Structural Equation Modelling in Investigating the Role of Academic Motivation upon Academic Achievement

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Abstract
Academic achievement is the degree to which students, educators, or organizations have attained their desired learning goals, whether short-term or long-term. It provides evidence of institutional efficiency in producing knowledgeable, proficient, and marketable graduates. Understanding the factors contributing to students' success is an important task not only for the students or lecturers but also for higher learning institutions. This understanding serves as valuable input for designing effective teaching, learning, and student activities to improve academic performance and reduce academic failure. Thus, the current study sought to determine the direct and indirect effects of self-esteem, personality traits, and emotional intelligence, as well as examine the role of academic motivation on students' learning outcomes as a mediator. A stratified random sampling method was employed, and 533 undergraduate students participated in this study. Four standard instruments have been adopted for data collection, which are Rosenberg Self-Esteem Scale (RSES), Schutte Self-Report Emotional Intelligence Test (SSEIT), Big Five Inventory (BFI), and Academic Motivation Scale. Structural equation modelling (SEM) was used to identify the relationship between self-esteem, personality traits, and emotional intelligence on academic achievement and examine academic motivation as a potential mediator for academic achievement. The findings of this study revealed that academic motivation, emotional expression, and conscientiousness were significant factors. Moreover, negative self-esteem, conscientiousness, openness, and self-emotional regulation exhibited significant indirect effects on academic achievement, and academic motivation has been proven to serve as a significant mediator. These results revealed essential inputs and provided a greater understanding of the higher learning institutions in structuring and planning their students' support systems and activities. Given the significant role of academic motivation as a mediator, it will be interesting to discover its significant contributors. Further studies can be conducted to determine the differences in

academic motivation contributing factors with regard to gender, discipline, and socio-economic backgrounds.

Keywords: Academic Achievement, Academic Motivation, Personality Traits, Self-Esteem, Structural Equation Modelling

Introduction

Academic achievement or success is the degree to which students, educators, or organizations have attained their desired learning goals, whether short-term or long-term (Hussain *et al.,* 2019, as cited in Khaliq *et al.,* 2019). It provides evidence of institutional efficiency in producing knowledgeable, proficient, and marketable graduates (Osaikhiuwu, 2014, as cited in Le et al., 2020). Additionally, it plays a significant role in fostering high-achieving students who have the potential to become exemplary leaders and valuable contributors to the country's workforce and overall development (Abdi et al., 2018; Le et al., 2020; Shah and Zamri, 2021). Understanding the factors contributing to students' success is an important task not only for the students or lecturers but also for higher learning institutions. This understanding serves as valuable input for designing effective teaching, learning, and student activities to improve academic performance and reduce academic failure.

Numerous prior studies have examined and explored the factors affecting students' achievement. Over the past decade, academic motivation has garnered significant research attention alongside other variables such as personality, self-esteem, and emotional intelligence (Chang and Tsai, 2022; Naseer et al., 2022; Mammadov et al., 2021; Tam et al., 2021; Trigueros et al., 2019). Nonetheless, according to existing literature, no prior studies have explored the simultaneous impact of these variables on academic accomplishment, especially in Sabah, Malaysia, as most existing studies have been conducted in other countries. Moreover, there is a growing necessity to investigate how these variables influence students' academic performance in higher education, as this stage plays a crucial role in shaping their future careers and motivates them to strive for academic excellence (Santiago et al., 2008, as cited in Wrigley-Asante et al., 2023). In light of this, this research included these variables to examine these factors' direct and indirect effects, as well as to explore the mediating role of academic motivation on undergraduate students' academic achievement.

Structural Equation Modeling (SEM) is the statistical analysis employed in this study, given its widespread use in prior research to examine direct and indirect effects. SEM utilizes bootstrapping techniques for resampling datasets and estimating confidence intervals for indirect effects (Dastgeer et al., 2020; Hayes, 2018). Moreover, it allows for the simultaneous examination of complex models and considers measurement errors by including latent variables and their corresponding indicators in the analysis (Demming et al., 2017; Hayes, 2018; Sidhu et al., 2021).

Literature Review

Academic Motivation and Academic Achievement

Increasing evidence suggests that academic motivation is crucial to academic success. Hence, the idea of motivation has received increasing attention from researchers (McGeown et al., 2014). Deci and Ryan introduced Self-Determination Theory (SDT) in 1985, categorising motivation into three distinct types: intrinsic, extrinsic, and amotivation (Clark et al., 2014; Vallerand et al., 1992). The three types of internal motivation were knowledge, achievement,

and stimulation. Extrinsic motivations include external regulation, introjection, and identification. Intrinsic motivation occurs when an act is performed for a reason or out of pleasure. Extrinsic motivation occurs when actions are taken to accomplish a goal or a reward. Amotivation occurs when people feel unmotivated to act because they do not believe they would benefit from anything.

Prior research has found that academic motivation is an influential factor that affects student achievement (De Feyter et al., 2012; Hazrati-Viari et al., 2012; Mammadov et al., 2021; Mega et al., 2014; Nazim and Ahmad, 2013; Ning and Downing, 2012; Önder et al., 2014; Sadipour et al., 2017; Tam et al., 2021; Trigueros et al., 2019; Tripathi et al., 2018; Xu and Wu, 2017). These findings suggested increased student motivation is associated with better educational outcomes (Tam et al., 2021).

Instead of a direct effect, motivation has been found indirectly affected academic achievement through other factors such as academic integration, study approach, and strategy (Barattucci et al., 2021; Clark et al., 2014; Kusurkar et al., 2013). On the contrary, some studies by Cetin (2015); Soufi et al (2014) have found that motivation did not significantly affect academic achievement. The accumulated reviews have demonstrated that studying student motivation is beneficial for facilitating their educational accomplishment. Therefore, the first research hypothesis in this study is as follows

H₁ = Academic motivation has a direct effect on academic achievement.

