

A Pilot Investigation Validating the Antecedents Measured by the Classroom Engagement Instrument in Chinese Educational Settings

Zhiyuan Yang¹, Connie Shin @ Connie Cassy Ompok^{2*}, Ting Pick Dew³, Sabariah Bte Sharif⁴

¹Universiti Malaysia Sabah, Malaysia, Email: yangzhiyuan88@hotmail.com

²Universiti Malaysia Sabah, Malaysia, Email: connieompok@ums.edu.my

³Universiti Malaysia Sabah, Malaysia, Email: t.elaine@ums.edu.my

⁴Universiti Malaysia Sabah, Malaysia, Email: Sabariah@ums.edu.my

*Corresponding Author

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ABSTRACT

The current research endeavors to substantiate the preconditions of classroom engagement instruments by employing rigorous scale validation methodologies. A tailored questionnaire comprising 78 items was distributed to 215 undergraduate students in China, undergoing Confirmatory Factor Analysis (CFA). The findings reveal that the influencing factors of classroom engagement, encompassing teacher-student interactions, peer relationships, and learning motivation, exhibit strong reliability and validity. This validated 78-item scale serves as a viable instrument for assessing classroom engagement, enhancing our understanding of the underlying factors that influence classroom engagement. Furthermore, the discussion delves into both the practical implications and methodological considerations of this research.

Keywords: Classroom Engagement, Teacher-Student Interactions, Peer Relationships, Learning Motivation

INTRODUCTION

The National Long-Term Education Reform and Development Strategy (2020-2030)

Framework said that higher education should promote socialist modernization, produce highly trained professionals, and develop science, technology, and culture.

Classroom teaching is the core of talent cultivation, and its tutorial standard measures the effectiveness of cultivation. The reform of university classrooms is crucial to the promotion of talent development. As a key place for teacher-student interaction, classroom participation, including attentive listening, active thinking and emotional involvement, is the key to evaluating teaching effectiveness and promoting students' all-round development. However, the gap between teachers and students often appears in university classrooms, with teachers speaking alone while students are lazy, forming a phenomenon of "invisible truancy", that is, students are physically present but mentally absent. Classroom participation has become an urgent problem to be solved.

According to Christensen (2016), teachers play a crucial role in students' classroom engagement. Positive interactions between students and teachers have been highlighted as an important component of increasing classroom engagement. Lepinoy, Vanderlinde, & Lo Bue (2023) argued that teacher-student interactions are potent forces that can significantly affect a student's cognitive and affective development. Karamane, Vatou, Tsigilis, & Gregoriadis (2023) highlighted the role and importance of teacher behavior in the classroom environment, mainly how it affects students' motivation and classroom engagement.

Gristy (2012) emphasized that peer relationships play an important part in influencing classroom engagement and academic achievement among students. Positive peer connections foster a supportive domain where students feel appreciated and encouraged to actively take part in classroom activities.

Martin & Collie (2019) mentioned that when students have strong bonds with their peers, they are more likely to collaborate, share ideas, and support each other's learning processes.

The relationship between learning motivation and classroom engagement has been extensively studied. According to research in the *Journal of Educational Psychology*, students who exhibit high intrinsic motivation demonstrate greater cognitive engagement. This is evident in their readiness to use sophisticated learning strategies and their consistent effort over time (Ryan & Deci, 2020). As mentioned

