. This means there are no significant patterns in the residuals, which reinforces the validity of the linear relationship. Table 6 provides a summary of the regression results, offering further insights into the model's performance and the strength of the relationships identified.
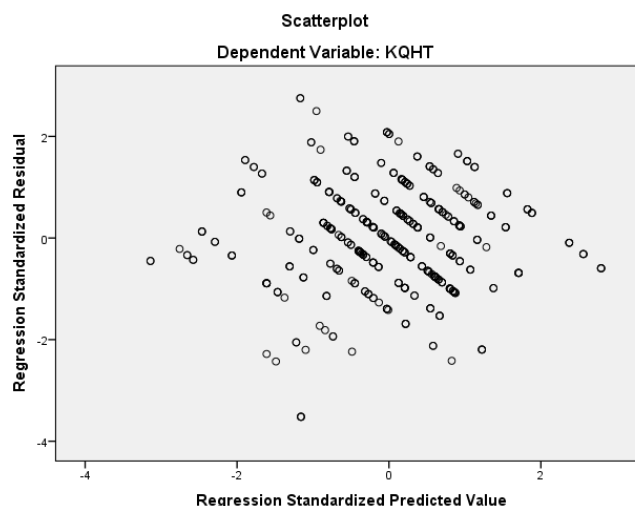
Figure 3. Scatter plot chart testing linear contact assumptions

Table 6 summarizes the findings of a regression analysis that examines various factors affecting students' learning performance. Each hypothesis proposes a specific relationship between a factor (such as the learning environment, persistence, and motivation) and students' learning performance.

- H1: indicates that the learning environment positively influences learning performance. This suggests that a supportive and resourceful environment can enhance students' academic outcomes.
- H2: indicates that learning persistence (the ability to continue working through challenges) significantly affects learning performance. This underscores the importance of resilience in educational success.
- H3: suggests that learning motivation plays a critical role in driving students' performance. Motivated students are likely to engage more deeply and perform better.
- H4: suggests that the methods employed in learning impact performance. This highlights the need for effective teaching strategies and learning techniques.
- H5: indicates that teachers' competencies (their skills and knowledge) significantly affect student performance. This points to the importance of teacher quality in educational outcomes.
- H6: suggests that the availability and quality of school facilities (like libraries, labs, and technology) have a positive impact on students' learning performance. Good facilities can enhance the learning experience.
- H7: indicates that participation in school extracurricular activities positively affects learning performance. This suggests that such activities can contribute to overall student engagement and development.

The overall acceptance of all hypotheses in the table indicates a strong relationship between these various factors and students' learning performance, suggesting that efforts to improve these areas could lead to better academic outcomes.

Table 6. Summary of regression results

No	Hypothesis	Result
H1	The learning environment has an impact on students' learning performance.	Accept
H2	Learning persistence affects students' learning performance.	Accept
H3	Learning motivation affects students' learning performance.	Accept
H4	Learning methods have an impact on students' learning performance.	Accept
H5	Teachers' competencies have an impact on students' learning performance.	Accept
H6	School facilities have an impact on students' learning performance.	Accept
H7	School extracurricular activities have an impact on students' learning performance.	Accept

4. DISCUSSION

The findings highlight the multifaceted nature of factors affecting high school students' academic performance. Each element plays a crucial role in shaping students' educational experiences and outcomes. Notably, the study revealed that while the teachers' competency factor had the strongest effect on students' learning outcomes, students also rated the facility factor as having a significant impact, ranking second (NLGV=0.344 and CSVC=0.225). The significant impact of teacher quality emphasizes the need for ongoing professional development. Effective teachers not only impart knowledge but also inspire and motivate

students. Investing in training programs that enhance pedagogical skills and classroom management can lead to improved student engagement and performance. The role of adequate school facilities cannot be overlooked. Schools should invest in maintaining and improving facilities to create an atmosphere conducive to learning. Access to well-resourced libraries, labs, and recreational spaces supports a well-rounded educational experience. Additionally, students perceived "learning motivation" and "learning persistence" as influencing their results, albeit with a lower effect coefficient of 0.193 and 0.103 respectively. The study underscores the importance of intrinsic motivation in students' academic journeys. Schools should implement strategies that cultivate a love for learning, such as goal-setting workshops and recognition programs that celebrate student achievements. Encouraging persistence through a growth mindset can help students navigate challenges more effectively. Furthermore, although the learning environment and extracurricular activities had minimal impact coefficients (MTHT=0.126 and HDNK=0.124), they still contributed to students' learning outcomes. A supportive learning environment is essential for fostering academic success. Schools should prioritize creating spaces that encourage collaboration and inclusivity, as well as providing resources that meet diverse student needs. Participation in extracurricular activities has been shown to positively influence academic performance. Schools should promote a wide range of activities that cater to various interests, allowing students to develop skills beyond the classroom and fostering social connections.

