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Student engagement as a mediator between online classroom management and learning outcomes in Beijing universities

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ABSTRACT

Online classroom management is considered essential for promoting student learning outcomes and engagement. This study examines the relationship between online classroom management and student learning outcomes, with student engagement as a mediator. A cross-sectional survey method was employed to collect data via questionnaires distributed through Google Forms. Respondents were selected using multi-stage cluster sampling from six universities in Beijing, China. A total of 400 valid questionnaires were analyzed quantitatively using SPSS to address the research questions. The findings indicate that online classroom management positively correlates with student engagement and learning outcomes. Moreover, student engagement significantly mediates the relationship between online classroom management and student learning outcomes. The study validates the model that online classroom management, mediated by student engagement, positively influences university students' learning outcomes, thus supporting the research hypotheses based on the relationships among the variables. This study contributes to the integration of theory and enhances the understanding of the relationship between online classroom management and student learning outcomes. Additionally, it offers insights for policymakers and practitioners on how to support online classroom management and improve student learning outcomes.

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1. INTRODUCTION

Online learning has emerged as a transformative mode of education, offering unparalleled flexibility in time and location [1]. In response, numerous Chinese universities and colleges have developed online courses and programs to cater to the diverse learning needs of students [2]. However, the shift to online learning brings forth a myriad of challenges. Despite its advantages, such as flexibility, it also presents obstacles like the lack of face-to-face interaction and limited opportunities for collaboration [3]. The rapid expansion of online education has outpaced empirical research, leaving a critical gap in our understanding of effective pedagogical practices in virtual environments [4]. Despite the growing popularity of online learning, there remains a dearth of evidence-based strategies for managing digital classrooms and optimizing learning outcomes [5]. Online classroom management encompasses various strategies to maintain order, guide students through assignments, and foster academic success in virtual learning environments [6].

This study on online classroom management for students in Beijing covers time management, conflict management, meta-cognitive skills management, course management, and supportive interactions and behaviors. While research often focuses on student achievement, this study considers student

engagement as a critical issue in higher education [7]. In this study, student engagement is categorized into skills, emotional, and participation engagement [8]. Learning outcomes refer to the increased knowledge, skills, attitudes, emotions, and abilities students acquire after specific learning experiences. The learning outcome is what a student achieves, not the knowledge and skills the educational institution plans to teach [9]. In this study, learning outcomes are divided into cognitive outcomes, social outcomes, and self-growth outcomes. However, online learning also presents several challenges, such as the lack of face-to-face interaction, limited opportunities for student collaboration and exchange, and the need for effective online classroom management [10]. Despite its critical role in learning, there remains a gap in empirical research investigating the relationship between online classroom management, student engagement, and learning outcomes, especially in universities [11]. Many universities use online classroom management to enhance student learning [12]. However, there is a lack of empirical research examining the relationship between online classroom management, student engagement, and learning outcomes. This study aims to fill this gap and provide valuable insights into the impact of online classroom management on student success in online courses. By investigating the relationship between online classroom management, student engagement, and learning outcomes, this study aims to fill a crucial gap in the literature and provide actionable insights for educators, policymakers, and stakeholders in education. Educators can enhance student engagement, promote learning, and ultimately improve educational outcomes in online settings by understanding how to manage digital classrooms effectively. Thus, the objectives of the study are as:

i) to determine the relationship between online classroom management and student engagement in selected universities in Beijing;
ii) to determine the relationship between online classroom management and student learning outcomes in selected universities in Beijing;
iii) to determine the relationship between student engagement and student learning outcomes in selected universities in Beijing;
iv) to examine whether student engagement is a significant mediator in the relationship between classroom management and student learning outcomes in online education in selected universities in Beijing.

