Structural Equation Modelling of Factors Influencing Students' Perception Towards Academic Performance

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Abstract: Academic performance is a central focus in education, reflecting a student's ability to understand and apply knowledge across various subjects while shaping their skills and attitudes. This study aimed to examine the relationship between factors (personal, teacher, institution, household) and perception on academic performance. In this study, a cross-sectional design was employed, selecting 183 students from two chosen cluster schools in Kelantan to determine the factors affecting students' perceptions of academic performance. Data were collected through a set of questionnaires and analysed using structural equation modelling (SEM) with partial least squares (PLS) in SmartPLS software using explanatory factor analysis. This study employed descriptive analyses, Pearson's correlation coefficient, and a structural equation model approach to comprehensively evaluate both the measurement and structural models. Results revealed a moderate relationship with students' perceptions of academic performance, whereas other variables such as teacher factor, institution factor, and household factor have a weak relationship. Apart from that, the findings indicate an insignificant relationship between teacher factors and perception of academic performance. Meanwhile, the perception of academic performance is significantly influenced by household, institutional, and personal factors. Consequently, the findings will allow relevant authorities, especially the educational authorities, to enhance academic achievement by addressing the key factors that influence students' academic achievement in cluster schools.

Keywords: Academic performance, Cluster schools, Structural equation modeling (SEM)

1   Introduction

Education is a fundamental aspect of life that starts at a young age, where journeys begin by learning basic skills, for instance, reading, writing, and arithmetic. The importance of education is undeniable, as the learning process extends far beyond the traditional classroom setting. Education has become more accessible and flexible with the rise of online platforms, allowing people from diverse backgrounds and locations to gain knowledge and skills [1]. Academic performance acts as a tangible measure of how well individuals are progressing within the educational system.

Generally, Malaysia offers a dynamic and comprehensive education system that spans from early childhood to higher education, including primary, secondary, and postsecondary levels [2]. In Malaysia, the Malaysian National Education Blueprint (NEB) 2006-2010 has established the 'Cluster Schools' program to enhance the education system and promote and elevate the performance of selected schools with the potential to excel further in specific areas [3].

Cluster schools are recognised as some of the best educational institutions, with students consistently achieving excellent academic results as well as notable success in sports, arts, and co-curricular activities. Although students at cluster schools generally perform well, individual academic achievement can vary due to factors related to instructional quality (such as social interactions, assessments, feedback, and the clarity of information), as well as student-specific characteristics (such as intelligence, prior academic performance, and motivation). Furthermore, numerous factors influence student achievement, which can differ from country to country and even from person to person [4]. It is crucial to examine factors in the students' academic performance among students at cluster schools.

Al-Tameemi et al. [5] performed a systematic literature review to examine poor academic performance among undergraduate students. They discovered four noteworthy factors that could impact students' performance, such as academic factors, personal factors, social factors, and demographic factors. An analysis of the subgroup at the beginning of the study showed that personal factors assessment of the health issues, emotional/self-regulation and help-seeking behaviour, personal attributes, adequate support system including family support, and personality attitude. Previous research found that having a poor and bad attitude stimulates the individual's thinking, feeling, and reacting processes, which enhances the student's performance [6]. In addition, [7] found evidence that students who demonstrated higher levels of life satisfaction showed signs of social support from their families and communities as well as self-control abilities. Motivation among students is a crucial factor that affects their academic achievement.

Teachers serve as a fundamental component in encouraging the cognitive, affective, and behavioural competencies of students, providing employment prospects, cultivating sociability, promoting diverse thinking styles and life perspectives, and contributing to the formation of future society [8]. In a separate study, Gilbert [9] showed that a teacher's efficacy substantially influences a student's performance. Moreover, a teacher's communication skills are crucial for imparting education to students. An educator must possess advanced proficiency in all communication abilities, including listening, speaking, reading, and writing, to instruct successfully [10].

Institutions, represented by classrooms, are often essential elements of a building's structure. The arrangement of seating is essential, and effective implementation starts when pupils are appropriately positioned within the classroom [11]. Baafi [12] identifies components such as personnel, instructional materials, technological tools, and educational resources; the curriculum, training, instruction, and physical environment are crucial in establishing an effective learning environment, which encompasses elements that affect students' learning progression. The physical learning environment in the classroom includes the configuration of furniture, walls, ceiling, chalkboard, lighting, fixtures, decorative elements, and all tangible facilitators of teaching and learning.

