INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 14, Issue 4, (2025) E-ISSN: 2226-6348

An Empirical Study of the Factors that Influence College Students' Academic Performance in Mathematics Subject

Nur Nadia Binti Zainul Arifin[1], Tay Choo Chuan[2], Sek Yong Wee[3], Liaw Geok Pheng[4]

[1,3]Institute of Technology Management and Entrepreneurship, Universiti Teknikal Malaysia Melaka (UTeM), 76100, Durian Tunggal, Melaka, Malaysia, [2]Faculty of Eletrical Enginering, Universiti Teknikal Malaysia Melaka (UTeM), 76100, Durian Tunggal, Melaka, Malaysia, [4]Faculty of Teknologi Maklumat dan Komunikasi(FTMK), Universiti Teknikal Malaysia Melaka (UTeM), 76100, Durian Tunggal, Melaka, Malaysia

Corresponding Author Email: pheng0128@gmail.com

DOI Link: http://dx.doi.org/10.6007/IJARPED/v14-i4/26680

Published Online: 15 October 2025

Abstract

This study investigates the factors influencing students' academic performance in Mathematics at Putra International College (PIC). Using a descriptive mixed-method design, quantitative data were collected from 73 students' examination results and questionnaires, complemented by qualitative interviews. Five independent variables were analysed: attitude tests, material availability, study environments, attendance, and parental marital status. Pearson correlation and multiple regression models were applied through SPSS version 20. The findings revealed that all five factors were positively correlated with student performance, with attitude tests showing the strongest relationship (r = 0.467) and marital status the weakest (r = 0.160). Regression analysis demonstrated that the explanatory power of the models increased with the addition of more factors, with the five-factor model achieving the highest performance (r = 0.606; R^2 = 0.367; Std. Error = 14.474). This proves that student performance is best explained by the combination of motivational, institutional, and demographic factors. The study concludes with theoretical, pedagogical, and policy implications, suggesting that institutions should prioritize fostering positive attitudes toward mathematics and ensuring adequate learning resources while considering the broader socio-demographic background of students.

Keywords: Mathematics, Low Performance, Factors, Combination, Higher Education

Background

Students' academic performance has been a topic of major concern to educators, parents, and policymakers for decades. While governments have made significant efforts to expand the number of schools, colleges, and universities, as well as to increase enrolment at various stages of education, questions remain about the quality of outcomes. The reality is that

academic achievement is not influenced by a single factor but rather by a complex interaction of variables both inside and outside the school environment (Farooq et al., 2011). These variables include not only the characteristics of the students themselves but also their family backgrounds, institutional conditions, and broader societal expectations. Furthermore, research has highlighted the importance of gender as a critical dimension that shapes both learning experiences and educational aspirations (Eitle, 2005). Understanding these interrelated factors provides a comprehensive view of why some students excel while others face persistent difficulties in achieving academic success.

The role of gender in academic achievement has been studied extensively, and the evidence points to persistent patterns across contexts. Girls have often been found to perform better than boys in certain academic domains, particularly in language and reading-related subjects, while boys are generally more inclined toward mathematics and science fields (Eccles, 2009; Lazarides & Lauermann, 2019). This divergence is not simply about ability but also reflects socialization processes, cultural stereotypes, and differing expectations from parents, teachers, and society. For example, boys may be encouraged to pursue STEM-related careers, while girls may be directed toward fields linked to literature, social sciences, or care professions. However, research also suggests that while pathways to ambitions may differ, the prestige of careers chosen by boys and girls can be comparable (Watt et al., 2012). More recent studies have emphasized the need to understand how motivational beliefs, self-concept, and values shape these aspirations, highlighting that persistent gender differences in career preferences are closely tied to identity and social norms (Widlund et al., 2020). Therefore, examining the role of gender is not just about identifying performance gaps but also about understanding the broader cultural and psychological factors that influence students' long-term educational and occupational trajectories.