2. LITERATURE REVIEW

2.1. Online classroom management, student engagement, and learning outcome

Online learning has revolutionized how students acquire knowledge and skills [13]. The proliferation of digital tools, educational software, and online platforms has made education accessible to everyone, regardless of age, location, or experience [14]. Effective online classroom management significantly influences student learning outcomes by creating a conducive learning environment that fosters engagement, critical thinking, and positive attitudes toward learning [15]. However, existing research does not comprehensively understand the specific online management factors that influence learning outcomes. Future studies should delve deeper into identifying these factors to enhance the effectiveness of online classroom management and improve student learning outcomes. Effective classroom management is crucial for creating a conducive learning environment, fostering student engagement, and ultimately impacting learning outcomes [16]. Learning outcomes also relate to the development level of a student's learning process, the development of a student's potential, and the comprehensive ability level to promote students' development [17]. Student engagement is pivotal in the intricate relationship between online classroom management and student learning outcomes [18]. Studies have consistently demonstrated that active student participation and involvement are essential to effective online classroom management [19]. Engaged students are more likely to exhibit higher levels of motivation, interest, and persistence in their learning endeavors, which, in turn, contribute to positive learning outcomes [20].

Effective management strategies, such as clear communication, well-structured learning activities, and timely feedback, create a conducive learning environment that fosters active student participation and engagement [21]. Conversely, inadequate management practices, such as technical issues, ambiguous instructions, and lack of instructor presence, can hinder student engagement and impede learning progress [22]. This research proposes the following hypotheses: i) There are significant relationships between online classroom management and student engagement in selected universities in Beijing, China (H1); ii) There are significant relationships between student engagement and student learning outcomes in selected universities in Beijing, China (H2); iii) There are significant relationships between online classroom management and student learning outcomes in selected universities in Beijing, China (H3); iv) Student engagement is a significant mediator in the relationship between classroom management and student learning outcomes in online education among students in selected universities in Beijing, China (H4).

2.2. Theoretical framework

Online collaborative learning (OCL) theory, developed by Harasim, emphasizes that participants must fulfill their goals over the Internet to advance their own and others' knowledge [23]. Cooperative education opens up a larger platform, and collaborative learning via online interactive teaching is gaining popularity [24]. OCL theory, conceptualized by Harasim, is an educational framework that adapts the constructivist approach to an online setting [25]. OCL encourages students to actively engage in their learning process by collaboratively solving problems through discourse rather than memorizing correct answers [26]. As a learning philosophy, social construction theory has significantly impacted today's knowledge and teaching concepts in social education [27]. The critical point is that learning involves actively constructing knowledge rather than one-way transmission or transfer from teacher to student. Students are the subjects of education and the builders of their experience [28].

2.3. Conceptual framework

The conceptual framework in Figure 1 comprises three parts: online classroom management, student engagement, and learning outcomes. In this research, the independent variable is online classroom management, the mediating variable is student engagement, and the dependent variable is learning outcomes. Online classroom management consists of five parts: time management, conflict management, meta-cognitive skills management, course management, and managing supportive interactions and behaviors [29]. Student engagement involves skills, emotions, and participation [30]. The learning outcomes consist of three parts: cognitive outcome, social outcome, and self-growth outcomes [31]. Figure 1 shows the conceptual framework of this study.

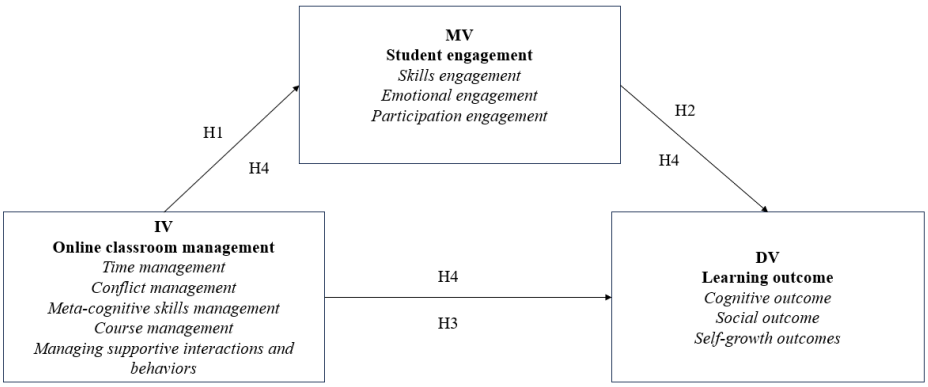

Figure 1. Conceptual framework

3. METHOD

3.1. Study design and setting

This study adopted a cross-sectional design with the survey as the instrument. This method facilitates accessing and collecting data and information from the relevant population for the data analysis. The researchers developed a study, retested it, and then administered it. Specifically, it conducted a cross-sectional survey among Beijing-selected university students who had taken at least one online course. An online questionnaire was distributed to them and used as the primary research tool to collect data on these variables.

