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Empowering tomorrow: A measurement model for student leadership skills in Malaysian boarding schools

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Abstract This study employs a quantitative research approach to develop and validate a measurement model for Student Leadership Skills (SLS) among students in Malaysian Fully Residential Schools (FRS) using Structural Equation Modeling (SEM) via IBM SPSS AMOS. Based on pilot study findings involving 116 FRS teachers, the instrument's validity was established through Exploratory Factor Analysis (EFA), while its reliability was confirmed with a Cronbach's alpha value of 0.964. The EFA results identified three dimensions within the SLS construct which are Entrepreneurial Mindset, Resilience across Emotional Intelligence, and Communication Skills with the removal of five items due to low factor loadings. Using actual study data from 407 FRS teachers, the measurement model was successfully developed and demonstrated a good model fit indices (Chi Square df = 2.884, RMSEA = 0.073, GFI = 0.923, AGFI = 0.891, CFI = 0.963, TLI = 0.955, NFI = 0.945) through Confirmatory Factor Analysis (CFA). The model was further tested for construct validity, convergent validity, discriminant validity, and normality distribution, confirming its robustness. This validated model serves as a guide for student character development, particularly in the teaching and learning process. It underscores the crucial role of teachers in fostering student leadership values such as decision making, valuing others, maintaining optimism, and practicing ethical communication on social media. Additionally, this model has the potential for global application across various educational settings beyond FRS schools. Future research is recommended to explore the model's applicability in different school environments, integrate qualitative approaches such as interviews and case studies, and provide deeper insights into the development and real world application of SLS.

Keywords: student leadership, fully residential schools, exploratory factor analysis, confirmatory factor analysis, validity, structural equation modeling

1. Introduction

A leader is an individual capable of motivating, inspiring, and guiding others to achieve a shared goal. Leadership skills are essential in shaping students into future leaders who can navigate challenges and drive societal progress. Student leadership skills (SLS) reflect the social competence and moral character that should be developed during their educational experience. In the context of Malaysian boarding schools, leadership development is a fundamental aspect of student education, emphasizing not only academic excellence but also personal and social responsibility.

Recognizing the importance of leadership development, the Malaysian Ministry of Education (MOE) has outlined various initiatives to cultivate leadership qualities among students. Programs such as Student Leadership Development Modules, school-based leadership training, and co-curricular activities are structured to enhance students' decision-making, problem-solving, and interpersonal skills. MOE emphasizes that leadership development should be embedded within the school curriculum, ensuring that students receive consistent and structured exposure to leadership experiences. However, despite these initiatives, there remains a need for a validated measurement model that accurately assesses leadership skills among students in these institutions.

Although previous studies have explored student leadership, most existing models have primarily focused on co-curricular activities (Tan & Adams, 2023) and specific leadership positions (Kennedy, 2020; Mwagi & Monda, 2023), with limited emphasis on the holistic development of student leadership within the teaching and learning process. Furthermore, prior research has predominantly examined leadership in day schools (Elias et al., 2018; Ibrahim et al., 2024) while studies on leadership development in boarding schools remain scarce. Moreover, on a global scale, much of the research on student leadership has been conducted at the higher education level (Sebake, 2023) despite the importance of cultivating leadership skills from an early stage of schooling. This gap underscores the need for a comprehensive study on student leadership within the context of Malaysian boarding schools.

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Addressing this need, this study aims to develop and validate a measurement model for SLS among Fully Residential School (FRS) students in Malaysia using Structural Equation Modeling (SEM) via IBM SPSS AMOS. By establishing a robust and reliable model, this study provides a structured framework for assessing student leadership competencies, enabling educators and policymakers to implement targeted interventions that enhance leadership development. The findings contribute to the broader educational landscape by offering empirical evidence to support leadership skill cultivation, ultimately preparing students to become future leaders who can navigate complex challenges in academic, social, and professional settings.

2. Literature Review

Student leadership must be nurtured from an early stage rather than being perceived as a future responsibility (Patrick, 2022). Educational institutions, therefore, should nurture leadership as a core skill from an early age in schools. Conversely, educational institutions ought to foster leadership as a fundamental talent from an early age in schools. Karnes & Bean (2021) contest the belief that youth lack leadership potential, asserting the necessity of fostering leadership abilities from a young age. This is because young individuals in this context need education to develop a reflective perspective on their environment (Piaget, 1936). Rayung et al. (2018) assert that contemporary educational contexts prioritize the evaluation of academic achievement as a primary metric for assessing student progress. However, children today require exposure to principles of communal living, including socialization, norms, friendships, and other fundamental aspects of sociology and psychology that extend beyond academic learning.