Furthermore, household factors align with the findings of [13], which emphasise the influence of family background on educational achievement, particularly the acquisition of higher education, which can improve a student's academic performance. Zuraidah et al. [14] assert that parents of students from low-income households must furnish financial assistance for their education, with helpful, non-violent encouragement and an understanding of adolescence. Consequently, fully grasping the mechanisms via which familial variables influence children's educational outcomes and academic success may be difficult without a comprehensive understanding of educational processes.

Thus, our study aimed to discover the impact of factors (personal, teacher, institution, household) that influence perception on academic performance. This inquiry also examines the relationship between those factors. The hypothesis proposes that factors (personal, teacher, institution, household) have a significant impact on perception of academic performance.

2   Methodology

A   Data Collection

Data was collected through a set of direct questionnaires to students from the selected cluster schools in Kelantan. This study used a sampling technique known as two-stage cluster sampling. In two-stage cluster sampling, a simple random sample of clusters is chosen, followed by a simple random sample of the units within each sampled cluster. There were 678 students from Form 4 in the year 2023 across five cluster schools in Kelantan. Based on the structured questionnaires provided, the dependent variable was the perception of academic performance, while the other five sections indicate the variables used to achieve each research objective considered in this study. The survey included 50 items for measuring the five constructs given in the questionnaire. The sources of these constructs are presented in Table 1. The questions given in the previous studies were altered and modified to improve the applicability of the research.

Table 1: Constructs and their sources.

Constructs	Number of items	Sources
Student's Perception on Academic Performance	10	[15]
Performance Personal Factor	10	[16]
Teacher Factor	10	[10], [17]
Institutional Factor	10	[18]
Household Factor	10	[19]

B   Pilot Study

To assess the reliability of the questionnaire items, a pilot study was carried out, which included 30 students randomly selected from the given population to represent it appropriately. According to [20], pilot research is carried out to assess the feasibility of using a survey questionnaire as well as the recruitment and data collection processes. Approximately 10% of the population was taken as the respondents for the pilot study before the actual research was conducted. The reliability coefficient of 0.7 is a crucial cutoff point for Cronbach's alpha because the items are sufficiently consistent to offer a valid measurement [21]. The Cronbach alpha for the 5 measurement scales given below is presented in Table 2.

Table 2: Cronbach's Alpha values for the pilot study (Cronbach's Alpha ≥ 0.7)

Constructs	Cronbach's Alpha
Academic Performance	0.909
Personal	0.924
Teacher	0.950
Institution	0.936
Household	0.965

3 Results and Discussion

A Measurements Model Analysis

In the SEM analysis, the measurement model was used to assess indicator reliability, internal consistency, and the convergent and discriminant validity of the constructs. The model initially comprised 50 items representing (personal, teacher, institutional, and household) factors and perceptions of academic performance. In Table 3, the criterion for the reliability and convergence validity, has been fulfilled by the results of our experiment for the convergence validity and questionnaire reliability. Factor loadings for 20 items, such as AP1, AP2, P1, T1, and others, were found to be below the 0.50 cutoff, and adjustments were made by removing these items until the Average Variance Extracted (AVE) values exceeded 0.50 for each latent variable, which is another requirement [22]. The factor loadings indicated the strength of the associations between the indicators and their respective constructs. All factor loading values were above the threshold of 0.50, confirming acceptable reliability. Furthermore, composite reliability (CR) for all constructs was between 0.815 and 0.910, and Cronbach's alpha values for all variables were above the acceptable value of 0.70 [21]. Based on Table 4, perceptions on academic performance and household factor, institution factor, personal factor, and teacher factor HTMT values were 0.4, 0.386, 0.7, and 0.388, respectively, indicating a value less than 1. It is verified that discriminant validity is accepted as the data from other columns similarly generate values that were less than 1.