Interestingly, the study found that students' learning methods had the least significant effect on academic achievement, with an adjusted beta coefficient of only 0.100. The diversity of learning strategies is critical for accommodating different learning styles. Educators should be encouraged to experiment with various teaching techniques, such as project-based learning and technology integration, to enhance student engagement and comprehension. These results align with the findings of previous studies [6], [23], who recognized that various factors, including the learning environment, teacher competency, learning motivation, learning strategies, and school facilities, influence students' learning outcomes. The results of this study are also similar to those identified by several researchers [21], [32], which highlighted that the factors of students, teachers, and facilities have the most significant impact on academic performance, particularly emphasizing the role of teacher competency, followed by facilities. Additionally, research by Rusticus *et al.* [20] noted that teacher competency positively affects students' learning outcomes. However, this study's findings differ from their study, where learning motivation was identified as having the most substantial positive impact, followed by learning interest, learning patterns, and family environment. Study by Nguyen *et al.* [18] suggested that consistency in learning and motivation also significantly enhance students' academic performance. In contrast, the findings here diverge from Evans [15], whose research outlined five groups of factors affecting students' learning outcomes, placing students' psychological characteristics—such as preparation, learning strategies, and goal commitment—as crucial elements positively correlated with academic success. Furthermore, previous studies [24]–[26], [29], [30] identified that students' attitudes towards family support, academic achievement, and self-motivation are key factors influencing academic performance. The results of the study is relatively similar to previous studies [34], [35], which confirmed that students' learning methods and teachers' active teaching were recognized as the impactful elements on student academic performance.

As discussed by various studies [25], [27], [28], [31], which identified three categories including educational environment, school reputation, and personal circumstances—had exerted a strong influence on students' academic performance. By addressing the interconnected factors identified in this study, schools can create an environment that not only enhances academic outcomes but also supports the overall development of students. Future research could further explore these relationships and examine the long-term effects of implementing these strategies. Specifically, schools should: i) invest in professional development programs that focus on improving teaching methodologies, classroom management, and effective communication skills to enhance teacher competencies; ii) create a supportive and inclusive school culture that encourages collaboration, respect, and open communication among students and staff; iii) implement programs that promote intrinsic motivation, such as setting clear goals, providing meaningful feedback, and recognizing student achievements; iv) incorporate diverse teaching strategies, such as project-based learning, collaborative group work, and technology integration, to engage students and cater to different learning styles; v) invest in upgrading school facilities, including classrooms, libraries, and recreational areas, to create an environment that supports effective learning; vi) encourage student participation in extracurricular activities that promote social skills, teamwork, and personal interests, which can enhance overall academic performance; vii) regularly evaluate student progress through formative assessments and feedback mechanisms to identify areas for improvement and adjust teaching strategies accordingly; and viii) instill a growth mindset in students by encouraging them to view challenges as opportunities for growth, fostering a love for learning that extends beyond the classroom. By implementing these recommendations, schools can create a more effective educational environment that promotes academic success and supports the holistic development of high school students.

5.   CONCLUSION

This article has examined the various factors influencing high school students' academic performance, identifying seven key elements: the learning environment, learning persistence, learning motivation, learning methods, teacher competencies, school facilities, and extracurricular activities. These factors will promote student learning and improve academic outcomes, ultimately enhancing the overall quality of education for high school students. The findings underscore the critical role of teacher quality and effective management strategies in fostering student success. Furthermore, the importance of a supportive learning environment and engaging learning practices has been emphasized as essential for enhancing student motivation and consistency in their academic efforts. By addressing these factors, educators and administrators can create a more conducive learning atmosphere, ultimately leading to improved academic outcomes and higher quality education for high school students. The insights gained from this research provide a valuable foundation for ongoing efforts to enhance educational practices and support student development in the future.

Based on the research findings, high school administrators and instructors should prioritize teacher quality and implement effective management strategies. In addition to enhancing teacher quality, schools and educators must foster clear and strong learning motivation for students, employ effective learning techniques, and ensure consistency in the learning process. Emphasizing a supportive learning environment and engaging learning support activities is essential.

However, the study's findings may be limited due to the quantitative research with small sample. Furthermore, the research may not account for external factors influencing academic performance, such as socio-economic status, family background, or individual student circumstances, which can significantly impact learning outcomes. While the study identifies several factors affecting academic achievement, it may overlook other important variables, such as emotional intelligence, peer influence, which could also play a role in students' academic success. The findings may not account for changes in teaching methodologies, curriculum standards, or educational technologies that could influence academic performance in the future. By addressing these areas, future research can contribute to a more comprehensive understanding of the factors influencing academic achievement and provide actionable insights for educators and policymakers.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization	I : **I**nvestigation	Vi : **Vi**sualization
M : **M**ethodology	R : **R**esources	Su : **Su**pervision
So : **So**ftware	D : **D**ata Curation	P : **P**roject administration
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CONFLICT OF INTEREST STATEMENT

We confirm that, this paper is our own research product. The paper is our original research result without a conflict of interest in connection with manuscripts. We do not have competition of interests of political, personal, religious, ideological, academic, and intellectual aspects with other individuals or associations. We have no pressure of financial interests or personal relationships that influence the work reported in this paper.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [DTTT] on request.

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