Among all determinants of academic performance, student-related factors are perhaps the most direct and immediate. Motivation, attitudes, study habits, and attendance are consistently identified as major predictors of achievement (Ambad et al., 2017; Awang, Jindal-Snape, & Barber, 2013). Students with a positive outlook toward learning tend to demonstrate higher levels of engagement, persistence, and academic resilience, while those with negative attitudes often disengage from classroom activities and underperform (Erdoğan & Deniz, 2008). In addition, absenteeism has been shown to have a significant detrimental effect on academic outcomes. Students who miss classes frequently are less able to participate in discussions, clarify their doubts, and keep pace with the curriculum (Luttah Waseka & Simatwa, 2016). Aptitude tests are another important measure, as they capture students' preparedness, prior knowledge, and problem-solving ability. Research shows that aptitude and consistent class participation can reliably predict performance outcomes (Medina & Tapia, 2004; Gallacher, n.d.). Together, these findings suggest that while institutional and parental support are important, a student's own drive and consistency remain central to academic success.

The family background of students plays a significant role in shaping their academic outcomes. Parents' education level, marital stability, and income all influence the learning opportunities and support that students receive at home. Educated parents are more likely to provide guidance, resources, and a supportive learning environment, thereby boosting their children's chances of academic success (Fantuzzo & Tighe, 2000; Krashen, 2005). For

example, parents who are themselves familiar with academic requirements can assist with homework, encourage effective study habits, and set high expectations. Marital stability also matters; children from stable families often benefit from consistent support, whereas family conflict and instability are linked to lower achievement and behavioural issues (Deci et al., 1981). Income is another determinant—families with higher socioeconomic status can provide access to books, technology, tutoring, and other educational resources that directly improve performance (Getachew, 2018). On the other hand, students from low-income families may struggle due to limited resources, less exposure to enriching activities, and stress related to financial instability. Hence, parental factors are not only about direct involvement in schoolwork but also about the broader home environment that shapes students' academic behaviours and aspirations.

Finally, the institutional environment is a crucial determinant of students' academic achievement. Learning environments that are well-resourced, safe, and conducive to study positively affect both motivation and outcomes (Tanner, 2009). Studies have shown that students' satisfaction with their physical and learning environments correlates strongly with their academic engagement and achievement (Costa & Steffgen, 2020). This includes factors such as classroom design, seating arrangements, lighting, and access to technology and materials (Higgins et al., 2016). Beyond physical infrastructure, the availability of educational materials—libraries, textbooks, laboratories, and online resources—greatly enhances the learning process (Young, 1999). When such resources are lacking, students are more likely to feel discouraged and underprepared, which directly impacts performance. Co-curricular activities also form an important dimension of institutional support. These activities foster personal development, leadership skills, and teamwork, which indirectly contribute to academic performance by building confidence and engagement (George & Thinguri, 2016). Participation in co-curricular activities has also been associated with better social skills and stronger commitment to schooling (Weber, 1994). Thus, the institutional role is not confined to formal teaching but extends to creating an environment that nurtures students' holistic development.

In summary, academic achievement is shaped by a complex interplay of gender dynamics, student characteristics, parental background, and institutional factors. Gender differences influence career aspirations and subject preferences, while students' own attitudes, habits, and attendance remain central to success. Parental support through education, stability, and income provides the foundation for effective learning, and institutions contribute by offering conducive environments and co-curricular opportunities. Together, these factors create a framework for understanding variations in student achievement and provide a basis for interventions aimed at improving outcomes in Mathematics and beyond.

Introduction

Mathematics is a compulsory subject in Malaysian higher education, serving as a foundation for critical thinking, problem-solving, and analytical reasoning across disciplines. Its role extends beyond the classroom to the broader context of national development, where numeracy and quantitative skills are essential for innovation and competitiveness. Despite its importance, consistent challenges in mathematics performance persist among students in many institutions. At Putra International College (PIC), this issue is particularly evident among Bachelor of Science in Business Administration (BSBA) students who must take Mathematics

as a core subject in their first semester. While the subject is designed to reinforce analytical competency acquired in the Sijil Pelajaran Malaysia (SPM) examination, performance data and classroom observations indicate that a significant portion of students underperform. This underachievement points to deeper, multifaceted issues beyond curriculum content, involving student attitudes, institutional resources, and socio-demographic backgrounds. This study seeks to identify the factors that contribute to this issue and to understand the root causes behind students' difficulties.