Yuntasilo & Sutheejariyawattana (2023) emphasize that students should engage in leadership experiences at school through teamwork, identity formation, and effective task execution to cultivate leadership traits. Building on this perspective, Lyssiotis (2021) asserts that student leadership enables active participation in school communities while fostering essential skills. In alignment with this view, Göktaş & Akyürek (2024) propose a student leadership development model centered on fostering happiness in schools. A positive school environment necessitates social, cultural, political, and environmental adjustments, as school happiness is a multifaceted concept. To further elaborate, Talebzadeh & Samkan (2011) identify four fundamental factors in their conceptual framework for school happiness: physical factors related to creative and engaging learning materials, individual factors emphasizing teacher-student relationships, social-emotional factors fostering a supportive environment, and instructional factors incorporating artistic and extracurricular activities. The implementation of this framework enhances overall school happiness, which in turn positively influences student leadership behaviors (Eker & Özgenel, 2021). Furthermore, instructional leadership significantly predicts school happiness, highlighting the principal's role in shaping a positive learning environment (Eker & Özgenel, 2021).

Astor & Benbenishty (2018) introduce a heuristic leadership approach, identifying five school-based dimensions essential for fostering positive learning environments: classroom management, class size, teacher-student interactions, school management, and infrastructure. These elements contribute to a safe and conducive school climate, supporting both academic and socio-emotional development (Eke, 2022). Among these dimensions, effective classroom management is crucial for maximizing learning experiences (Rodríguez-Largacha et al., 2014). In South Africa, student representatives enforce behavioral codes, reducing misconduct and promoting a constructive learning atmosphere (Radebe, 2019). However, while appointing student leaders is common, they are often tasked with assisting school management rather than enforcing discipline, highlighting a gap in leadership training for peer regulation.

Mahadevia (2022) introduces the concept of silent leadership, which challenges the traditional preference for extroverted leadership traits. This approach comprises four key dimensions: defining direction, implementation, connection-building, and fostering followership. Silent leaders lead through actions rather than words, prioritizing empathy, active listening, and trust-building. This leadership style fosters a collaborative and productive environment, enhancing team motivation without relying on dominant leadership approaches. However, its effectiveness may sometimes be misconstrued as a lack of decisiveness in critical situations.

In the school context, student leaders must balance assertiveness and empathy, aligning with emotional intelligence dimensions that support resilience. The literature highlights the importance of early leadership exposure, a supportive school climate, and diverse leadership approaches. Integrating elements such as resilience, teamwork, and alternative leadership models can strengthen student leadership development, ultimately fostering a generation of capable and reflective leaders.

This study is grounded in the Malaysia Education Blueprint (PPPM) 2013–2025, which serves as the primary model for understanding student leadership development. The blueprint outlines the Student Aspiration Model, identifying four key markers of student leadership: (1) communication skills, (2) resilience, (3) entrepreneurship, and (4) emotional intelligence (Kementerian Pendidikan Malaysia, 2013). Building on this foundation, this article aims to develop a comprehensive measurement model for student leadership, ensuring a valid and reliable framework to assess and enhance leadership competencies among students in FRS.

3. Material & Methods

3.1. Research Methods

This study adopts a quantitative cross-sectional survey approach, chosen for its practicality and efficiency in collecting data from a large population within a short timeframe (Creswell, 2015). Specifically, it employs a quantitative research design to develop and validate a measurement model for SLS among students in Malaysian Fully Residential Schools (FRS) using Structural Equation Modeling (SEM) via IBM SPSS AMOS. SEM provides a holistic approach to model evaluation by integrating measurement and structural models, ensuring that both the reliability of measurements and the validity of hypothesized relationships are assessed simultaneously (Fakultas Sains dan Teknologi UIN Walisongo, n.d.).

3.2. Participants

This study identifies FRS teachers as the study population, focusing on their perceptions of students' leadership skills during the teaching and learning process, as suggested by York-Barr & Duke (2004). A total of 69 out of 71 FRS were included, involving 3,664 teachers, after excluding 132 teachers from two schools in Selangor due to pilot study contamination (Chua, 2014). Based on Krejcie and Morgan (1970), a minimum of 348 samples was required, aligning with SEM recommendations (Hair, 2019). To prevent data loss, the sample was increased by 17% (59 additional respondents), ensuring reliability (Sekaran & Bougie, 2010). Thus, the final sample size for questionnaire distribution was 415 respondents.

3.3. Instrument & Data Collection

The questionnaire instrument is adapted from literature on key models, supporting theories, and prior studies, undergoing a rigorous development process to ensure each variable and dimension is well-defined (DeVellis, 2017; Mahmud, 2021). It is systematically validated through face validity, expert validation, pilot testing, exploratory factor analysis (EFA), and Cronbach’s alpha reliability testing before being applied in the actual study. This study involves teachers' perceptions of their students' leadership skills during the teaching and learning process. Each selected participant was provided with a questionnaire through an official letter containing a QR code for the survey.