3.2. Sampling

This study employed multi-stage cluster sampling to discover this educational phenomenon. It is an extension of cluster sampling that comprises sampling in different stages [32]. In line with the model of Krejcie and Morgan, in the case of having a 1 million total study population, 384 is the proper sample for the study. Based on this reference, the present research sent 430 questionnaires and 400 valid questionnaires. There are 67 universities in Beijing city [33]. Universities in Beijing are mainly concentrated in five districts. This study applied Multi-Stage Cluster Sampling, which consists of two stages of Cluster Sampling and Proportional Stratified Random sampling. To choose three districts from these districts as the sample location. From each location, this study chose two universities. From Table 1, the total valid sample from this research is 400—all the participation of university students who took online classes before.

Table 1. The data of the university samples

University	Number of students	Number of samples	District
A	16500	68	A District
B	16400	68	A District
C	21000	87	B District
D	14800	61	B District
E	13000	54	C District
F	15000	62	C District
Total	96700	400	

3.3. Study instruments

This questionnaire contains four sections and 74 questions. Section A concerns basic information with students' basic information and 7 questions. In the basic information, the basic features include gender, age, grade, university, major, online course attendance, and GRA ranking. Section B is online classroom management (OCM) with 35 questions. Section C addresses student engagement (STE), including three subsections with 17 questions. Section D is about learning outcomes (LEO) and 15 questions. All the items assessed were measured on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree.'

3.4. Reliability and validity

Table 2 offers a reliability analysis, emphasizing the internal consistency of the various factors used in the research. The high alpha coefficients suggest that these measurement tools are trustworthy in the study and can effectively assess the relevant concepts of online classroom management, student engagement, and learning outcomes. The KMO sampling adequacy measure is a statistical measure used to assess the suitability of data for factor analysis. It ranges from 0 to 1, with higher values indicating a better fit for factor analysis. In Table 3, the KMO values for OCM, STE, and LEO are 0.751, 0.882, and 0.884, respectively. These values are all above 0.7, which suggests that the data for all three variables are highly suitable for factor analysis. This indicates that the data have a high degree of shared variance, making them appropriate for identifying underlying factors.

Table 2. Reliability analysis for each factor

Variable	Dimension	Number	Alpha
OCM	TE	6	0.943
	CT	3	0.881
	MA	3	0.897
	CE	11	0.970
	MG	12	0.980
STE	SS	6	0.943
	EL	5	0.959
	PN	6	0.941
LEO	CEO	5	0.953
	SL	5	0.949
	SG	5	0.956

Table 3. Sum calculation of the EFA and validity of the questionnaire

Variable	Number of KMO sample tangents	Approximate Chi-square	Degree of freedom	Significance
OCM	0.751	4309.772	595	0
STE	0.882	1638.161	136	0
LEO	0.884	1612.217	105	0

3.5. Data analysis

Table 4 presents the demographic profile of the 400 respondents. Among them, 48% are male and 52% are female. The age distribution shows 57.25% are between 15-20 years, 34.25% between 20-25 years, and 8.5% between 25-30 years. For academic grades, 13% are in grade 1, 39.5% in grade 2, 28.5% in grade 3, 13.75% in grade 4, and 5.25% are classified as others. University representation includes 17% from Universities A and B, 21.75% from University C, 15.25% from University D, 13.5% from University E, and 15.5% from University F. Majors are distributed as 9.25% in Arts, 45% in Engineering, 30.25% in Social Science, and 15.5% in others. Online course attendance is divided into 13.25% attending less than 50%, 42.5% attending 50-70%, 25.5% attending 71-90%, and 18.75% attending more than 90%. Lastly, GPA rankings show that 31.75% are in the top 30%, 60.75% between 30-70%, and 7.5% in the bottom 30%.