by Fredricks, Blumenfeld, & Paris (2004), this enhanced cognitive engagement is crucial for academic success, resulting in a more profound grasp of the subject and improved academic outcomes. Scholars in China have focused on examining the determining factors and countermeasures of college students' classroom engagement, studying specific types of professional classroom engagement, and identifying measures to enhance classroom engagement. For example, Li (2016) from the School of Management, Taiyuan University of Science and Technology, conducted a comprehensive investigation on undergraduate students. The research assessed the level of classroom engagement of students majoring in various disciplines through questionnaires. Similarly, Huang (2017) noted that more classroom engagement was needed in higher mathematics classes in private independent colleges. These findings provide an essential reference point for understanding the current engagement in college classrooms. Despite ongoing research, challenges remain. Studies by Zhang et al. (2019) mentioned that classroom silence among students is prevalent among all higher education institutions, significantly impacting the standard of undergraduate andragogy. Yang et al. (2020) contended that the main reason affecting college students' classroom engagement is their failure to transition from passive to active learning. The excessive pressure of the university entrance exam and over-idealization of university life lead to changes in student behaviors upon entering university, reducing classroom engagement. Although scholars emphasize the importance of classroom engagement, research on the factors affecting it still needs to be completed. Simply attributing low classroom engagement to the failure of students' role transitions appears too one-sided. Additional investigation is required on the comprehensive impact of various factors on classroom engagement. Most of the current research focuses on Western countries, especially involving research on teacher-student interactions, peer relationships, and the relationship between motivation and classroom participation. Furthermore, existing research has primarily concentrated on public schools, with a relatively scant focus on private schools, especially private undergraduate universities. Therefore, this study takes the students of private undergraduate schools in Shandong, China as the research object to verify the influence of teacher-student interactions, peer relationships and learning motivation on classroom engagement, to provide reference opinions for teaching staff, improve students' classroom engagement and teaching level, and promoting the realization of the national long-term education reform and development strategy (2020-2030).

METHODOLOGY

The purpose of this quantitative research is to validate the measurement tools for the influencing factors of teacher-student interactions, peer relationships, and learning motivation on college students' classroom engagement. In the research design section, we used a cross-sectional study. Convenience sampling was used to select the sample, and the participants were college students from private undergraduate colleges in Qingdao. The questionnaire is mainly created on a website called "Wenjuanxing". After collecting the questionnaires, they were sorted and screened to eliminate invalid ones. The principles of elimination are as follows: firstly, questionnaires with incomplete or blank information are eliminated; secondly, questionnaires with the same answers are eliminated. The collected data are analyzed by SPSS 22.0. There are four instruments in the study: teacher-student interactions scale, peer relationships scale, learning motivation scale, and classroom engagement scale.

A. Teacher-Student Interactions Scale

The Teacher Interaction Questionnaire proposed by Clayton & Humes (1985) explores the scope, needs, and effectiveness of teacher-student interactions. This scale contains eight dimensions and 48 question items. In this study, five of these dimensions are selected, drawing on the findings of the previous scholars, and the specific settings of the questions are adjusted to take into account the element of the subjects, to put differently, the students, the impact of goal selection and situational factors on feedback seeking. As shown in Table 1, considering scholars' findings, the study set up a total of 22 questions in 5 dimensions, including the regularity of interaction, the content of interaction, the quality of interaction, the way of seeking interaction, and the validity of interaction.

Table 1: Teacher-Student Interactions

Dimension	Items	Total Items
Leadership	1,5,9,13,17,21	6
Helping/Friendly	25,29,33,37,45	5
Understanding	2,6,10,14,18,22	6
Student Responsibility/Freedom	26,30,46	3
Strict	32,40	2
Total	22	

The scale used a 5-point Likert scale in this study, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicates a higher level of teacher-student interaction. The Cronbach's alpha of scale on the present sample is found to be 0.89.

B. Peer Relationships

Peer relationships are developed by Fatih Aydogdu (2022), which comprises 29 items across four sub-dimensions, utilizing a 5-point Likert-type scale to evaluate responses. This scale's structure was approved through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), showing good statistical value and structural validity. The internal constant, measured by Cronbach's α , for the overall scale, was found to be 0.93, with sub-dimensions scores of 0.94, 0.90, 0.87, and 0.84, respectively. Split-half reliability values for the total scale and sub-dimensions were 0.85, 0.87, 0.82, 0.79, and 0.77, respectively. The design of the Peer Relationship Scale in this study entirely drew on scholars' well-established question items, starting from the traits of college students and giving full consideration to the characteristics of the more mature psychological needs of college students in developing peer relationships. The questionnaire contents are shown in Table 2. The Cronbach's alpha of scale on the present sample is found to be 0.89.