3.3.1. Exploratory factor analysis

Social science research frequently uses EFA to identify latent variables in questionnaire items and assess their internal reliability (Fah & Hoon, 2010). EFA is the most frequently employed multivariate statistical method for identifying, reducing, and organizing a large number of questionnaire items into more specific constructs to conduct research (Ehido et al., 2020). EFA is employed to investigate the primary constructs from a relatively large latent construction dataset, as the instrument developed employs temporary factors derived from the literature (Thompson, 2004). Hair et al. (2019) define EFA as factors or dimensions that are highly interrelated and presumed to represent constructs within a dataset. Each variable necessitates its own execution of the stages of this EFA procedure. We aim to prevent multicollinearity and factor adjustment with the variables (Hair et al., 2019). Table 1 summarizes the five conditions that the EFA procedure must satisfy to increase the reliability of this factor analysis. Initially, the KMO measure of sampling adequacy must surpass the value of '0.50' (Hair et al., 2014).

Second, to demonstrate a significant correlation between constructs, Bartlett's test must attain a p value of less than 0.001 (Hair et al., 2014) or $p < 0.05$ (Hair et al., 2019). Third, we retain items with a factor loading greater than 0.6 and discard those with a factor loading less than 0.6 (Awang, 2015; Awang et al., 2018; Hair et al., 2014). Fourth, the consolidation of items into a single dimension occurs when the scale loading reaches eigenvalues of 1 or higher (Tabachnick & Fidell, 2013). The variance must exceed the suggested threshold of 60%, indicating that the items accurately assess the construct (Hair et al., 2014). The guidelines proposed by Tabachnick & Fidell (2013) classify loadings above 0.71 as very good, 0.63 as good, 0.55 as acceptable, 0.45 as moderate, and 0.32 as weak.

Table 1 Conditions for meeting EFA.

No	Indicator	Accepted value	Source
1	Kaiser–Meyer–Olkin	KMO > 0.50	Hair et al. (2014)
2	Bartlett’s test	Significant at $p < 0.001$	Hair et al. (2014)
3	Factor loading	Factor loading > 0.60	Hair et al. (2014), Awang (2015), and Awang et al. (2018)
4	Eigenvalue	Obtains eigenvalues of 1 and greater	Tabachnick and Fidell (2013)
5	Total variance explained	Total Variance explained > 0.60	Hair et al. (2014)

The EFA procedure calculates the factor loading for each item, which indicates its usefulness in measuring the construct, as well as determining the dimensions of these items. The minimum acceptable value for factor loading is 0.60 (Bahkia et al., 2019). The construct's total variance explained (TVE) is also determined by the EFA procedure. TVE indicates the degree to which the measurement items and their components can be estimated from the construct (Mahfouz et al., 2019). Items and their components (if any) must measure 60% of the construct, as the minimum TVE is 0.60 (Shkeer & Awang, 2019). Finally, the internal consistency of the measurement items is determined in this study through the application of Cronbach's alpha.

The construct's internal consistency is a measure of the degree to which the selected elements are interrelated (Bahkia et al., 2019). Cronbach's alpha's minimal value is 0.7.

3.3.2. EFA Output from Pilot Study

The pilot study data were analyzed via the EFA procedure in IBM-SPSS 25.0. Principal component analysis (PCA) was employed as the extraction technique, whereas the varimax (variance maximization) method was used for rotation. The EFA results yielded a Kaiser–Meyer–Olkin (KMO) score of 0.932, as presented in Table 2. This KMO value indicates sample adequacy, surpassing the minimum threshold of 0.6 recommended by Hoque et al. (2018). Additionally, Table 2 displays the results of Bartlett's test of sphericity, which is significant, with a p value less than 0.05, confirming the suitability of the data for factor analysis.

Table 2 KMO and Bartlett's test scores.

KMO and Bartlett's Test		
Kaiser–Meyer–Olkin Measure of Sampling Adequacy.		.932
Bartlett's Test of Sphericity	Approx. Chi-Square	2708.188
	df	300
	Sig.	.000

The EFA procedure also determines the number of components (or themes) that emerged for the items. The procedure groups items that measure a similar theme. The graph in Figure 1 indicates three components that should emerge, which would divide the 20 measuring items for the SLS into three distinctive components.

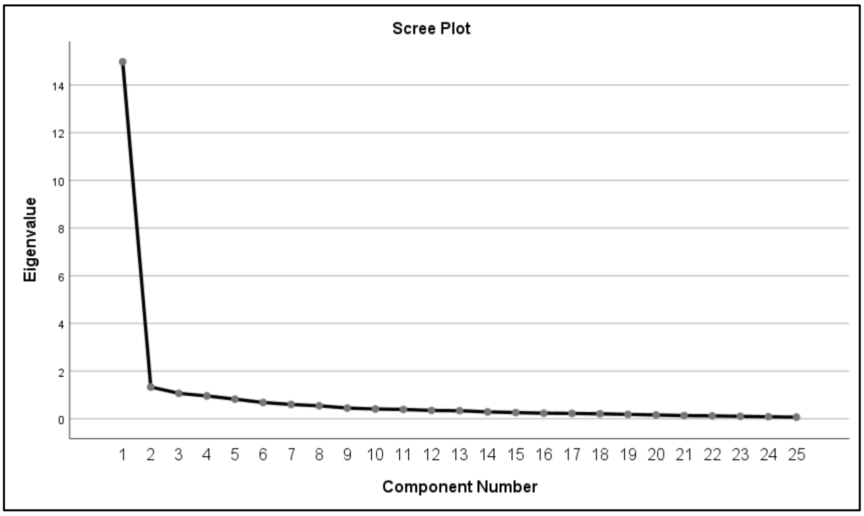

Figure 1 Scree plot for the SLS construct.