Self-Esteem and Academic Achievement
Few experts define self-esteem merely as one's attitude toward oneself, describing it as a positive or negative attitude towards oneself (Alipio, 2020). The Rosenberg Self-Esteem Scale 1965 (RSES) is a widely used tool for evaluating self-esteem (Boduszek et al., 2013; Huang and Dong, 2012; Kielkiewicz et al., 2020). It was designed to assess self-esteem as a single construct based on the idea that self-esteem is part of a person's self-concept that reflects both positive and negative judgments of the self. However, whether this is unidimensional or multidimensional remains controversial (Ang et al., 2006; Boduszek et al., 2013; Huang and Dong, 2012; Hyland et al., 2014). Two dimensions of self-esteem are called positive and negative self-esteem. Positive self-esteem was defined using five positively phrased items, whereas negative self-esteem was defined using five negatively worded items.

Additionally, Ang et al (2006); Boduszek et al (2013); Hyland et al (2014); Kielkiewicz et al (2020); Tomás and Oliver (1999) suggested that the utilisation of a two-factor model comprising positive and negative latent variables yielded a better degree of fit. Unidimensionality in self-esteem can be achieved with a better fit by correlating the error terms (Hyland et al., 2014; Michaelides et al., 2016; Salerno et al., 2017; Supple et al., 2013). One recommendation for determining whether to employ a two-factor model is to analyse the relationship between these factors with other variables (Ang et al., 2006; Boduszek et al., 2013; Huang and Dong, 2012). If positive and negative self-esteem measure significantly distinct aspects, they should react differently to external variables. As a result, the two self-esteem factors may be considered.

Self-esteem has been found to have a significant relationship and has been discovered as a significant determinant in educational success by (Isha and Hashim, 2022; Colquhoun and Bourne, 2012; Duru and Balkis, 2017; Quílez-Robres et al., 2021). These results showed that students with higher self-confidence tended to perform better academically. Prior studies

have illustrated the role of self-esteem in influencing student performance. Therefore, the second research hypothesis is as follows:

H₂ = Self-esteem has a direct effect on academic achievement.

Personality Traits and Academic Achievement
Personality describes an individual's fundamental characteristics that shape common ways of acting, thinking, and feeling (McGeown et al., 2014). There are five key personality traits: openness to experience, neuroticism, extraversion, agreeableness, and conscientiousness (Hazrati-Viari et al., 2012; McGeown et al., 2014; Safdar et al., 2013). Several studies have explored the link between students' traits and educational accomplishment. In comparison to the other characteristics, conscientiousness is the most frequently proven to be a significant determinant of academic performance (Aghamohammadi and Asgari, 2016; Hazrati-Viari et al., 2012; Lim and Abdullah, 2012; Meyer et al., 2019; Rosander et al., 2011). Conscientious students perform better academically than others due to they work in an organized, honest, reliable, and precise manner (De Feyter et al., 2012; Hazrati-Viari et al., 2012).

In addition, openness has been proven to correlate significantly with academic success (Aghamohammadi and Asgari, 2016; Hazrati-Viari et al., 2012; Lim and Abdullah, 2012; Mammadov et al., 2021; Meyer et al., 2019; Troncone et al., 2014). This is due to the fact that open students have a higher level of intellectual curiosity, and as a result, they may have a stronger drive to study and explore (Mammadov et al., 2021). Moreover, neuroticism has been identified to be significantly linked to educational success (Aghamohammadi and Asgari, 2016; De Feyter et al., 2012; Önder et al., 2014; Rosander et al., 2011; Troncone et al., 2014). Numerous scholars have suggested that neuroticism reduces performance in an academic setting because it causes individuals to be apprehensive, agitated, tense, and worried (De Feyter et al., 2012).

Extraversion has also been shown to be a crucial determinant of academic success (De Feyter et al., 2012; Rosander et al., 2011). Extraversion is associated with greater assertiveness, friendliness, and talkativeness (Komarraju, 2011, as cited in Ag Isha and Hashim, 2022). Extraversion can positively affect academic success because extroverts are enthusiastic, energetic, and willing to learn. However, it can also negatively affect academic success because extroverts are very social and excited, so they may prefer to spend time with friends rather than study (De Feyter et al., 2012).

Finally, agreeableness is another trait that influences academic success (De Feyter et al., 2012; Mammadov et al., 2021). Trustworthiness, straightforwardness, altruism, obedience, modesty, and tendermindedness are characteristics of agreeableness (McGeown et al., 2014). Students who scored higher in agreeableness performed well because cooperative and trustworthy students are more likely to learn through group activities (De Feyter et al., 2012). Prior studies have illustrated the role of personality traits in students' achievement. Therefore, the third research hypothesis is as follows:

H₃ = Personality traits have a direct effect on academic achievement.

Emotional Intelligence and Academic Achievement
Emotional intelligence (EI) is another non-cognitive aspect recognized as a significant predictor of students' educational success (Tam et al., 2021). Emotional intelligence is a

collection of abilities used to read, comprehend, and respond appropriately to emotional signals conveyed by others and oneself (Kiss et al., 2014). Salovey and Mayer's (1990) model of EI divides emotional abilities into three categories: evaluation and expression of emotions, control of emotions in oneself and others, and adaptive use of emotions (Zhoc et al., 2016).

Previous research by Sadipour et al (2017); Khan (2019) discovered that EI significantly impacted student accomplishment. Aghamohammadi and Asgari (2016); Iqbal et al (2021); Marjanović et al (2021); Okwuduba et al. (2019) found that some dimensions of emotional intelligence contributed to student achievement. By contrast, Ag Isha and Hashim (2022) observed that emotional intelligence had no significant influence on academic success. In contrast, Tam et al (2021) discovered that this variable indirectly affected academic accomplishment rather than directly. Previous studies have shown how crucial emotional intelligence is to students' academic performance. As a result, the following is the fourth research hypothesis:

H₄ = Emotional intelligence has a direct effect on academic achievement.