Table 3: Convergent validity results which assures acceptable values (Factor loading, Cronbach's alpha, composite reliability $\geq$ 0.7 and AVE > 0.5

Constructs	Items	Factor Loading	Cronbach's Alpha	CR	AVE
Perception on Academic Performance	AP3 AP7 AP8 AP9 AP10	0.665 0.693 0.743 0.785 0.757	0.784	0.850	0.533
Personal Factor	P7 P8 P9 P10	0.722 0.757 0.694 0.723	0.7	0.815	0.525
Teacher Factor	T3 T4 T5 T6 T7 T8 T9 T10	0.688 0.780 0.719 0.711 0.704 0.731 0.827 0.802	0.887	0.910	0.558
Institution Factor	I1 I3 I7 I8 I9 I10	0.713 0.778 0.690 0.767 0.694 0.723	0.825	0.871	0.530
Household Factor	H1 H2 H3 H4	0.793 0.581 0.784 0.828	0.871	0.902	0.571

Constructs	Items	Factor Loading	Cronbach's Alpha	CR	AVE
	H5	0.818			
	H6	0.794			
	H7	0.656			

Table 4: Heterotrait-Monotrait Ratio (HTMT)

	Perception on Academic Performance	Household	Institution	Personal
Household	0.400			
Institution	0.386	0.266		
Personal	0.700	0.424	0.374	
Teacher	0.388	0.477	0.738	0.487

B   Assessment of Structural Model

It is usually the case that the multicollinearity measure is used to examine the structural model. The level of multicollinearity among the formative indicators was assessed by calculating the variance inflation factor (VIF). According to [23], when two or more predictor variables in a multiple regression model are closely associated, this statistical phenomenon is known as multicollinearity, also known as near-linear dependence. Furthermore, according to [24], if VIF is between 5 and 10, there will be multicollinearity among the predictors in the regression model, and a VIF greater than 10 indicates that the regression coefficients are poorly estimated due to the presence of multicollinearity. According to Table 5, there are no multicollinearity issues, as all the VIF values were less than 5. To further determine how significant the results are, examining the effect size needs to be done.

Table 5: Multicollinearity of variable

Variables	VIF	Remarks
Household Factor	1.272	no multicollinearity
Institution Factor	1.757	no multicollinearity
Personal Factor	1.234	no multicollinearity
Teacher Factor	2.088	no multicollinearity

According to [25], the effect size f^2 value assesses the degree of the impact of specified exogenous latent variables toward the endogenous latent variables by measuring the R^2 change in the endogenous latent variables [26]. A guideline for assessing the impact of the effect size has been proposed by Cohen [27], where f^2 the values of 0.02, 0.15, and 0.35 can be viewed as the small, medium, and large effect sizes of the exogenous latent variable towards the endogenous latent variable. Thus, Table 6 shows that the teacher factor did not have any significant effect on perception of academic performance. Household and institution factors had small effects since the values were less than the cut-off point of 0.15. On the other hand, the personal factor had a medium effect as its value was more than the cut-off point of 0.15.

Table 6: Effect Size, f^2

Endogenous Latent Construct	Effect Size	Type of effect size
Household Factor	0.034	Small
Institution Factor	0.021	Small
Personal Factor	0.239	Medium
Teacher Factor	<0.001	Small

The Stone-Geisser's (Q^2) is used to determine the value for a certain omission distance of 5-10 in PLS [25]. The Q^2 values should be greater than zero. If the Q^2 is greater than zero, this indicates that the exogenous construct has predictive relevance for the endogenous construct [25]. Results in Table 7 show that the Q^2 values for the endogenous construct were over zero; hence it is acceptable to conclude that the predictive prevalence was established.

Table 7: Predictive Relevance, Q^2

Exogenous Variable	Endogenous Variable	Q^2	Remark
Household Factor	Perception on Academic Performance	0.303	medium
Institution Factor			
Personal Factor			
Teacher Factor			

Figure 3 depicted the structural equation model for the final model after removing the items for each latent variable that meet the requirements for the criteria. The R^2 value of 0.351 indicates that 35.1% of the variance in students' perceptions on academic performance is explained by the exogenous latent variables (personal factor, teacher factor, institutional factor, and household factor). After factor loadings with values less than 0.5 were eliminated and the AVE value of each of the latent variables was greater than 0.5, the final model is shown in the above figure. The final items left were AP3, AP7, AP8, AP9, AP10, P7, P8, P9, P10, T3, T4, T5, T6, T7, T8, T9, T10, I1, I3, I7, I8, I9, I10, H1, H2, H3, H4, H5, H6, and H7, with a total of 30 items left. There were five items in the academic performance section, four items in the personal section, eight items in the teacher section, six items in the institution section, and seven items in the household section.