Table 2. Peer Relationships

Dimension	Items	Total Items
Intimacy	1,2,3,4,5,6,7,8,9	9
Trust	18,19,20,21,23	5
Popularity	14,15,16,17	4
Insightfulness	25,26,28	3
Total	21	

C. Learning Motivation

The Motivational Strategies for Learning Questionnaire (MSLQ) is a self-assessment tool designed to evaluate college students' motivational orientations and the various learning strategies they employ. The foundational theoretical framework for the MSLQ was presented by McKeachie et al. (1986), with additional theoretical elaborations found in works by Pintrich (1988a, b; 1989), Pintrich & Garcia (1991), and Pintrich & De Groot (1990). The MSLQ comprises two primary sections: one focusing on motivation and the other on learning strategies. The motivation section contains 31 items that measure students' goals and value beliefs, such as their skills to excel in a course, anxiety levels regarding exams, self-beliefs, and interest in learning. Responses are recorded on a 5-point Likert scale, ranging from "completely untrue of me" to "very true of me." Scores for each dimension are determined by averaging the corresponding items. Cronbach's alpha for the MSLQ spans from 0.52 to 0.93, indicating satisfactory factor validity and confirming the reliability of the questionnaire in assessing student learning motivation. As shown in Table 3, three scales for the motivation section, including Goal Orientation, Task Value, and Self-Efficacy for Learning and Performance are chose. The Cronbach's alpha of scale on the present sample is found to be 0.91.

Table 3. Learning Motivation

Dimension	Items	Total Items
Goal Orientation	1,7,11,16,22,24,30	7
Task Value	4,10,17,23,26,27	6
Control of Learning Beliefs	5,6,12,15,20,21,29	7
Total	20	

D. Classroom Engagement

This section of the questionnaire aims to assess the extent of classroom engagement in classroom activities. It is based on the scale Handelsman et al. (2005) developed, designed to estimate college classroom engagement. This questionnaire includes 23 items using a 5-point Likert scale. It is split into four sub-factors; the first factor is skill engagement, which consists of nine items with an alpha coefficient of 0.82. The second factor is emotional engagement, which comprises five items with an alpha coefficient of 0.82. The third factor is interactive engagement, comprising six items with an alpha coefficient of 0.79. The fourth factor is performance engagement, which consists of three items with an alpha coefficient of 0.76 (Handelsman et al., 2005).

To ensure the validity and feasibility of the questionnaire in practice, after careful consideration, this study finally screened out 15 items from the original questionnaire that are sharply related to the topic of this study. At the same time, items with weak relevance to this study and items containing negative statements were excluded to avoid possible misleading or understanding bias. The details of the screened questionnaire items are shown in Table 4. The Cronbach's alpha of scale on the present sample is found to be 0.84.

Table 4. classroom engagement

Dimension	Items	Total Items
Skills Engagement	1,2,3,6,7,8,9	7
Emotional Engagement	10,14	2
Interaction Engagement	15,16,18,20	4
Performance Engagement	22,23	2
Total	15	

Research Reliability

The reliability of the four variables, namely teacher-student interactions, peer relationships, learning motivation, and classroom engagement are performed and Cronbach's Alpha is used to measure the internal consistency of each variable and its sub-dimensions.

Table 5. Cronbach's Alpha for Tested Variables (N=215)

Section	Focus	N	Cronbach alpha	Interpretation	Remarks
A	Teacher-student interactions		0.89	Good	Independent
	Leadership	6	0.86	Good	
	Helping/Friending	5	0.90	Excellent	
	Understanding	6	0.87	Good	
	Student	3	0.80	Good	
	Responsibility/Freedom	2	0.76	Acceptable	
B	Peer relationship		0.89	Good	Independent
	Intimacy	9	0.92	Excellent	
	Popularity	4	0.84	Good	
	Trust	5	0.88	Good	
	Insightfulness	3	0.80	Good	
C	Learning motivation		0.91	Excellent	Independent
	Goal orientation	7	0.96	Excellent	
	Task value	6	0.95	Excellent	
	Control of learning beliefs	7	0.96	Excellent	
D	Classroom engagement		0.84	Good	Dependent
	Skills engagement	7	0.90	Excellent	
	Emotional engagement	4	0.74	Acceptable	
	Interaction engagement	2	0.67	Satisfactory	
	Performance engagement	2	0.74	Acceptable	