Self-Esteem, Personality Traits, Emotional Intelligence, Academic Motivation, and Academic Achievement

Despite the direct effects of self-esteem, personality traits, and emotional intelligence on educational achievement, prior studies have also revealed a relationship between these factors and academic motivation. To illustrate this, Moayed and Vahedian-Azimi (2021); Soufi et al (2014); Supple et al (2013) discovered that self-esteem had a significant relationship with and a significant predictor of academic motivation. Moreover, Chang and Tsai (2022); Tam et al (2021); Trigueros et al (2019) revealed that emotional intelligence did not directly influence academic achievement but did directly affect academic motivation. These demonstrated that individuals with greater emotional intelligence could control their emotions, feel others' emotions, and be more motivated, indirectly influencing their academic performance.

In addition, personality traits have been found to have a significant relationship with motivation (Ahmadi et al., 2021; De Feyter et al., 2012; Hazrati-Viari et al., 2012; Mammadov et al., 2021; McGeown et al., 2014; Önder et al., 2014). Ahmadi et al (2021) revealed that all five personality traits significantly affected academic motivation, and Önder et al (2014) discovered that conscientiousness, openness, and neuroticism explained the variance in academic motivation. These findings suggested that intellectually interested, disciplined, orderly, and less neurotic students tend to be academically motivated. De Feyter et al (2012), Hazrati-Viari et al (2012); Mammadov et al (2021) discovered that some personality traits were predictors of motivation and significantly influenced academic success.

Present Study

The reviews of the literature have shown that students' self-esteem, personalities, emotional intelligence, and motivation all play a role in academic achievement. Furthermore, previous research has shown that academic motivation served as a mediator in the link between self-esteem, emotional intelligence, traits and educational outcomes. Nonetheless, to the best of our knowledge, no previous study has explored the simultaneous impact of these variables and how they interact with motivation, which influences academic accomplishment. Consequently, this study was conducted to examine the direct and indirect effects of self-esteem, emotional intelligence, and personality traits, as well as to explore the mediation

effect of academic motivation on academic achievement by utilizing SEM. The hypotheses and conceptual model (Figure 1) for the present study are as follows:
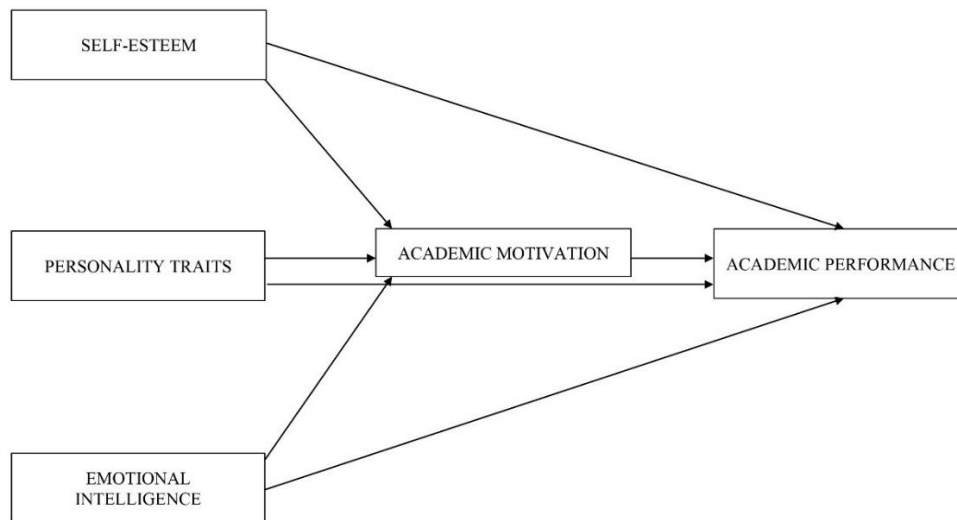

Figure 1. Conceptual model of the present study

H_1: Academic motivation directly affects academic achievement.
H_2: Self-esteem has a direct effect on academic achievement.
H_3: Emotional intelligence has a direct effect on academic achievement.
H_4: Personality traits directly affect academic achievement.
H_5: Self-esteem indirectly influences academic achievement through academic motivation.
H_6: Personality traits indirectly influence academic achievement through academic motivation.
H_7: Emotional intelligence indirectly influences academic achievement through academic motivation.

Methodology

A total of 12,052 undergraduate students from Universiti Malaysia Sabah in Kota Kinabalu constituted the study population. The sample size was determined using Krejcie and Morgan's (1970) formula, which indicated a requirement of 373 participants. Five hundred seventy-six (576) undergraduate students enrolled in Semester 2-2021/2022 participated and were selected using a stratified sampling method. Data collection was conducted through an online survey approach, utilizing Google Forms to distribute the questionnaires to each faculty. Nevertheless, 43 participants were excluded after data cleaning (identification of missing data, observations with the same answers to all questions, and outliers), leaving 533 participants for analysis. Table 1 summarizes the demographic profiles of the respondents.

Table 1
Demographic profiles (N=533)

Demographic Characteristics		Frequency	Percent
Year	1st Year	188	35.3
	2nd Year	261	49.0
	3rd Year	52	9.8
	4th Year	28	5.3
	5th Year	4	0.8
Sex	Female	385	72.2
	Male	148	27.8
Accommodation	Hostel	221	41.5
	Non-Resident (NR)	124	23.3
	Family House	188	35.3
Age	<20	2	0.4
	20 – 24	522	97.9
	25 – 29	9	1.7

Measurement Scales
Academic achievement was the dependent variable measured by GPA (Semester 2-2021/2022). The independent variables in the present study were self-esteem, emotional intelligence, and personality characteristics, with academic motivation as a mediator.

A. Rosenberg Self-Esteem Scales (RSES)
Rosenberg Self-Esteem Scale (RSES) was used to measure students' self-esteem. It was developed by Rosenberg (1965) and had ten items with a 5-Likert scale from strongly disagree (1) to strongly agree (4).