The choice of PIC as the focus of this research is based on the researcher's teaching experience at the institution since 2016. PIC offers a small classroom environment, which allows for close monitoring of students' learning patterns. However, the student body is diverse, drawing learners from across Malaysia, including Sabah and Sarawak, and representing various streams from the SPM. These differences in academic preparation and background often result in varied levels of readiness for higher-level mathematics. Moreover, students' interest in mathematics plays a significant role in shaping their attitudes and performance. While some approach the subject with enthusiasm, others struggle with motivation or confidence, which can negatively influence examination outcomes.

Importantly, the research is conducted under the assumption that low performance cannot be attributed solely to students. Factors beyond their control—such as family background, parental support, institutional resources, and learning environments—may act as barriers to achievement. Although numerous studies have investigated academic performance in general, there is limited research that focuses specifically on Mathematics at the higher education level, particularly with respect to gender comparisons.

This study therefore aims to examine the extent to which factors related to students, parents, and institutions, alongside gender differences, affect academic performance in Mathematics at PIC. By applying a Multiple Regression Model, the research will identify the main predictors of success and provide insights that can help students, educators, and policymakers create more effective strategies to improve learning outcomes and future opportunities.

This research contributes to the field of social science by integrating psychological, institutional, and socio-demographic dimensions within a single empirical model to explain mathematics performance at the tertiary level. While prior studies have examined academic achievement factors separately, this study's novelty lies in its combined quantitative and qualitative approach, applying a five-factor regression model to reveal the relative influence of student, parental, and institutional variables. The findings provide practical implications for policy and pedagogy by identifying actionable factors that higher education institutions can target to enhance students' mathematical competency and learning outcomes.

Methodology

This study adopted a descriptive research design to examine factors affecting students' performance in Mathematics. A mixed-method approach was employed, combining quantitative data from final grades and questionnaires with qualitative insights from student interviews. The population consisted of 73 students at Putra International College (PIC) who had formed the sample, which considered adequate under the Central Limit Theorem. A structured questionnaire served as the main instrument, divided into four sections:

demographics, student factors, parental influences, and institutional aspects. Data were collected using Google Forms for efficiency and accessibility, then screened for completeness. Responses were coded and analysed using SPSS version 20. Descriptive statistics (means, frequencies, standard deviations) and inferential tests (Chi-square, correlation, regression) were applied.

The dependent variable was student performance, while ten independent variables—including gender, aptitude, attendance, parental background, and institutional conditions—were tested under the null hypothesis that none significantly influenced achievement.

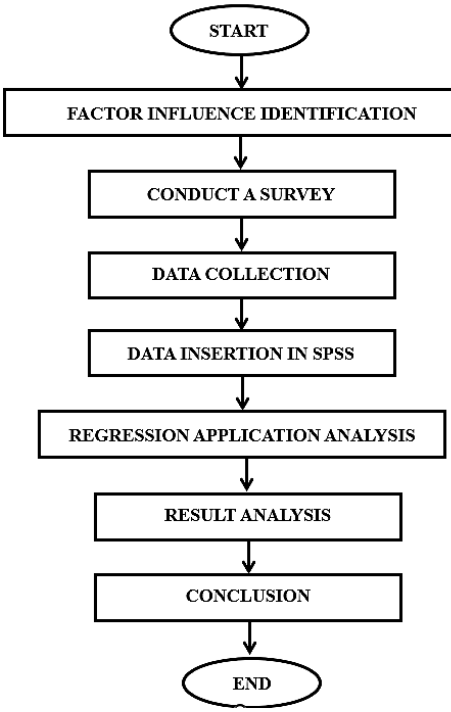

Figure 3.1: The flow chart of project

Result and Discussion

The aim of this study was to investigate the relationship between five independent variables—attitude tests, material availability, study environments, attendance, and parental marital status—and students' academic performance in Mathematics subject at Putra International College (PIC). Using Pearson correlation and multiple regression models, the analysis sought to determine the relative importance of each factor and identify the best-performing predictive model.