Table 3 presents the three components that emerged with the eigenvalue for every component (column 1), the total variance explained for each component (column 2) and the cumulative variance explained (column 3). The eigenvalue for each component should be greater than 1.0, and the cumulative variance explained should be greater than 60% (Shkeer & Awang, 2019). The eigenvalues obtained ranged between 14.975 and 1.068; the variance explained for component 1 was 59.901%, for component 2 was 5.327%, and for component 3 was 4.271%. The total variance explained for measuring this construct is 69.499%, which is acceptable as it exceeds the minimum requirement of 60% (Rahlin et al., 2019a).

Table 3 Total variance explained for every component.

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.975	59.901	59.901	14.975	59.901	59.901	7.214	28.854	28.854
2	1.332	5.327	65.228	1.332	5.327	65.228	5.175	20.699	49.553
3	1.068	4.271	69.499	1.068	4.271	69.499	4.987	19.947	69.499

Extraction Method: Principal Component Analysis.

Table 4 shows the components, the corresponding items associated with each component, and the factor loading for each item. An item factor loading must exceed 0.6 for retention; otherwise, the item should be eliminated from the actual study instruments (Awang, 2012). Consequently, the EFA approach for examining the measurement items related to student leadership qualities has yielded three components. Component 1 comprises six items, component 2 comprises nine items, and component 3 comprises five items. The results of the EFA procedure indicated that five items were removed because the factor loadings were below the threshold of 0.6. Consequently, the number of items accepted for use in the actual study was 20, as shown in Table 4.

Table 4 The rotated component matrix for the students' leadership skills construct.

Rotated Component Matrix[a]				
Item Code	Item Statement	*Component* 1	2	3
D1	Students produce more creative alternative ideas to solve problems during learning sessions	.722		
D2	Students consider various aspects before making decisions during class discussions.	.713		
D3	Students are excited when asked to think about modifying existing ideas during learning sessions.	.709		
D4	Students use ICT to solve problems in self-directed learning tasks.	.701		
D5	Students can identify effective learning styles to excel in exams.	.699		
D6	Students are more committed when given coursework such as Project-Based Learning (PBL).	.618		
D7	Students can identify effective learning styles to excel in exams.		.808	
D8	Students can find solutions when in conflict situations with their classmates.		.722	
D9	Students show sensitivity to the emotions of their classmates during group activities conducted by the teacher.		.714	
D10	Students do not give up when they fail to achieve good scores in exams		.708	
D11	Students are disciplined when asked to complete assignments within a given time frame.		.695	
D12	Students are capable of motivating classmates who are falling behind to put in more effort.		.676	
D13	Students can express opinions clearly when asked by the teacher.		.642	
D14	Students can express opinions clearly when asked by the teacher.		.636	
D15	Students show appreciation for the opinions of their classmates during classroom discussions.		.605	
D16	Students behave courteously when communicating with teachers.			.818
D17	Students write ethically when communicating via social media			.769
D18	Students give clear instructions as group leaders.			.744
D19	Students can lead school programs.			.645
D20	Students have confidence when presenting in class.			.618

Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser normalization.

The reliability of the scale is determined by calculating the alpha coefficient. Therefore, we used the traditional Cronbach's alpha method to assess the reliability of the items in this study. (Sekaran & Bougie, 2010) and Nunnally (1978) suggest that a better alpha coefficient is above 0.70. They stated that Cronbach's alpha is a consistent coefficient, which indicates that the items are proportionally correlated with each other. Furthermore, they argue that a reliability level below 0.60 is considered a weak model. Table 5 presents the reliability analysis of the student leadership construct. The Cronbach's alpha value is 0.964 for 20 items in the questionnaire, indicating that the construct items are acceptable and reliable in measuring the response.

Table 5 Reliability analysis.

Construct	Reliability Statistics		
	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
SLS	.964	.965	20

Using the results of the EFA, the final questionnaire for the field study was developed. The questionnaire for the SLS now consists of three components with 20 items, as determined by appointed experts. The first component consists of nine items, renamed Resilience across Emotional Intelligence; the second component consists of six items, renamed Entrepreneurial Mindset; and the third component consists of five items, renamed Communication Skills.

3.3.3. Data analysis

The validated questionnaire is further assessed using SEM to develop a measurement model, ensuring validity and reliability through Confirmatory Factor Analysis (CFA). Items with low factor loadings, redundancy, or high multicollinearity are removed to refine the structural model, as CFA determines whether indicators accurately represent the observed variables (Shek & Yu, 2014). Once the structural model achieves a robust fit index, the questionnaire can serve as a reliable instrument for future educational research, contributing to measurement quality through comprehensive validation procedures.