B. Schutte Self-Report Emotional Intelligence Test (SSEIT)
This study adopted Schutte Self-Report Emotional Intelligence Test (SSEIT) to measure students' emotional intelligence. It was developed by Schutte (1998) and had 33 items with a 5-Likert scale from strongly disagree (1) to strongly agree (5). It has six dimensions: Appraisal of Emotions in Others (AEO), Appraisal of Emotions in the Self (AES), Emotional Regulation of Others (ERO), Emotional Expression (EE), Emotional Regulation of the Self (ERS), and Utilization of Emotions in Problem-Solving (UEPS) (Zhoc *et al.,* 2016).

C. Big Five Inventory (BFI)
The Big Five Inventory was employed to measure students' personality traits. It was developed by John and Srivastava (1999) and measured five characteristics: openness to experience, neuroticism, extraversion, agreeableness, and conscientiousness. It has 44 items with a 5-Likert scale from strongly disagree (1) to strongly agree (5).

D. Academic Motivation
This study adopted an academic motivation scale to measure students' academic motivation. It was developed by Vallerand *et al* (1992) and had 28 items with a 7-Likert scale that does not correspond all (1) to exactly (7). It has seven dimensions of motivation: to know (MTK), toward accomplishment (MTA), to experience stimulation (MTES), identified (MID), introjected (MIN), external regulation (MER), and amotivation (AMV). The following formula

(Equation 1) was used to generate the academic motivation score reported by Guay *et al.* (2003), Martín-Albo *et al.* (2014), and Önder *et al.* (2014):

$$AM = \left(2\left(\frac{MTK + MTA + MTES}{3}\right) + MID\right) - \left(\left(\frac{MIN + MER}{2}\right) + 2AMV\right) \quad [1]$$

Statistical Analysis

AMOS version 26 was used to analyse the data. SEM was employed to explore the significant factors and the mediating role of academic motivation in the relationship between self-esteem, emotional intelligence, personality characteristics, and academic accomplishment. The steps taken in this study are shown in Figure 2.
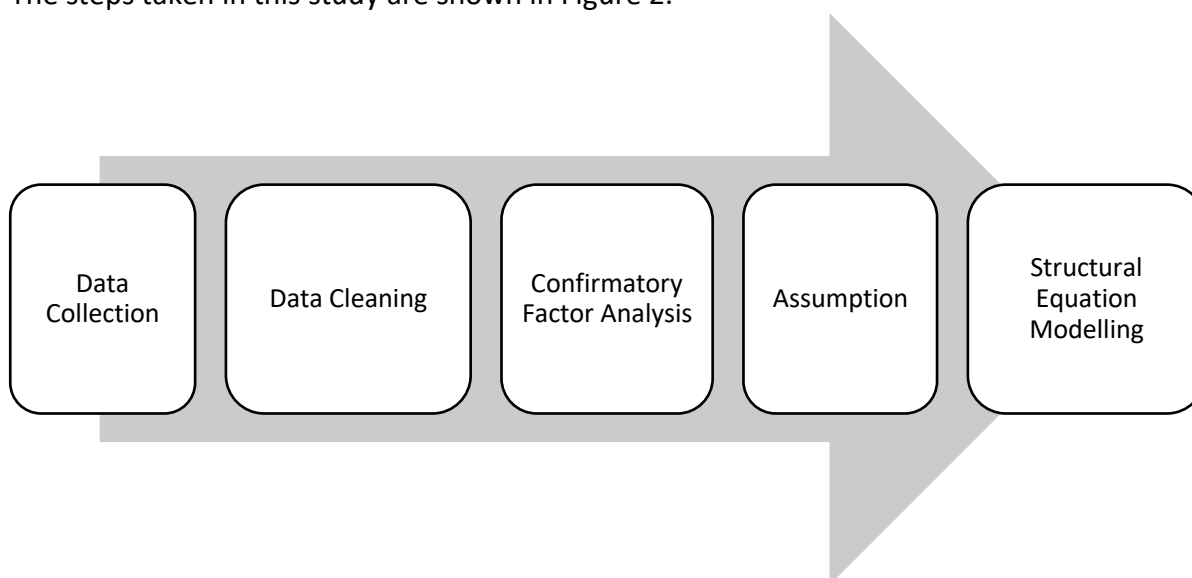

Figure 2. Steps Taken in the Present Study

A. Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a statistical technique that examines the indicators' ability to capture the unobserved constructs and ascertain if they are distinctively different (Collier, 2020). It provides information about the fitness of the individual and pooled measurement models. The model fitness was measured by using statistical measures such as the Chi-square test (χ^2), the ratio Chi-square, the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), and Standardized Root Mean Square Residual (SRMR).

The reliability and validity of the instruments were assessed by composite reliability (CR), Cronbach's Alpha (α), average variance extracted (AVE), and Heterotrait-Monotrait Correlation Ratio (HTMT) after the evaluation of the model fit indices. The threshold value for each measure can be found in Table 2.

Table 2
Threshold Value

No.	Indices	Cut-off	Sources
1.	χ^2 Test	*p*-value > 0.05	
2.	χ^2 Ratio	< 5.00	
3.	GFI	≥ 0.90	Hair et al. (2010), Collier (2020),
4.	RMSEA	≤ 0.08	Schumacker and Lomax (2010)
5.	SRMR	≤ 0.08	
6.	CFI	≥ 0.90	
No.	**Reliability and Validity**		
1.	α	≥ 0.60	Hair et al. (2010), Ursachi et al. (2015)
2.	CR	≥ 0.60	Ab Hamid et al. (2017), Hair et al. (2010), Janadari et al. (2013), Lola and Azreen (2016)
3.	AVE	≥ 0.50	Collier (2020), Hair et al. (2010), Janadari et al. (2013),
4.	HTMT	< 0.90	Cardella et al. (2021) Henseler et al. (2015)

B. Assessing the Assumptions in Present Study

The assumptions of normality and multicollinearity were assessed before proceeding with the mediation analysis. The normality of the variables was examined using kurtosis and skewness values. All the variables in the present study have kurtosis and skewness values between -2 to +2, which is in the range of allowable threshold values (George and Mallery, 2020; Hair et al., 2010). Thus, all the variables in the present study were normally distributed. Next, the assumption of multicollinearity was assessed by observing the correlation matrix. The multicollinearity problem was absent in this study because none of the correlation coefficients exceeds 0.9 (Kline, 2016).