Reliability means the degree of consistency in the results gathered from persistent measurements of the same object using the same method, reflecting the dependability of the testing tool. It is divided into intrinsic and extrinsic reliability. Intrinsic reliability focuses on whether a group of assessment items measures the same characteristics and maintains internal consistency. Extrinsic reliability touches on the consistency of assessment results when repeated measurements are carried out on the same subjects at different times. The primary methods for testing reliability include the retest reliability method, the split-half reliability method, and Cronbach's alpha coefficient method, with Cronbach's alpha being the most commonly used. The value of Cronbach's alpha ranges from 0 to 1, with higher values indicating greater reliability. A coefficient greater than 0.9 is considered excellent, between 0.8 and 0.9 is considered good, between 0.7 and 0.8 is acceptable, and between 0.6 and 0.7 is satisfactory (Tavakol & Dennick, 2011). Therefore, a Cronbach's alpha greater than 0.6 is deemed appropriate. From the above analysis, it can be seen that the Cronbach's alpha values of all variables and their sub-dimensions exceed 0.6, indicating that

they have satisfactory internal consistency. This suggests that the scales used to assess these variables are reliable.

The Corrected Item-Total Correlation (CITC) value

The CITC value indicates the correlation between each item and the total score, with higher values suggesting better item consistency. Typically using CITC values to decide whether to adjust, retain, or delete items. Deleting items with a CITC value below 0.3 is thought to improve overall reliability (Lu, 2002).

A. Teacher-Student Interactions

The questionnaire includes 5 dimensions; Leadership, Helping/Friendly, Understanding, Student Responsibility/Freedom, and Strict. There are 22 items altogether, namely 6 items for Leadership: L1, L3, L5, L7, L9, L11, 5 items for Helping/Friendly: H13, H15, H18, H19, H21, 6 items for Understanding: U2, U4, U6, U8, U10, U12, 3 items for Student Responsibility/Freedom: F14, F16, F22, and only 2 items for Strict : S17, S20.

Table 6. Results of Reliability Analysis of Teacher-Student Interactions Scale

Dimension	Code	CITC	Cronbach α after item deletion	Cronbach α for teacher-student interactions
Leadership	L1	0.49	0.893	0.897
	L3	0.55	0.892	
	L5	0.50	0.893	
	L7	0.51	0.893	
	L9	0.53	0.892	
	L11	0.58	0.891	
Helping/Friendly	H13	0.51	0.893	
	H15	0.61	0.890	
	H18	0.49	0.893	
	H19	0.49	0.893	
	H21	0.53	0.892	
Understanding	U2	0.53	0.892	
	U4	0.49	0.893	
	U6	0.40	0.895	
	U8	0.57	0.891	
	U10	0.47	0.894	
	U12	0.40	0.896	
Student Responsibility/Freedom	F14	0.57	0.894	
	F16	0.47	0.894	
	F22	0.43	0.895	
Strict	S17	0.50	0.893	
	S20	0.47	0.894	

As shown in Table 6, the reliability of the teacher interaction questionnaire is 0.897, which is greater than 0.7, indicating that the questionnaire has good reliability. The CITC values for all 22 items on this scale were above 0.4, indicating that the items are in good condition and can be retained. The Cronbach's alpha coefficient for teacher-student interactions is 0.89, exceeding the acceptable standard and indicating high reliability. The Cronbach's alpha coefficients for deleted items were all lower than for the full scale, suggesting good consistency among the remaining questions. Therefore, the Teacher-Student Interaction Scale meets the study's reliability requirements.

B. Peer Relationships

The peer Relationships questionnaire is adapted from Fatih Aydogdu (2022) and comprises 21 items categorized into four dimensions: Intimacy, Popularity, Trust, and Insightfulness. I1, I2, I3, I4, I5, I6, I7, I8, I9

to measure the Intimacy dimension, P10, P11, P12, P13 to measure Popularity, Trust is measure by T14, T15, T16, T17, T18, and lastly, Insightfulness measure by IS19, IS20, and IS21.