The findings consistently demonstrated positive associations between all five factors and student marks, though the strength of these relationships varied. Attitude tests emerged as the strongest single predictor, followed by material availability and study environments. Attendance and marital status showed weaker correlations. Regression analysis confirmed that predictive power increased as more factors were included, with the five-factor model achieving the best overall performance ($r = 0.606$; $R^2 = 0.367$; Adjusted $R^2 = 0.320$; Std. Error = 14.474).

These results highlight the multidimensional nature of academic achievement in Mathematics, where motivational, institutional, and socio-demographic variables interact to shape student outcomes.

Correlation Analysis

Table 4.1

Presents the Correlation Coefficients between each Factor and Students' Marks

Factor	Correlation (r)	Significance (p)
Attitude Tests	0.467	0.000
Material Availability	0.400	0.000
Study Environments	0.349	0.001
Attendance	0.189	0.055
Marital Status	0.160	0.088

Figure 4.10: Correlation between Factors and Students' Marks

Figure 4.1 illustrates these relationships in graphical form.

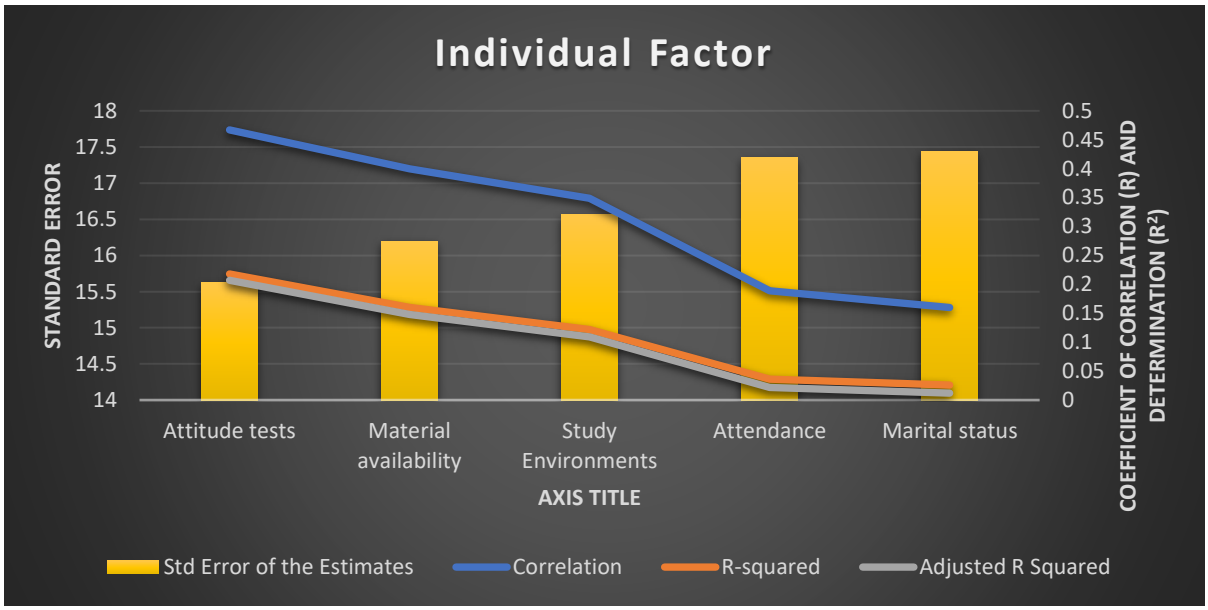

Figure 4.1. Correlation of individual factors with student marks in Mathematics.

The data indicate that attitude tests had the highest correlation ($r = 0.467$, $p < 0.001$), suggesting that students with positive attitudes toward mathematics consistently performed better. Material availability ($r = 0.400$, $p < 0.001$) and study environments ($r = 0.349$, $p = 0.001$) also demonstrated moderate, significant correlations. Attendance ($r = 0.189$, $p = 0.055$) and marital status ($r = 0.160$, $p = 0.088$) showed weaker, non-significant relationships. These results suggest that student-centred and institutional factors are more important predictors of performance than background variables.

Regression Analysis

Regression models were developed to examine the combined effects of the independent variables. Table 4.2 summarizes the results.