C. Structural Equation Modelling

SEM is a bootstrapping method, which is a non-parametric resampling method that does not rely on assumptions about the distribution of the indirect effect (Hayes, 2018). It involves multiple data resampling processes to generate an empirical depiction of the indirect effect's sampling distribution, which is then utilized to produce a confidence interval (Hayes, 2018; Örs Özdil and Kutlu, 2019).

This study employed SEM with a bias-corrected confidence interval to examine the significance of indirect effects, using 5,000 samples with a 95% confidence interval, as Collier (2020); Hayes (2018) suggested. The chart below (Figure 3) shows the step in conducting the bootstrapping for mediation analysis:

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┌─────────────────────────────────────────────────────────────────────┐
│ 1. Generate bootstrap sample                                        │
│                                                                     │
│ A random sample of n cases is obtained from the original sample,    │
│ these cases is sampling with replacement, where n is the original   │
│ sample size.                                                        │
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                                  ↓
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│ 2. The indirect effect, $a_k b_k$ is estimated in the bootstrap     │
│    sample.                                                           │
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                                  ↓
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│ 3. Multiple data resampling                                         │
│        Repeat (1) and (2) a total of 5,000 times, saving the value  │
│        of $a_k b_k$ each time.                                       │
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│ 4. Contruct the bootstrap confidence interval                       │
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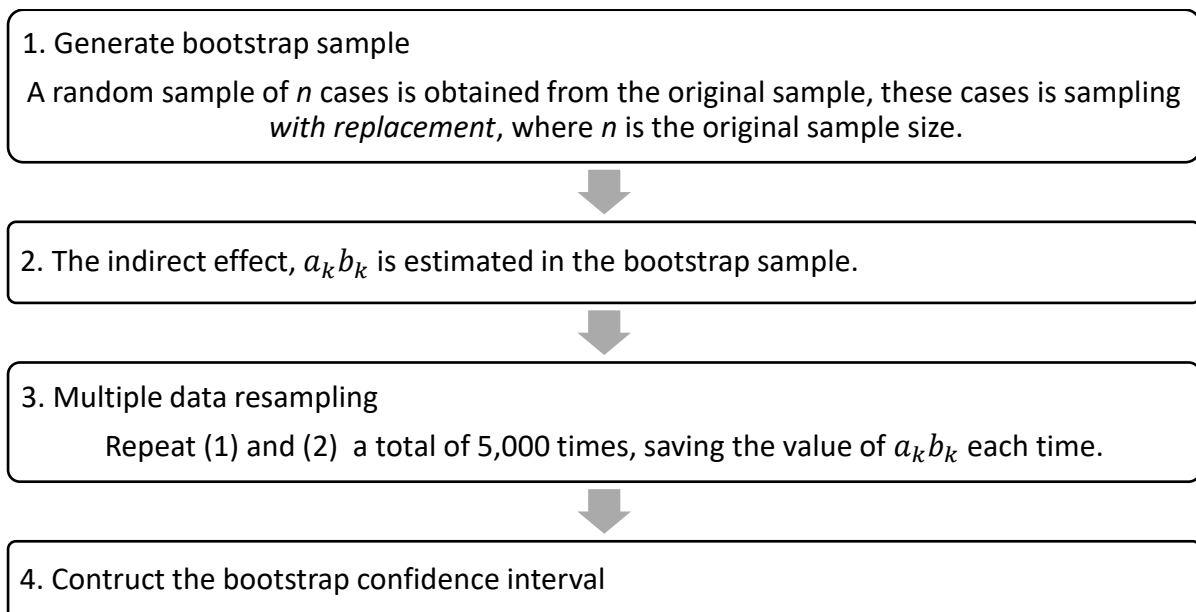
Figure 3. Steps in bootstrapping for mediation analysis
Source: Hayes (2018)

Result

Confirmatory Factor Analysis
The primary objective of this research was to determine the significant factors and to examine the mediation effect of academic motivation on academic success; hence, the results of the CFA were not presented and explained in detail. Several items were deleted because of their low factor loadings and redundancy (Table 3). Table 3 shows that the chi-square values were significant, and all other fit indices were within the acceptable value except the personality traits' construct (nearer to the recommended value), indicating well-fitting individual models.

The discriminant validity was assessed using the HTMT method. The HTMT values obtained in this study were found to be less than 0.9. Thus, the model's discriminant validity was confirmed. The Cronbach's alpha and composite reliability were larger than 0.6, indicating the good scale's internal consistency. The AVE values for certain variables were below the permissible threshold of 0.50. Nonetheless, Fornell and Larcker claimed that the construct's convergent validity is still appropriate as long as the composite reliability is more than 0.6 (Facultad *et al.,* 2019; Huang *et al.,* 2013; Lola and Azreen, 2016; Pervan *et al.,* 2018). The items were combined into one composite measure by taking the average score of the items in the construct for subsequent analysis.