Figure 1: Structural Equation Model for the Final Model
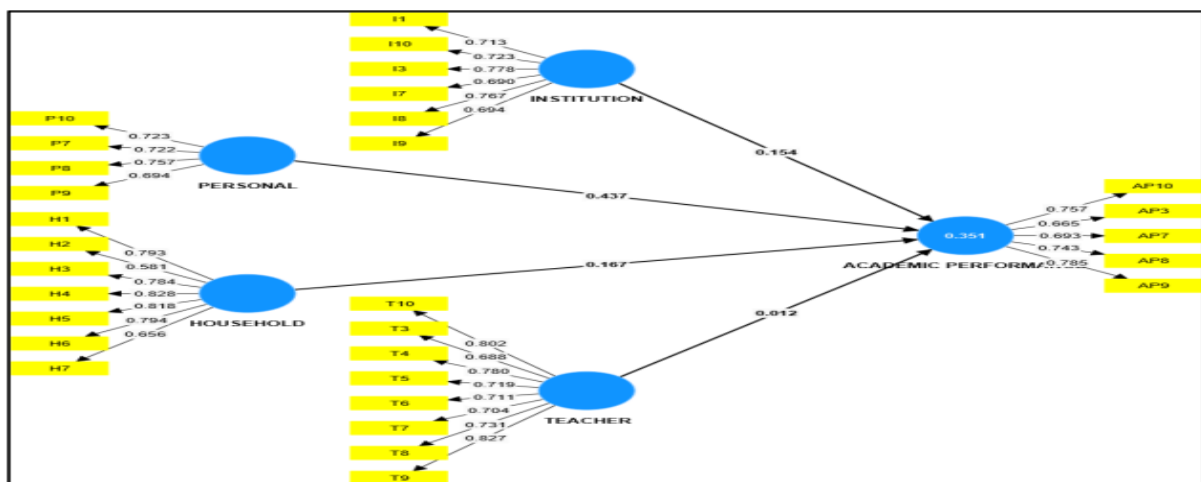
The structural model represents the relationship between the latent variables that were hypothesised in the research model [28]. Table 8 lists down the path coefficients, observed t-value, and significance level for all hypothesised paths. The path analysis is used to determine whether the hypotheses are supported or not. The analysis showed that household factors (path coefficient = 0.167, =2.174, =0.030), institutional factors (path coefficient = 0.154, =1.969, =0.049), and personal factors (path coefficient = 0.437, =7.971, =0.000) were significantly correlated with perception on academic performance. However, it is evident that the only insignificant relationship between teacher factor influence and perceptions on academic performance is (path coefficient = 0.012, t = 0.141, p = 0.888). Moreover, the highest path coefficient observed was 0.437, thus personal factor was the most crucial factor affecting students' perception of academic performance.

Table 8: Path Coefficient Inner Model

Hypothesis	Path	Path Coefficient	t-statistics	p-value	Results
H1$_a$	Household ->Academic Performance	0.167	2.174	0.030	Supported**
H1$_b$	Institution ->Academic Performance	0.154	1.969	0.049	Supported**
H1$_c$	Personal -> Academic Performance	0.437	7.971	0.000	Supported**
H1$_d$	Teacher -> Academic Performance	0.012	0.141	0.888	Not supported

** the indicator loadings were significant at 95% confidence level if t-statistics > 1.83 (p<0.05)

4 Conclusion

The results showed that personal, institutional, and household factors were found to be statistically significant, while teachers were not statistically significant in relation to academic performance. All factors indicated a significant influence on academic performance except for teachers, since it produced a small effect size compared to others. Concerning the first objective, we discovered a moderate relationship between personal and students' perceptions of academic performance. Meanwhile, the association between academic performance and teacher, institution, and household was poor. This suggests that personal, institutional, and household factors play an important role in influencing academic performance. In conclusion, to address the challenges and improve the current situation at cluster schools in Kelantan, several key recommendations have been identified. First, expanding the study population to include students from multiple states in Malaysia is recommended to gain a more comprehensive understanding of factors influencing students' perceptions of academic performance across different cluster schools. This broader scope would provide more diverse data and enhance the accuracy of the analysis. Additionally, since the teacher factor did not show a significant relationship with students' academic perceptions, future studies should explore other variables related to the teacher-student dynamic, such as teaching style, communication, and support, to better understand their impact. It is also recommended to improve the research questionnaire by carefully reviewing and revising questions to ensure they are directly relevant to the constructions being measured. This will enhance the validity and reliability of future studies, preventing the omission of important latent variables.

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Conflict of Interest Statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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