Table 4.2
Regression Models (One to Five Factors)

Model	Factors Included	r	R^2	Adjusted R^2	Std. Error
1	Attitude Tests	0.467	0.218	0.207	15.625
2	Attitude + Material Availability	0.563	0.317	0.297	14.710
3	Attitude + Material + Study Environment	0.594	0.353	0.325	14.413
4	Attitude + Material + Study Environment + Attendance	0.604	0.364	0.327	14.396
5	Attitude + Material + Study Environment + Attendance + Marital Status	**0.606**	**0.367**	**0.320**	**14.474**

Figure 4.2 depicts the progression of R^2 values across models, while Figure 4.3 shows the decline in standard error.

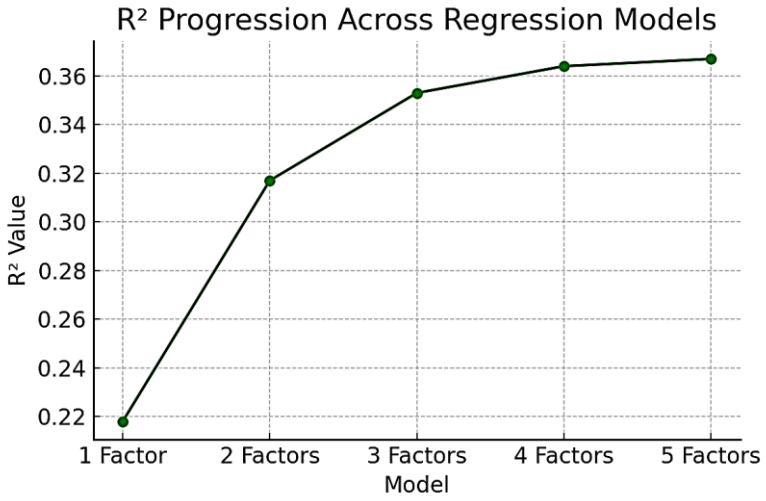

Figure 4.2. R^2 progression across regression models.

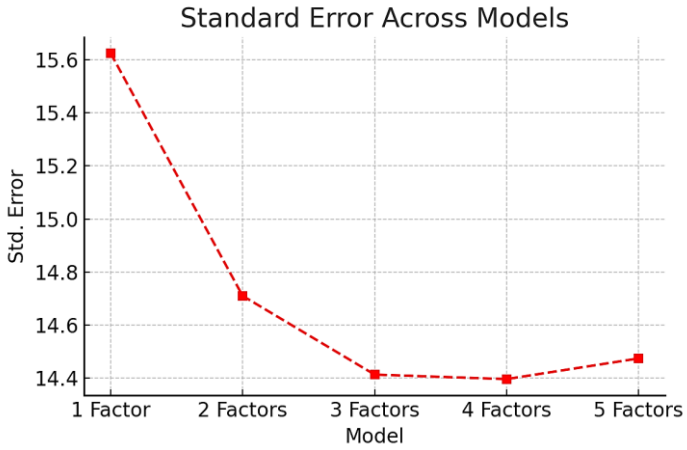

Figure 4.3. Standard error of the estimate across models.

The one-factor model with only attitude tests explained 21.8% of variance (R^2 = 0.218). Adding material availability increased explanatory power to 31.7%. The three-factor model (attitude, materials, environments) explained 35.3%. The four-factor model (adding attendance) achieved 36.4%, and the five-factor model (adding marital status) provided the highest performance with R^2 = 0.367 and lowest error (14.474).

Discussion of Individual Factors

Attitude Tests

Attitude tests consistently emerged as the strongest single predictor of student marks. With r = 0.467 and R^2 = 0.218, student attitudes alone explained nearly a quarter of the variance in performance. This finding aligns with Erdogan & Deniz (2008) and Awang et al. (2013), who reported that positive attitudes toward learning significantly enhance achievement. Students with higher motivation, persistence, and confidence in mathematics were more likely to engage actively with the subject and perform better.

Material Availability

Material availability ranked second in importance (r = 0.400). When combined with attitude, it increased explanatory power from 21.8% to 31.7%. This suggests that student motivation must be complemented by adequate resources. Without textbooks, notes, or digital access, even motivated learners face limitations. This finding supports Tanner (2009) and Higgins et al. (2016), who found that access to learning materials is a significant determinant of achievement.