Table 3
Reliability and validity of the measurement scales

Construct		Item	CR	α	AVE	Fit Indices
Personality Traits	1. Agreeableness	4	0.697	0.695	0.367	χ^2=732.729***, χ^2 Ratio = 3.331, GFI = 0.881, CFI = 0.862, RMSEA = 0.066, SRMR = 0.055
	2.Conscientiousness	5	0.750	0.746	0.379	
	3. Extraversion	4	0.710	0.709	0.382	
	4. Neuroticism	3	0.684	0.676	0.425	
	5. Openness	7	0.787	0.784	0.347	
Self-Esteem	1. Positive Self-Esteem	5	0.804	0.800	0.451	χ^2=77.612***, χ^2 Ratio = 2.985, GFI = 0.967, CFI = 0.969, RMSEA = 0.061, SRMR = 0.04
	2. Negative Self-Esteem	4	0.819	0.818	0.530	
Emotional Intelligence	1. Appraisal of Emotions in the Self	6	0.763	0.762	0.351	χ^2=697.423***, χ^2Ratio = 2.682, GFI = 0.904, CFI = 0.902, RMSEA = 0.056, SRMR = 0.049
	2. Appraisal of Emotions in Others	3	0.772	0.768	0.531	
	3. Emotional Regulation of the Self	6	0.758	0.759	0.346	
	4. Emotional Expression	3	0.712	0.710	0.453	
	5. Emotional Regulation of Others	4	0.643	0.630	0.317	
	6. Utilization of Emotions in Problem Solving	3	0.758	0.735	0.514	
Motivation	1. Intrinsic Motivation to Know	4	0.863	0.861	0.612	χ^2=915.096***, χ^2 Ratio = 3.292, GFI = 0.878, CFI = 0.916, RMSEA = 0.066, SRMR = 0.049
	2. Intrinsic Motivation Toward Accomplishment	3	0.809	0.806	0.587	
	3. Intrinsic Motivation to Experience Stimulation	4	0.841	0.837	0.571	
	4. Extrinsic Motivation Identified	4	0.812	0.801	0.520	
	5. Extrinsic Motivation Introjected	4	0.789	0.761	0.488	
	6. Extrinsic Motivation External Regulation	3	0.797	0.794	0.567	
	7. Amotivation	4	0.850	0.842	0.590	

*Note: ***p-value < 0.001*

The fit indices of the pooled measurement model indicated that the chi-square value was significant. All other fit indices were within the threshold values except for the GFI and

CFI, which were nearer to the recommended value of 0.9 ($\chi^2 = 3095.778, p < 0.001; \chi^2 ratio = 1.999; GFI = 0.824; CFI = 0.862; RMSEA = 0.043; SRMR = 0.048$).

Structural Equation Modelling (SEM)

Figure 4 shows the simplified mediation model, and Table 4 displays the unstandardized and standardized coefficients of the model. This study aimed to examine the direct and indirect effects of emotional intelligence, self-esteem, and personality traits, as well as explore the mediation effect of academic motivation on students' learning outcomes. The study findings demonstrated that academic motivation (AM), conscientiousness (Cons), and emotional expression (EE) emerged as the key factors contributing significantly to academic achievement, as the variables exhibited significant direct effects on students' academic performance (GPA).
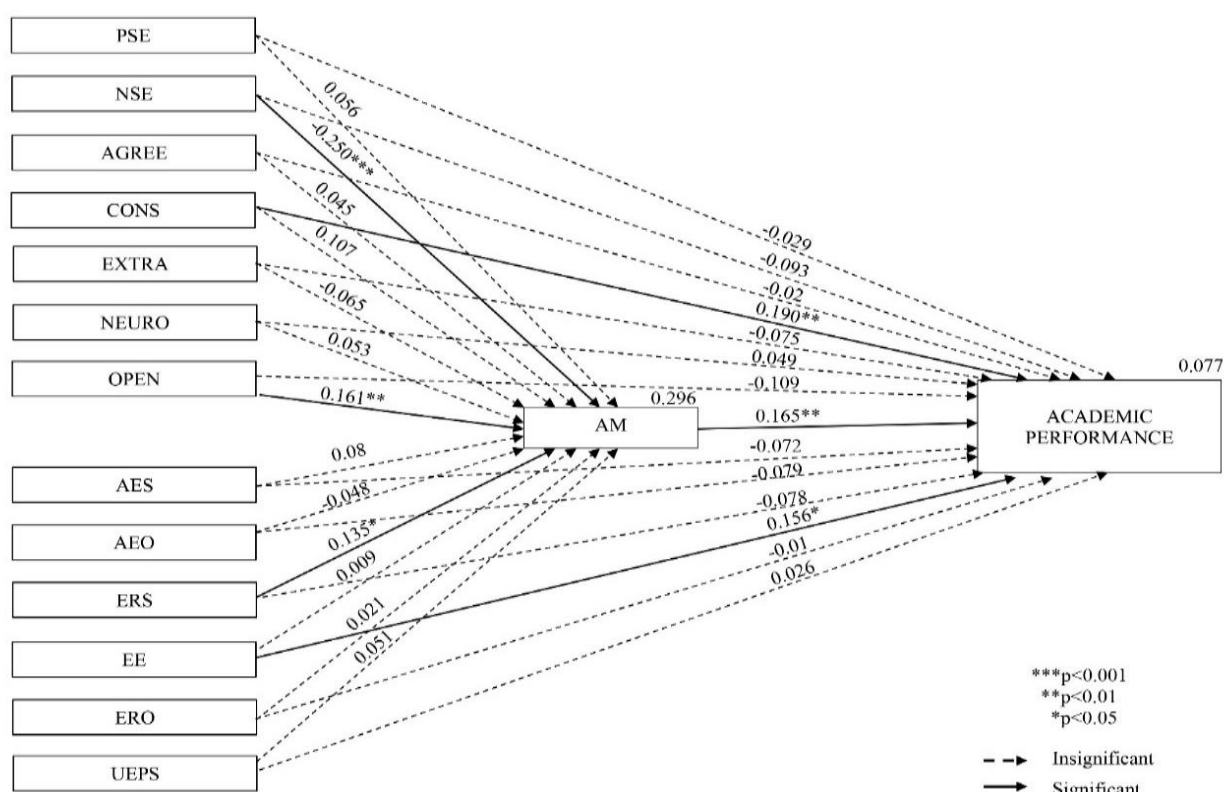

Figure 4. Simplified mediation model of SEM with standardized coefficient

The results also revealed that negative self-esteem (NSE), openness (Open), and self-emotional regulation (ERS) have an indirect effect on academic performance (GPA) through academic motivation (AM). However, these factors have no significant direct impact on academic performance. Therefore, AM fully mediated the relationship between NSE, Open, and ERS with GPA. In addition, this study discovered that AM partially mediated the relationship between conscientiousness (Cons) and students' performance since the direct effect of Cons and GPA was significant. Also, this study discovered that the rest of the variables did not have significant direct or indirect effects on GPA.