Costello & Osborne (2005) argue that the EFA procedure should not serve as a substantive conclusion for testing hypotheses through inferential techniques. In this study, the CFA procedure is employed to assess the reliability, validity, and unidimensionality of variables (Rahlin et al., 2019a). Instrument items that fail to meet the measurement model's fit standard, specifically, a factor loading value below 0.6, are excluded from the model. The fitness indices provide an accurate assessment of the measurement model's suitability (Awang, 2015). This investigation employs the CFA procedure to evaluate variables for reliability, validity, and unidimensionality (Ong & Puteh, 2017). Furthermore, we excluded from the model any instrument items that failed to satisfy the measurement model's fit standard, with a factor loading value of less than 0.6. Fitness indices describe the accuracy of the measurement model (Awang, 2015).

This study's devised measurement model must pass three types of validity and achieve the concordance index, as shown in Table 6. The latent constructs of the measurement model must satisfy three types of validity: convergent validity, construct validity, and discriminant validity, as per Hussain & Husain (2022). Moreover, this investigation employs composite reliability (CR) evaluation to guarantee that the data collected are consistent and stable for future research. CR is a good way to check reliability because it can be used instead of the usual way of computing Cronbach's alpha and is good for SEM analysis (Rahlin & Gualin, 2023).

After the items and their components were identified, this study used the retained items (items with a loading factor greater than 0.6) to collect data from the field study. Using these data, the CFA procedure was conducted to validate the construct. The CFA procedure determines the validity and reliability of the instrument for measuring the construct (Mohamad et al., 2019). Three types of validity are required in the CFA procedure, namely, construct validity, convergent validity, and discriminant validity (Yusof et al., 2017). For reliability, using the CFA results, researchers can calculate the composite reliability for the construct (Aimran et al., 2017). Construct validity is determined via a set of fit indices generated via the CFA procedure. The fit categories that need to be met for construct validity are parsimony fit, absolute fit, and incremental fit (Awang, 2015). A summary of the validity and reliability requirements is presented in Table 6.

Table 6 Types of validity and reliability.

Validity	Name of Category		Threshold
Construct Validity	Fitness Indices	Absolute fit	RMSEA < 1.0
		Incremental fit	GFI > 0.85
			AGFI > 0.85
		Parsimonious fit	Chi-Square/df < 5.0
Convergent Validity	Average Variance Extracted (AVE)		AVE > 0.5
Discriminant Validity	Discriminant Validity Indeks Summary		Corellation between component/construct > 0.85
Composite Relialibility	Value of CR		CR > 6

In the second stage of data collection, field study data were collected via the same procedure for 407 respondents. The study validates the measurement model for the SLS as a second-order construct measured with three components. The CFA procedure was conducted via IBM-SPSS-AMOS 24.0 with the maximum likelihood estimator (MLE) algorithm. The MLE algorithm is fast, efficient and accurate (Awang, 2015; Awang et al., 2018).

4. Results

The results of the CFA procedure using MLE are presented in Figure 2. This construct has three components. The first component, SLS1, represents Entrepreneurial Mindset, the second component, SLS2, represents Resilience across Emotional Intelligence, and the third component represents Communication Skills. Hair et al. (2006) suggested that once the requirements of the measurement model fit have been met, it is necessary to inspect the construct validity and reliability of the model before continuing with the structural model.

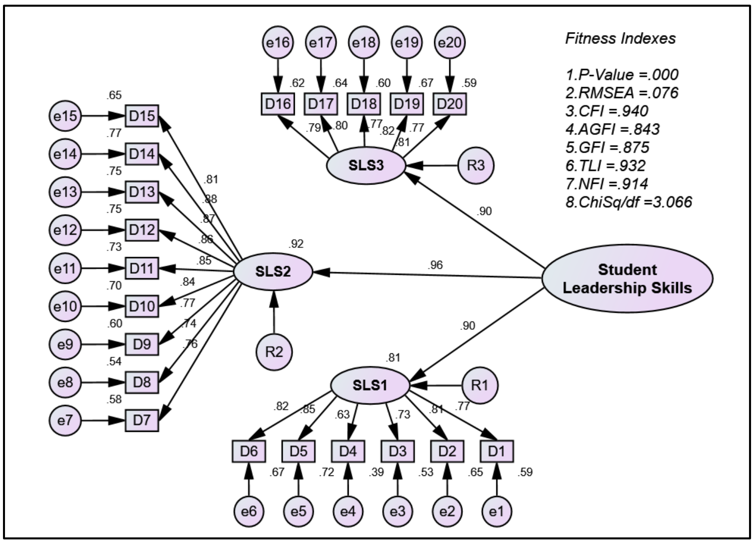

Figure 2 The second-order construct for the measurement model of SLS.