Study Environments

Study environments (r = 0.349) also contributed meaningfully, raising the three-factor model to R^2 = 0.353. This highlights the role of conducive classrooms, peer interactions, and study facilities. Fraser (1998) noted that supportive environments encourage collaboration and deeper understanding, while Costa & Steffgen (2020) linked physical and social environments to student satisfaction and outcomes.

Attendance

Attendance showed a weaker relationship (r = 0.189, p = 0.055). While regular attendance provides exposure to instruction, its direct effect on performance was minimal compared to motivation and resources. This aligns with García & Weiss (2018), who noted that absenteeism affects performance indirectly by reducing engagement and syllabus coverage rather than directly determining grades.

Marital Status

Marital status had the weakest correlation (r = 0.160, p = 0.088). While family stability may influence student well-being, it does not directly impact academic performance as strongly as in-class or institutional factors. Deci et al. (1981) similarly found that while family disruptions affect social development, their academic impact varies widely.

Why the Five-Factor Model Is Best

The superiority of the five-factor model is evident in its statistical performance:

Highest correlation (r = 0.606)
Greatest explained variance (R^2 = 0.367)
Lowest prediction error (Std. Error = 14.474)

Although the incremental gain from four to five factors was modest (R^2 = 0.364 → 0.367), the improvement indicates that combining all dimensions provides the most holistic explanation of student performance. Academic achievement is thus best predicted not by single variables but by integrating motivational, institutional, and demographic influences.

This multidimensional perspective aligns with Farooq et al. (2011), who argued that student achievement is shaped by interrelated school, student, and family factors. It also reflects expectancy-value theory (Eccles, 2009), which posits that motivation, expectations, and contextual support jointly determine achievement outcomes.

Conclusion

The purpose of this study was to examine the factors influencing students' performance in Mathematics at Putra International College (PIC). By analysing five independent variables—attitude tests, material availability, study environments, attendance, and parental marital status—this research sought to uncover the extent to which each factor contributed to student achievement and to identify the most effective predictive model. The results from correlation and regression analyses provided valuable insights into the multidimensional nature of academic performance.

The findings demonstrated that student attitudes, as measured through attitude tests, were the strongest individual predictor of performance. Students who exhibited more positive attitudes toward mathematics consistently achieved higher marks. This aligns with previous studies (Awang et al., 2013; Erdogan & Deniz, 2008) that highlighted the central role of motivation and self-belief in academic success. Attitude not only influenced effort and persistence but also shaped how students approached problem-solving in Mathematics.

Material availability and study environments were also found to be significant contributors. When combined with attitude, these institutional factors improved explanatory power substantially, reinforcing the importance of adequate learning resources, access to textbooks, and supportive study conditions. As supported by Fraser (1998) and Tanner (2009), the quality of the learning environment directly affects engagement and performance, and this study confirmed that PIC students benefit from structured environments and readily available learning materials.

Attendance and parental marital status, although weaker predictors, were not entirely irrelevant. Attendance was positively associated with marks, albeit weakly, suggesting that while regular class participation matters, it is insufficient on its own without motivation and resources. Parental marital status had the least impact, indicating that socio-demographic background exerts only indirect influence compared to direct academic and institutional variables.

The regression analysis confirmed the superiority of the five-factor model, which achieved the highest correlation ($r = 0.606$), explained the greatest variance ($R^2 = 0.367$), and yielded the lowest standard error (14.474). While incremental gains beyond three factors were modest, the results nonetheless prove that performance is best explained by a comprehensive model that integrates motivational, institutional, and socio-demographic factors. This finding resonates with the broader literature (Farooq et al., 2011), which asserts that achievement results from the interaction of multiple influences rather than isolated variables.

From a theoretical standpoint, the results support expectancy-value theory, which posits that achievement depends on both motivation and contextual support (Eccles, 2009). They also echo constructivist perspectives, where learning is seen as a process shaped by personal engagement and environmental conditions.