Table 4
Findings of SEM

Structural Path	Estimate	SE	z	Biased-Corrected Confidence Interval	p-value
AM → GPA	**0.015 (0.165)**	**0.005**	**3.000**	**[0.006, 0.025]**	**0.002**
PSE → GPA					
PSE → GPA	-0.02 (-0.029)	0.042	-0.476	[-0.104, 0.063]	0.618
PSE → AM	0.411 (0.056)	0.417	0.986	[-0.420, 1.211]	0.337
PSE → AM → GPA	0.006 (0.009)	0.007	0.857	[-0.005, 0.023]	0.230
NSE → GPA					
NSE → GPA	-0.046 (-0.093)	0.026	-1.769	[-0.097, 0.004]	0.067
NSE →AM	-1.341 (-0.25)	0.232	-5.780	[-1.822, -0.912]	<0.001
NSE → AM → GPA	**-0.021 (-0.041)**	**0.008**	**-2.625**	**[-0.038, -0.008]**	**0.001**
Agree → GPA					
Agree → GPA	-0.012 (-0.02)	0.032	-0.375	[-0.076, 0.051]	0.685
Agree → AM	0.3 (0.045)	0.366	0.820	[-0.403, 1.030]	0.418
Agree → AM → GPA	0.005 (0.007)	0.006	0.833	[-0.005, 0.019]	0.321
Cons → GPA					
Cons → GPA	**0.117 (0.19)**	**0.039**	**3.000**	**[0.042, 0.193]**	**0.002**
Cons →AM	0.707 (0.107)	0.375	1.885	[-0.026, 1.429]	0.055
Cons → AM → GPA	**0.011 (0.018)**	**0.007**	**1.571**	**[0.001, 0.029]**	**0.033**
Extra → GPA					
Extra → GPA	-0.039 (-0.075)	0.031	-1.258	[-0.099, 0.024]	0.212
Extra → AM	-0.362 (-0.065)	0.299	-1.211	[-0.990, 0.187]	0.202
Extra → AM → GPA	-0.006 (-0.011)	0.005	-1.200	[-0.020, 0.002]	0.140
Neuro → GPA					
Neuro → GPA	0.023 (0.049)	0.024	0.958	[-0.022, 0.071]	0.330
Neuro → AM	0.265 (0.053)	0.25	1.060	[-0.266, 0.732]	0.334
Neuro → AM → GPA	0.004 (0.009)	0.004	1.000	[-0.003, 0.014]	0.221
Open → GPA					
Open → GPA	-0.070 (-0.109)	0.037	-1.892	[-0.145, 0.001]	0.056
Open → AM	1.118 (0.161)	0.384	2.911	[0.390, 1.908]	0.001
Open → AM → GPA	**0.017 (0.027)**	**0.008**	**2.125**	**[0.005, 0.039]**	**0.001**
AES→ GPA					
AES → GPA	-0.045 (-0.072)	0.043	-1.047	[-0.130, 0.036]	0.285
AES → AM	0.543 (0.080)	0.421	1.290	[-0.289, 1.372]	0.206
AES → AM → GPA	0.008 (0.013)	0.007	1.143	[-0.003, 0.027]	0.128
AEO→ GPA					

Structural Path	Estimate		SE	z	CI	p-value
AEO → GPA	-0.041 *(-0.079)*		0.027	-1.519	[-0.095, 0.009]	0.113
AEO → AM	-0.272 *(-0.048)*		0.259	-1.050	[-0.789, 0.236]	0.282
AEO → AM → GPA	-0.004 *(-0.008)*		0.004	-1.000	[-0.016, 0.003]	0.202
ERS→ GPA						
ERS → GPA	-0.050 *(-0.078)*		0.047	-1.064	[-0.142, 0.038]	0.28
ERS → AM	0.924 *(0.135)*		0.468	1.974	[0.006, 1.825]	0.048
ERS → AM→ GPA	**0.014 *(0.022)***		**0.009**	**1.556**	**[0.001, 0.037]**	**0.026**

Note: Standardized value is in bracket, SE is standard error

Table 4
Findings of SEM (cont.)

Structural Path	Estimate	*SE*	*z*	Biased-Corrected Confidence Interval	*p*-value
EE → GPA					
EE → GPA	**0.085 *(0.156)***	**0.033**	**2.576**	**[0.021, 0.151]**	**0.011**
EE → AM	0.052 *(0.009)*	0.31	0.168	[-0.585, 0.626]	0.913
EE → AM→ GPA	0.001 *(0.001)*	0.005	0.200	[-0.009, 0.011]	0.863
ERO → GPA					
ERO → GPA	-0.006 *(-0.01)*	0.04	-0.150	[-0.084, 0.071]	0.881
ERO→ AM	0.146 *(0.021)*	0.38	0.384	[-0.585, 0.921]	0.683
ERO → AM→ GPA	0.002 *(0.004)*	0.006	0.333	[-0.008, 0.017]	0.609
UEPS → GPA					
UEPS → GPA	0.014 *(0.026)*	0.034	0.412	[-0.051, 0.083]	0.658
UESPS→ AM	0.298 *(0.051)*	0.347	0.859	[-0.370, 0.973]	0.385
UEPS→ AM→ GPA	0.005 *(0.008)*	0.006	0.833	[-0.005, 0.019]	0.299

Note: Standardized value is in bracket, SE is standard error

Discussion

The current study used SEM to determine the significant determinants and explore the mediating role of academic motivation in the relationship between self-esteem, personality traits, emotional intelligence, and students' learning outcomes. The present study revealed that only academic motivation, emotional expression, and conscientiousness significantly and directly impacted academic achievement. The findings implied that academic motivation, emotional expression, and conscientiousness were the determinants of undergraduate students' academic achievement. This finding coincided with previous findings by De Feyter *et al* (2012); Hazrati-Viari *et al* (2012); Mammadov *et al* (2021); Mega *et al* (2014); Nazim and Ahmad (2013); Ning and Downing (2012); Önder *et al* (2014); Sadipour *et al* (2017); Tam *et al* (2021); Trigueros *et al* (2019); Tripathi et al (2018); Xu and Wu (2017) found that academic motivation were the significant factors of students' academic achievement.