Table 7. Results of Reliability Analysis of Peer Relationships Scale

Dimension	Code	CITC	Cronbach α after item deletion	Cronbach α for teacher-student interaction
Intimacy	I1	0.64	0.884	0.893
	I2	0.58	0.886	
	I3	0.60	0.885	
	I4	0.61	0.885	
	I5	0.65	0.884	
	I6	0.63	0.884	
	I7	0.59	0.885	
	I8	0.62	0.885	
	I9	0.63	0.884	
Popularity	P10	0.36	0.892	
	P11	0.34	0.892	
	P12	0.31	0.893	
	P13	0.37	0.892	
Trust	T14	0.50	0.888	
	T15	0.51	0.888	
	T16	0.56	0.886	
	T17	0.52	0.888	
	T18	0.47	0.889	
Insightfulness	IS19	0.31	0.893	
	IS20	0.33	0.893	
	IS21	0.32	0.893	

As shown in Table 7, of the 21 items covered by the Peer Relationships Scale, the CITC values are all greater than 0.3, explaining that the content of the item meets the requirements of the objective to be measured and that each question item can be retained. The peer relationships Cronbach alpha coefficient is 0.89, more significant than the acceptable standard. The item deleted Cronbach alpha coefficient is less than or equal to the Cronbach alpha coefficient of the peer relationships subscale, the reliability level is high, and meets the research requirements.

C. Learning Motivation

The learning Motivation questionnaire is adapted from Pintrich etc (1991) and comprises 20 items organized into three dimensions, namely Goal Orientation, Task Value, and Control of Learning Beliefs. Goal Orientation includes G1, G2, G3, G4, G5, G6, G7, Task Value includes T8, T9, T10, T11, T12, T13, and Control of Learning Beliefs includes C14, C15, C16, C17, C18, C19, and C20.

Table 8. Results of the Reliability Analysis of the Learning Motivation Scale

Dimension	Code	CITC	Cronbach α after item deletion	Cronbach α for teacher-student interactions
Goal Orientation	G1	0.55	0.911	0.915
	G2	0.60	0.91	
	G3	0.54	0.911	
	G4	0.59	0.91	
	G5	0.59	0.91	
	G6	0.54	0.912	
	G7	0.56	0.911	

Task Value	T8	0.52	0.912
	T9	0.56	0.911
	T10	0.52	0.912
	T11	0.56	0.912
	T12	0.52	0.911
	T13	0.53	0.911
Control of Learning Beliefs	C14	0.57	0.911
	C15	0.55	0.911
	C16	0.55	0.91
	C17	0.55	0.911
	C18	0.62	0.911
	C19	0.55	0.911
	C20	0.57	0.911

In Table 8, of the 20 question items covered by the Learning Motivation Scale, the CITC values are all greater than 0.4, explaining that the content of the item meets the requirements of the objective to be measured and that each question item can be retained. The Learning Motivation Cronbach alpha coefficient is 0.91, which is greater than the acceptable standard. The item deleted Cronbach alpha coefficient is less than the Cronbach alpha coefficient of the study motivation subscale. The reliability level is high and meets the research requirements.

D. Classroom Engagement

The classroom Engagement questionnaire is adapted from Handelsman et al. (2005), and comprises 15 items organized into four dimensions, namely Skills Engagement, Emotional Engagement, Interaction Engagement, and Performance Engagement. Skills Engagement includes SE1,SE2,SE3,SE4,SE5,SE6,SE7, Emotional Engagement includes EE8,EE9,EE10,EE11, Interaction Engagement includes IE12,IE13,and PE14,PE15 for Performance Engagement.