Practically, the study highlights the need for institutions like PIC to prioritize interventions that strengthen student attitudes toward mathematics, such as motivational workshops, mentorship programs, and innovative teaching strategies. Simultaneously, ensuring consistent access to resources and improving study environments will further support learning. Policymakers and educators should thus adopt a holistic approach that combines personal development with institutional support.

In conclusion, this study establishes that improving performance in Mathematics requires addressing multiple dimensions of the learning experience. By fostering positive attitudes, enhancing resource availability, and creating conducive environments, while acknowledging the role of attendance and family context, institutions can create conditions for sustained academic success. Ultimately, a comprehensive and integrative strategy is essential for nurturing not only higher grades but also lifelong confidence and competence in mathematics.

References

Ambad, N. A., Nawardi, F., & Mohamad, M. F. (2017). Students' attitudes and academic performance. International Education Studies, 6(11), 21–28. https://doi.org/10.5539/ies.v6n11p21

Awang, M. M., Jindal-Snape, D., & Barber, T. (2013). A documentary analysis of the government's circulars on positive behavior strategies. Asian Social Science, 9(5), 203–208. https://doi.org/10.5539/ass.v9n5p203

Barnard, W. M. (2004). Parent involvement and student academic achievement. Children and Youth Services Review, 26(1), 1–26.

Costa, A. P., & Steffgen, G. (2020). After the move to a new campus—effects on satisfaction with physical and learning environment. Education Sciences, 10(12), 1–13. https://doi.org/10.3390/educsci10120370

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1981). Motivation and education: The self-determination perspective. Educational Psychologist, 26, 325–346.

Eccles, J. S. (2009). Who am I and what am I going to do with my life? Journal of Personality and Social Psychology, 97(4), 817–827.

Eitle, T. M. N. (2005). Do gender and race matter? Sociological Spectrum, 25(2), 177–195. https://doi.org/10.1080/02732170590883997

Erdoğan, Y., & Deniz, L. (2008). Factors that influence academic achievement and attitudes in web-based education. International Journal, 1(1).

Fantuzzo, J., & Tighe, E. (2000). A family involvement questionnaire. Early Childhood Research Quarterly, 15(4), 625–646.

Farooq, M. S., Chaudhry, A. H., Shafiq, M., & Berhanu, G. (2011). Factors affecting students' quality of academic performance. Journal of Quality and Technology Management, 7(2), 1–14.

Gallacher, M. (n.d.). Predicting academic performance.

Getachew, B. (2018). Socio-economic factors and academic performance. Journal of Education and Practice, 9(4).

Higgins, S., Hall, E., Wall, K., Woolner, P., & McCaughey, C. (2016). The impact of school environments: A literature review. Design Council.

Krashen, S. (2005). The hard work hypothesis: Is doing your homework enough to improve academic achievement? Multicultural Education, 12(4), 16–19.

Lazarides, R., & Lauermann, F. (2019). Gendered paths into STEM- and language-related careers. Frontiers in Psychology, 10, 1243. https://doi.org/10.3389/fpsyg.2019.01243

Luttah Waseka, E., & Simatwa, E. M. W. (2016). Student factors influencing academic performance in secondary education in Kenya. Educational Research, 7(3). https://doi.org/10.14303/er.2016.138

Medina, L., & Tapia, J. A. (2004). Aptitude tests and academic performance: Evidence from the University of Chile.

Tanner, C. K. (2009). Effects of school design on student outcomes. Journal of Educational Administration, 47(3), 381–399. https://doi.org/10.1108/09578230910955809

Watt, H. M. G., Shapka, J. D., Morris, Z. A., Durik, A. M., Keating, D. P., & Eccles, J. S. (2012). Gendered motivational processes in mathematics participation and aspirations. Developmental Psychology, 48(6), 1594–1611. https://doi.org/10.1037/a0027838

Weber, B. (1994). Student involvement in co-curricular activities and success on the Kansas assessments (Master's thesis).

Widlund, A., Tuominen, H., Tapola, A., & Korhonen, J. (2020). Gendered pathways to adolescents' aspirations. Learning and Instruction, 66, 101299. https://doi.org/10.1016/j.learninstruc.2019.101299