The measurement model of latent constructs needs to pass three types of validity, namely, construct validity, convergent validity, and discriminant validity (Hair et al., 2010). The construct validity is assessed through the fitness indices of the measurement model, the convergent validity is assessed through computing the average variance extracted (AVE), and discriminant validity is assessed through developing the discriminant validity index summary. Although the developed model has achieved construct validity through strong goodness-of-fit indices, we aim to produce a more refined model with a chi-square/df value of less than 3.0. Awang (2018) suggested that the ideal chi-square/df value for an optimal model should be less than 3.0. Therefore, we identified modification index (MI) values exceeding 15 for the purpose of item removal. This is because an MI > 15 indicates the presence of redundant items or statements with similar meanings from the respondents' perspective. Addressing this redundancy is essential to ensure that the goodness-of-fit indices are fully achieved (Hair et al., 2010; Awang, 2023). Figure 3 shows the results when the second-order variable model SLS achieves the goodness-of-fit index level.

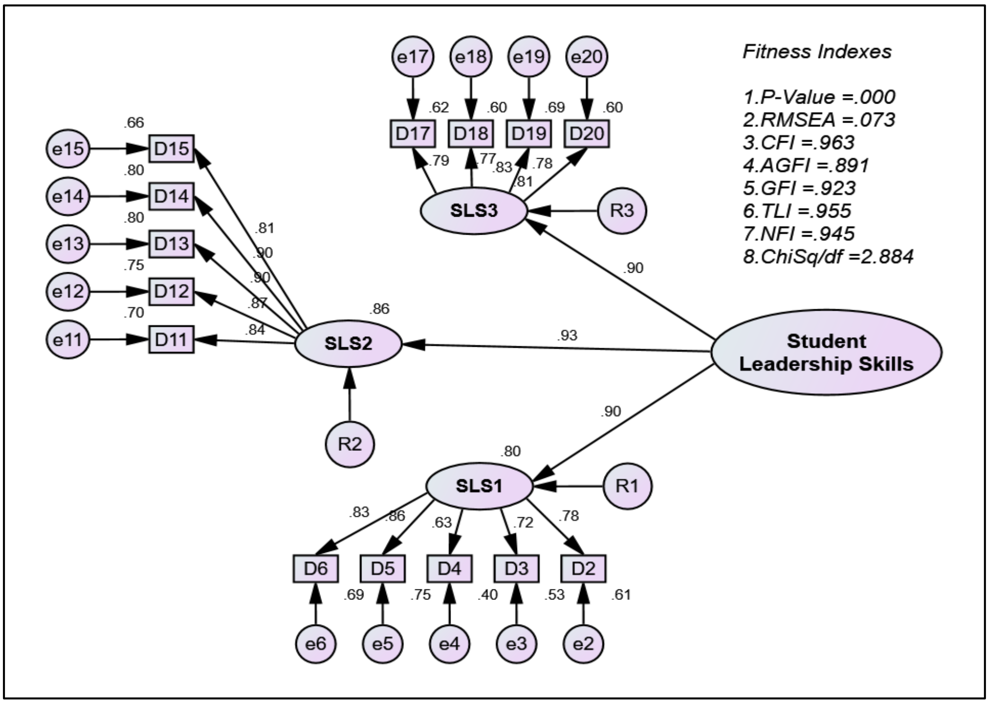

Figure 3 The second-order variable model with the SLS achieves the goodness-of-fit index.

According to Awang et al. (2018), construct validity is assessed through fitness indices. There are three fit categories to fulfill, namely, absolute fit, incremental fit, and parsimonious fit. These three fitness indices obtained from the CFA results in Figure 3 are presented in Table 7. A total of six items were removed to achieve an appropriate level of model fit index through the CFA procedure. The fitness indices meet the criteria for construct validity; hence, we can ascertain that the SLS constitutes a legitimate construct.

Table 7 Assessment of construct validity.

Name of Category	Name of Index	Level of acceptance	Index Value	Comment
Absolute fit	Chi-Square	P value > 0.05	0.000	Achieved
	RMSEA	RMSEA < 1.0	0.073	Achieved
	GFI	GFI > 0.85 for complex models.	0.923	Achieved
Incremental fit	AGFI	AGFI > 0.85 for complex models.	0.891	Achieved
	CFI	CFI > 0.85 for complex models.	0.963	Achieved
	TLI	TLI > 0.90	0.955	Achieved
	NFI	NFI > 0.90	0.945	Achieved
Parsimonious fit	Chisq/df	Chi-Square/df < 5.0	2.884	Achieved

Convergent validity and composite reliability are calculated based on the factor loadings of each item retained in the model following the CFA procedure. Table 8 presents the components, the items associated with each component, the factor loadings for each item, and the calculated values for composite reliability (CR) and average variance extracted (AVE). The results indicate that convergent validity and composite reliability for the SLS construct have been achieved, as all the CR values are greater than 0.5 and all the AVE values exceed 0.6 (Shkeer & Awang, 2019). Therefore, the study concludes that the composite reliability and convergent validity of the SLS construct have been successfully attained.

Table 8 Composite reliability, convergent validity and discriminant validity.