Table 9. Results of the Reliability Analysis of Classroom Engagement Scale

Dimension	Code	CITC	Cronbach α after item deletion	Cronbach α for teacher-student interactions
Skills Engagement	SE1	0.59	0.829	0.846
	SE2	0.61	0.828	
	SE3	0.51	0.834	
	SE4	0.60	0.83	
	SE5	0.55	0.832	
	SE6	0.51	0.836	
	SE7	0.55	0.839	
Emotional Engagement	EE8	0.49	0.837	
	EE9	0.43	0.842	
	EE10	0.42	0.844	
	EE11	0.47	0.845	
Interaction Engagement	IE12	0.38	0.844	
	IE13	0.32	0.842	
Performance Engagement	PE14	0.34	0.845	
	PE15	0.33	0.844	

As seen from Table 9, of the 15 question items covered by the Student Classroom Engagement Scale, the CITC values are all greater than 0.3, explaining that the content of the item meets the requirements of the objective to be measured and that each question item can be retained. The classroom engagement Cronbach alpha coefficient is 0.84, more significant than the acceptable standard. The Cronbach alpha coefficient after item deletion is less than the Cronbach alpha coefficient of the classroom engagement subscale, with a high level of reliability, which meets the requirements of the study.

Research Validity

The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test frequently employ statistics to evaluate the appropriateness of a dataset for factor analysis (Kaiser, 1974; Williams et al., 2010). The KMO test measures the proportion of variance among variables that might be attributable to underlying factors by calculating the KMO statistic. This statistic ranges from 0 to 1, with higher values indicating better suitability for factor analysis. Specifically, a KMO value between 0.90 and 1.00 is considered excellent, 0.80 to 0.89 is very good, 0.70 to 0.79 is good, 0.60 to 0.69 is acceptable, and 0.50 to 0.59 is poor. Values below 0.50 are deemed unsuitable for factor analysis. Generally, KMO values above 0.60 suggest that the data are appropriate for factor analysis (Kaiser, 1974; Williams et al., 2010).

Bartlett's test evaluates whether the correlation matrix among variables is an identity matrix, indicating no correlations between variables. If the p-value is less than 0.05, it suggests that the correlation matrix is not an identity matrix, and the data are suitable for factor analysis (Bartlett, 1950; Williams et al., 2010).

Table 10. KMO and Bartlett's test for pretest scales

KMO test and Bartlett test		
KMO value		0.874
Bartlett's test of sphericity	approximate chi-square	12550.124
	df	3003
	P	<.001

In our analysis, both the KMO and Bartlett's tests are performed on the dataset, with results presented in Table 10. The KMO value is 0.874, and the p-value less than .001. This indicates that the data are appropriate for factor analysis (Williams et al., 2010).

In further analysis, we employ CFA to validate these instruments. Hair et al. (2014) suggest analyzing three types of fit: (1) Absolute Fit Index (e.g., RMSEA), (2) Incremental Fit Indices (e.g., CFI, IFI, TLI), and (3) Chi-Square Fit Index (e.g., CMIN/DF). Reporting these fit indices typically provides adequate information for evaluating structural models. According to Schumacker & Lomax (2004), a good model fit is indicated by RMSEA values less than 0.05, acceptable fit by RMSEA values between 0.05 and 0.08, and acceptable fit for CFI, TLI, and IFI values above 0.90. Additionally, CMIN/DF values between 1 and 5 are considered acceptable.

The results of the CFA for the instruments measuring teacher-student interactions, peer relationships, learning motivation, and classroom engagement in this study are shown in Table 11. The fit indices fall within the recommended ranges, indicating good validity for these instruments.

Table 11. Result of Assessing the Overall Fit Model in CFA

Type of Fit	Fit Measure	Index	Interpretation
Absolute fit	RSMEA	0.24	Good Fit
Incremental fit	CFI	0.987	Acceptable Fit
	TLI	0.984	Acceptable Fit
Chi-square	IFI	0.987	Acceptable Fit
	CMIN/DF	1.562	Acceptable fit

Normality Test Results

The W-statistic in the Shapiro-Wilk test is derived by comparing the sample data with the expected values for a corresponding normal distribution. This test is highly efficient and accurate for small sample sizes, making it one of the best tests for assessing normality (Shapiro & Wilk, 1965). To assess the normality of the data, Kolmogorov-Smirnov and Shapiro-Wilk normality tests were used.