Table 4. Demographic profile of respondents

Item	Option	No. of students	Percentage
Gender	A. Male	192	48.00
	B. Female	208	52.00
Age	A. 15~20	229	57.25
	B. 20~25	137	34.25
	C. 25~30	34	8.50
Grade	A. Grade 1	52	13.00
	B Grade 2	158	39.50
	C Grade 3	114	28.50
	D Grade 4	55	13.75
	E. Others	21	5.25
University	A	68	17.00
	B	68	17.00
	C	87	21.75
	D	61	15.25
	E	54	13.50
	F	62	15.50
Major	Arts	37	9.25
	Engineering	180	45.00
	Social Science	121	30.25
	Others	62	15.50
Online course attendance	A. ＜50%	53	13.25
	B. 50%~70%	170	42.50
	C. 71%~90%	102	25.50
	D. ＞90%.	75	18.75
GPA ranking	A. Top 30%	127	31.75
	B. 30% to 70%	243	60.75
	C After 30%.	30	7.50
Total		400	100.0

4. RESULTS AND DISCUSSION

4.1. What is the relationship between online classroom management and student engagement in selected universities in Beijing?

Table 5 shows the relationship between classroom management and student engagement. The model formula is STE=1.268+0.612×OCM, and the model R-squared value is 0.261, which means OCM can explain 26.1% of the variation in STE. When the F test was performed on the model, it was found that the model passed the F test (F=140.570, p=0.000<0.05), which means that OCM will have an impact on STE. The final detailed analysis shows that the regression coefficient value of OCM is 0.612 (t=11.856, p=0.000<0.01), which means that OCM will have a significant positive impact on STE.

Table 5. Linear regression analysis results of OCM and STE

	Regression	95% CI	Collinearity diagnostics	
			VIF	Tolerance
Constant	1.268** (7.187)	0.922 ~ 1.614	-	-
OCM	0.612** (11.856)	0.511 ~ 0.713	1.000	1.000
Sample		400		
R^2		0.261		
Adjusted R^2		0.259		
F		F (1,398)=140.570, p=0.000		

Dependent variable: STE; D-W value: 2.135
* p<0.05; ** p<0.01 The t value is in the brackets

4.2. What is the relationship between online classroom management and student learning outcomes in selected universities in Beijing?

As can be seen from Table 6, OCM is used as the independent variable, and LEO is used as the dependent variable for linear regression analysis. The model formula is: LEO=2.060 + 0.606*OCM, and the model R-squared value is 0.287, which means OCM can explain 28.7% of the changes in LEO. When the F test was performed on the model, it was found that the model passed the F test (F=160.016, p=0.000<0.05), which means that OCM will have an impact on LEO. The final detailed analysis shows that the regression coefficient value of OCM is 0.606 (t=12.650, p=0.000<0.01), which means that OCM will significantly impact LEO.

Table 6. Linear regression analysis results of OCM and LEO

	Regression	95% CI	Collinearity diagnostics	
			VIF	Tolerance
Constant	2.060** (12.568)	1.738 ~ 2.381	-	-
OCM	0.606** (12.650)	0.513 ~ 0.700	1.000	1.000
Sample		400		
R^2		0.287		
Adjusted R^2		0.285		
F		*F* (1,398)=160.016, *p*=0.000		

Dependent variable: LEO; D-W value: 1.760
* p<0.05; ** p<0.01 The t value is in the brackets

4.3. What is the relationship between student engagement and student learning outcomes in selected colleges in Beijing?

As can be seen from Table 7, STE is used as the independent variable, and LEO is used as the dependent variable for linear regression analysis. The model formula is LEO=2.548 + 0.465*STE, and the model R-squared value is 0.242, which means STE can explain 24.2% of the changes in LEO. When the F test was performed on the model, it was found that the model passed the F test (F=127.261, p=0.000<0.05), meaning that STE will impact LEO. The final detailed analysis shows that the regression coefficient value of STE is 0.465 (t=11.281, p=0.000<0.01), which means that STE will have a significant positive impact on LEO. The summary analysis shows that all STE will have a significant positive effect on LEO.

Table 7. Linear regression analysis results of STE and LEO

	Regression	95% CI	Collinearity diagnostics	
			VIF	Tolerance
Constant	2.548** (18.087)	2.272 ~ 2.824	-	-
STE	0.465** (11.281)	0.385 ~ 0.546	1.000	1.000
Sample		400		
R^2		0.242		
Adjusted R^2		0.240		
F		*F* (1,398)=127.261, *p*=0.000		

Dependent variable: LEO; D-W value: 1.694
* p<0.05; ** p<0.01 The t value is in the brackets

4.4. Is student engagement a significant mediator in the relationship between classroom management and student learning outcomes in online education in Beijing?