Moreover, the findings aligned with Okwuduba *et al* (2019) demonstrated that emotional expression was significantly and positively related to student learning outcomes,

signifying that those students who are good at expressing their feelings tend to have higher academic outcomes. Furthermore, among the five traits, conscientiousness was found as a significant determinant of academic performance which aligned with (Aghamohammadi and Asgari, 2016; Hazrati-Viari *et al.,* 2012; Lim and Abdullah, 2012; Meyer *et al.*, 2019; Rosander *et al.*, 2011). The most probable explanation is that conscientious individuals exhibit hard work, self-discipline, and goal orientation (Ali *et al.,* 2021; Mammadov *et al.,* 2021). Their proactive approach to setting clear objectives makes them better prepared compared to others, consequently contributing to positive learning outcomes (Mammadov *et al.,* 2021).

Besides that, in examining the indirect effects, the present study discovered a significant indirect effect of negative self-esteem and scholastic achievement. These indicated that self-esteem did not directly impact academic success but through a mediator that agreed with Soufi et al (2014) findings and in contrast to (Ag Isha and Hashim, 2022; Colquhoun and Bourne, 2012; Duru and Balkis, 2017; Quílez-Robres et al., 2021). The findings demonstrated that students with lower negative self-esteem tend to have higher academic motivation, resulting in higher academic achievement. This research also concurs with the results of Moayed and Vahedian-Azimi (2021); Soufi et al (2014); Supple et al (2013), signifying that self-esteem significantly influenced motivation.

In addition, recent research has discovered that personality characteristics, such as conscientiousness and openness, indirectly influence academic success through academic motivation. SEM revealed that openness has a significant indirect effect on academic achievement, supported by Hazrati-Viari *et al* (2012); Mammadov *et al* (2021), suggesting that motivation significantly mediated the relationship between openness and educational success. Students with high openness tend to be intellectually inquisitive, bright, introspective, aesthetic, and interested and have a strong desire to acquire a comprehensive grasp of numerous topics (Hazrati-Viari *et al.,* 2012).

Additionally, the findings found that conscientiousness indirectly influenced academic achievement via academic motivation. These findings were in line with De Feyter et al (2012) and Mammadov et al (2021), in which the relationship between conscientiousness and students' academic performance was mediated by academic motivation. Moreover, the direct effect of conscientiousness on students' success was significant, indicating that motivation partially mediated the relationship between conscientiousness and educational achievement. Individuals with high conscientiousness possess order, effort, and responsibility, which motivates them to study with greater persistence and responsibility, resulting in better success and advancement (Ahmadi et al., 2021).

Lastly, the present study demonstrated that motivation mediated the link between emotional intelligence (self-emotional regulation) and educational achievement. The findings were consistent with prior research in which Chang and Tsai (2022); Tam *et al* (2021); Trigueros *et al* (2019) found that emotional intelligence indirectly affected academic success through motivation. These demonstrated that students' capability to regulate their emotions influences the development of their learning motivation, which in turn affects their academic performance (Chang and Tsai, 2022). Besides that, students who can handle and deal with emotion-laden information effectively perform better in educational settings. This is because these students tend to be more motivated to learn, more able to deal with stress and solve difficulties, and less likely to procrastinate or have behavioural issues (Tam *et al.,* 2021).

Conclusion

This study intended to identify the significant factors in academic achievement, as well as to examine the mediation effects of academic motivation in the relationship between personality traits, self-esteem, and emotional intelligence on students' achievement. The present study included 533 undergraduate students of UMS. The current study revealed that academic motivation, emotional expression, and conscientiousness were significant factors in academic achievement, as the direct effects were significant. Besides that, the findings discovered that negative self-esteem, conscientiousness, openness, and self-emotional regulation have significant indirect effects on learning outcomes through academic motivation.

The results of the present study extend the existing knowledge of the determinants that influence educational achievement. Besides that, the findings demonstrated the evidence regarding the vital role of academic motivation in the relationship between some dimensions of personality traits, self-esteem, and emotional intelligence with students' learning outcomes. These findings revealed essential inputs and provided a greater understanding of the higher learning institutions in structuring and planning their students' support systems and activities.

For instance, the study's findings highlight the crucial role of academic motivation and offer a comprehensive guide for educators to implement effective measures to foster students' motivation for their studies, as Oz (2016) suggested. Moreover, similar to Ebinagbome and Nizam (2016) and Id et al. (2019), it is advisable for professionals in universities, including administrators and counsellors, to introduce interventions, such as seminars and programs, aimed at motivating and enabling students to acquire an in-depth knowledge of their personality, emotions, and self-esteem, and how these variables influence their academic performance and educational pursuits.

Limitation and Suggestions

There are some limitations in the present study. First, respondents self-reported their academic success (GPA) rather than official data. Second, even though the sample size was big enough, the sample only consisted of students in UMS, Kota Kinabalu campus. Third, the current study did not consider other variables such as attendance, time management, study habits, and instructor and institutional factors that might affect students' performance.

As a result, rather than relying on students' self-reported grades, future studies should obtain consent from participants to gather grades from official records. Next, expanding the sample to another campus, such as Labuan and Sandakan, might be interesting to generalize the UMS students. Furthermore, given the significant role of academic motivation as a mediator, it will be interesting to discover its significant contributors. Further studies can be conducted to determine the differences in academic motivation contributing factors with regard to gender, discipline, and socio-economic backgrounds. Lastly, future research should examine the influence of other potential factors, such as attendance, time management, and study habits, on students' achievement.

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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