Component	Item	*Factor Loading*	CR $(\Sigma K)^2/[(\Sigma K)^2 + (\Sigma 1- K^2)]$	AVE $\Sigma K^2/n$
SLS1	D2	0.81	0.90	0.59
	D3	0.73		
	D4	0.63		
	D5	0.85		
	D6	0.82		
SLS2	D11	0.85	0.95	0.67
	D12	0.87		
	D13	0.87		
	D14	0.88		
	D15	0.81		
SLS3	D17	0.80	0.94	0.79
	D18	0.77		
	D19	0.82		
	D20	0.77		
CR and AVE of SLS construct			0.93 (CR > 0.6)	0.69 (AVE > 0.5)

Another validity requirement is discriminant validity. Since the SLS is a second-order construct with three components, it is important to assess the strength of the correlation between these components. Discriminant validity for the SLS construct is considered achieved if the correlation coefficient among the components does not exceed 0.85 (Noor et al., 2015). Figure 4 illustrates the evaluation of discriminant validity for the SLS construct. Using IBM SPSS AMOS software, we calculated the correlation coefficients among all three components in the model. The results show that the correlation coefficients among all the components do not exceed 0.85. Therefore, the study concludes that the measuring model for the SLS construct has attained discriminant validity.

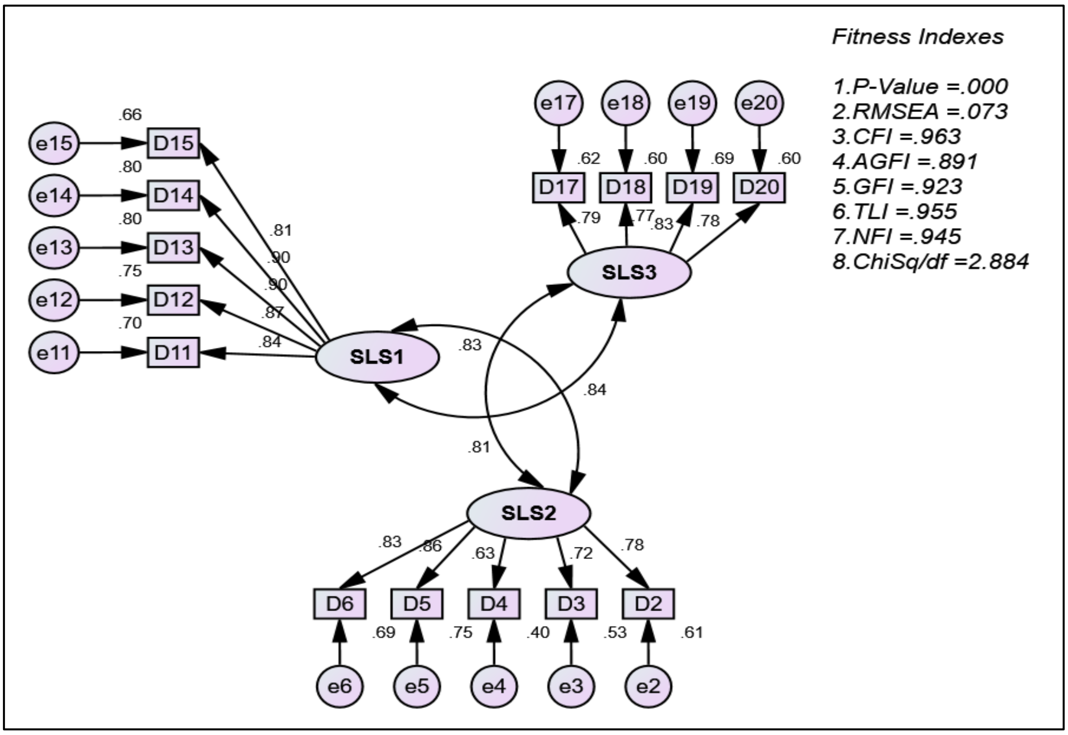

Figure 4 Assessment of convergent validity for the SLS construct.

Finally, before establishing the structured model to apply SEM, this study must evaluate the normality distribution of every item measuring the variables. This is crucial because SEM uses a parametric statistical modeling approach. Table 9 displays the assessment of normality of the items.

Table 9 Assessment of normality of the items.

Variable	min	max	skew	c.r.	kurtosis	c.r.
D20	4.000	7.000	-.709	-5.452	-.078	-.301
D19	4.000	7.000	-.394	-3.029	-.199	-.764
D18	3.000	7.000	-.659	-5.065	.310	1.192
D17	4.000	7.000	-.484	-3.719	-.561	-2.159
D15	3.000	7.000	-.414	-3.181	-.364	-1.400
D14	3.000	7.000	-.662	-5.091	.490	1.884
D13	2.000	7.000	-.719	-5.531	1.123	4.321
D12	2.000	7.000	-.656	-5.048	.410	1.577
D11	4.000	7.000	-.305	-2.347	-.429	-1.649
D6	3.000	7.000	-.522	-4.012	-.155	-.596
D5	4.000	7.000	-.374	-2.878	-.541	-2.079
D4	2.000	7.000	-1.308	-6.062	2.453	7.435
D3	3.000	7.000	-.533	-4.101	-.401	-1.542
D2	4.000	7.000	-.473	-3.642	-.451	-1.735
Multivariate					109.554	48.761