Table 12. Normality Tests for Instrument

Tests of Normality						
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Teacher-student interactions	.108	215	.166	.953	215	.310
Peer relationships	.109	215	.099	.961	215	.075
Learning motivation	.115	215	.070	.939	215	.080
Classroom engagement	.093	215	.200	.950	215	.240

The outcome of the normality tests shown in Table 12 shows that the significance level of the Shapiro-Wilk test for teacher-student interaction is 0.31 ($p > 0.05$), the significance level of the Shapiro-Wilk test for peer relationships is 0.075 ($p > 0.05$), the significance level of the Shapiro-Wilk test for learning motivation is 0.08 ($p > 0.05$), and the significance level of the Shapiro-Wilk test for classroom engagement is 0.24 ($p > 0.05$), and it can be concluded that the data were normally distributed, It can be used for subsequent analysis.

DISCUSSION

The scales used in this study, including the Teacher-Student Interactions Scale, Peer-Relationships Scale, Learning Motivation Scale, and Classroom Engagement Scale, demonstrated good reliability in the sample. Specifically, the Cronbach's alpha value for the classroom engagement Scale is 0.84, indicating high internal consistency. Each dimension of the scale had a Cronbach's alpha value exceeding the 0.6 threshold, demonstrating satisfactory stability in measuring various aspects of classroom engagement. Similarly, Cronbach's alpha values for the Teacher-student Interactions Scale, Peer Relationships Scale, and Learning Motivation Scale are 0.89, 0.89 and 0.91, respectively. These results indicate high reliability in assessing the respective constructs. Each dimension of these scales had a Cronbach's alpha value exceeding the 0.7 threshold, demonstrating good stability in measuring various aspects of instruments.

In addition the CITC values for all 22 items on teacher-student interactions scale are above 0.4, the CITC values of the 21 items covered by the peer relationships scale are all greater than 0.3, the CITC values of the 20 question items covered by the learning motivation scale are all greater than 0.4, the CITC values of the 15 question items covered by the Student Classroom Engagement Scale are all greater than 0.3, explaining that each question item meets the requirements of the research objectives can be retained and the instruments with a high level of reliability.

Regarding validity, the KMO values and Bartlett's test of sphericity indicated that the data are suitable for Confirmatory Factor Analysis (CFA). The KMO value is higher than 0.6, and the p-values for Bartlett's test is below 0.05, indicating that the data structure is appropriate for factor analysis.

In our confirmatory factor analysis, analyzing three types of fit: (1) Absolute Fit Index (e.g., RMSEA), (2) Incremental Fit Indices (e.g., CFI, IFI, TLI), and (3) Chi-Square Fit Index (e.g., CMIN/DF). The RSMEA value is 0.24, the CFI, TLI, and IFI values are 0.987, 0.984, 0.987, the CMIN/DF value is 1.562, indicating good validity for these instruments.

CONCLUSION

This study advanced a Chinese version of the antecedents of the university classroom engagement instrument measured by 78 reliable and validated items. The instrument can be used as an evaluative tool to assess the antecedents of Chinese university students' classroom engagement. Research has shown that classroom engagement is an influential gauge of the standard of universities. Classroom engagement is an essential perspective for deciphering the rules of teacher-student interactions and reflecting on the quality of classroom teaching (Mustapha et al., 2010; Chang et al., 2022). Therefore, the instrument of this research can be used to assess the effect of teacher-student interactions, peer relationships and learning motivation towards classroom engagement in universities and colleges. Hence some relative actions can be applied to improve student classroom engagement. The insights derived from these findings can assist teachers and school administrators in identifying factors that influence classroom engagement during these challenging times. To mitigate the constraints of the current study, it is strongly advised to embark on a cross-cultural comparative analysis. This approach enriches not only the existing scholarly discourse on classroom engagement; it would also provide tangible insights that transcend diverse educational settings, offering a nuanced understanding of classroom engagement in practice.

In summary, the measurement scales employed in this investigation demonstrated strong reliability and validity in assessing classroom engagement alongside its correlated factors. These findings not only confirm the suitability of these scales for practical use but also provide invaluable insights and benchmarks for future research endeavours within the pertinent disciplines. Researchers can leverage these established scales as a foundation to delve deeper into the underlying factors and dynamics that shape classroom engagement.

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