An absolute skewness value of 1.0 or less indicates a normal distribution. However, for SEM software that uses the maximum likelihood estimator (MLE), such as IBM-SPSS-AMOS, skewness values of up to 1.5 are acceptable if the sample size exceeds 200 and the critical region (CR) for skewness does not exceed 8.0. This is because MLE is robust to skewed data (Awang, 2018). The skewness values in Table 9 indicate that all the values fall within the range of -1.5-1.5. In summary, the validation of this measurement model has successfully met all the standards required by the CFA procedure, confirming its readiness to be employed as a structured model in the SEM analysis of this study. Consequently, we verified that the study's data distribution met the normality distribution requirements necessary for parametric statistical analysis. Additionally, the structural model ensures the validity and reliability of each measurement item, establishing a strong foundation for its potential development as an innovative instrument in future research.

5. Discussion

The study employed EFA and CFA to validate the measurement model for SLS among FRS teachers. In the pilot study involving 116 teachers from FRSs, the EFA results revealed the emergence of three components within the SLS construct. Five items were removed due to factor loadings below the threshold of 0.6, resulting in a refined instrument consisting of 20 items. Expert discussions led to the renaming of the three components: the first component, comprising nine items, was labeled Resilience across Emotional Intelligence; the second component, consisting of six items, was named Entrepreneurial Mindset; and the third component, containing five items, was identified as Communication Skills. The refined instrument was tested for reliability, and the results indicated a high level of internal consistency, with a Cronbach’s alpha value of 0.964, aligning with the recommendations of Rahlin and Gualin (2023), thus confirming its robustness in measuring SLS.

Using the validated EFA instrument, the actual study was conducted with 407 FRS teachers to develop a measurement model through CFA. The measurement model was successfully established after undergoing rigorous assessments, including construct validity, convergent validity, discriminant validity, and normality distribution evaluation, in accordance with the recommendations of Hussain and Husain (2022). These assessments ensure the model's robustness and reliability in accurately measuring student leadership skills. Students with an entrepreneurial mindset demonstrate the ability to make thoughtful decisions, modify ideas creatively, use ICT for problem-solving, identify effective learning strategies, and show commitment in project-based tasks. Resilience across emotional intelligence is reflected in students’ capacity to motivate peers, articulate opinions clearly, and appreciate diverse perspectives. Meanwhile, strong communication skills enable students to engage ethically on social media, give clear instructions, lead school programs, and present with confidence.

This model is also validated by considering aspects of emotional management, aligning with previous studies by Göktaş & Akyürek (2023), which primarily emphasize happiness. However, this study expands the model to encompass a deeper emotional dimension, namely emotional intelligence and resilience. This broader perspective allows for a more holistic understanding of student leadership, integrating both cognitive and affective components. A contradiction arises when compared to the *Silent Leader* model by Mahadevia (2022), as the developed model places greater emphasis on a balanced approach to effective communication skills. Furthermore, the proposed model adopts a more equitable approach, disregarding students' positions or popularity, as student leadership is assessed within the classroom context. This stands in stark contrast to the existing student leadership model introduced by Radebe (2019), which heavily relies on appointed students who are granted authority to enforce misconduct codes among their peers.

6. Conclusions

This study established a validated measurement model for SLS in FRS, confirming three key components: Entrepreneurial Mindset, Resilience across Emotional Intelligence, and Communication Skills. The refined 20-item instrument demonstrated high reliability, and the CFA results affirmed its validity. These findings highlight the structured nature of SLS and their significance in holistic education. Beyond its application in Malaysia, this model holds the potential for global adaptation across various educational settings. Student leadership development is a universal priority, and the validated framework can be implemented in different school environments, including public, private, and international institutions. By fostering essential leadership competencies, this model can contribute to shaping future leaders worldwide.

To enhance student leadership development, schools should integrate project-based learning, ICT-driven problem-solving, and structured leadership training. Providing opportunities for students to lead programs and participate in decision-making will strengthen their leadership competencies. At the national level, the Ministry of Education (MOE) should develop a leadership framework, embed leadership skills in the curriculum, organize competitions, and enhance teacher training. These efforts will ensure that students acquire essential leadership skills, preparing them for future challenges and responsibilities. Future research should explore the long-term impact of student leadership programs, examine cross-cultural applicability, and expand the model to include emerging leadership constructs such as digital leadership and ethical decision-making. Additionally, qualitative studies on student experiences could provide deeper insights into leadership development and its influence on personal growth.

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Ethical considerations

Before conducting the study, approval was obtained from the Ministry of Education Malaysia via an official letter (Reference No: KPM.600-3/2/3-ERAS(17412)) dated 12 September 2023. Prior to the interviews, all research informants voluntarily provided their consent without any element of coercion. Additionally, approval from the school principal was obtained before proceeding with the data collection. The researcher ensured the confidentiality of the informants' personal data throughout the research process. All data will be securely protected until the study is completed.

Conflict of interest

All the authors declare that they have no conflicts of interest.

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