Table 8 shows the mediating role of student engagement in the relationship between online classroom management and student learning outcomes. As can be seen from the table, the mediation effect analysis involves a total of three models, as: i) LEO=2.060+0.606×OCM; ii) STE=1.268+0.612×OCM; and iii) LEO=1.705+0.435×OCM+0.280×STE. Table 8 shows the mediation effect model test results in a simplified format. In this model, the relationship between the independent variable (OCM), the mediating variable (STE), and the dependent variable (LEO) is studied. First, we notice that the independent variable OCM has a significant direct effect on the dependent variable LEO, with an estimated value of 0.606 (t=12.650, p<0.01). This means that there is a direct positive relationship between OCM and LEO; that is, as OCM increases, LEO also increases.

On the other hand, the mediating effect model examines the role of the mediating variable STE. The mediating effect is divided into two parts. The first part is the effect of the independent variable OCM on the mediating variable STE, with an estimated value of 0.612 (t=11.856, p<0.01). This shows that OCM has a significant positive effect on STE. The second part is the effect of the mediating variable STE on the dependent variable LEO, with an estimated value of 0.280 (t=6.293, p<0.01). This shows that STE also has a significant positive effect on LEO. By combining these parts, we can see the existence of mediation effects. Specifically, OCM indirectly affects LEO through STE, with an estimated value of 0.171 (t=5.476, p<0.01), meaning that STE partially mediates between OCM and LEO. Finally, the table also provides model fit statistics, including R^2, adjusted R^2 values, and F values. These statistics are used to evaluate the fit and significance of the model. Overall, the results in the table indicate the existence of mediating effects and the complex relationship between OCM, STE, and LEO.

Table 9 summarizes the findings from a mediation analysis, which seeks to examine the relationships and effects of key variables in a research model. The analysis revolves around three central variables: OCM, STE, and LEO. The table outlines different paths within this mediation model and their respective effect sizes, 95% confidence intervals, statistical significance values, and overall conclusions.

Table 8. Mediation effect model test

	LEO	STE	LEO
Constant	2.060** (12.568)	1.268** (7.187)	1.705** (10.252)
OCM	0.606** (12.650)	0.612** (11.856)	0.435** (8.175)
STE			0.280** (6.293)
Sample	400	400	400
R^2	0.287	0.261	0.351
Adjusted R^2	0.285	0.259	0.348
F	*F* (1,398)=160.016, *p*=0.000	*F* (1,398)=140.570, *p*=0.000	*F* (2,397)=107.566, *p*=0.000

* $p<0.05$; ** $p<0.01$ In the parentheses, there are t-values.

Table 9. Mediation test results-horizontal format

Item	Symbol	Meaning	Effect	95% CI		*z* /*t*	P	Result
				Lower-bound	Upper-bound			
OCM≥STE≥LEO	a*b	Indirect effect	0.171	0.088	0.212	5.476	0.000	Mediation
OCM≥STE	a	X=>M	0.612	0.511	0.713	11.856	0.000	
STE≥LEO	b	M=>Y	0.280	0.193	0.367	6.293	0.000	
OCM≥LEO	c’	Direct effect	0.435	0.331	0.540	8.175	0.000	
OCM≥LEO	c	Total effect	0.606	0.513	0.700	12.650	0.000	

To begin with, the path “OCM≥STE≥LEO” signifies a sequence of mediation from OCM to STE and then to LEO. In this context, the a×b value represents the indirect effect, and its magnitude is 0.171. This indirect effect's 95% confidence interval spans from 0.088 to 0.212. These results suggest that student engagement plays a partially mediating role in the relationship between online classroom management and learning outcomes. The z-value of 5.476 and a p-value of 0.000 indicate the statistical significance of this indirect effect. Moving on, the “OCM≥STE” pathway reflects the total effect of OCM on STE, which amounts to 0.612. The 95% confidence interval ranges from 0.511 to 0.713, demonstrating a substantial direct impact of online classroom management on student engagement. The t-value of 11.856 and a p-value of 0.000 confirm the statistical significance of this direct effect.

Furthermore, “STE≥LEO” represents the total effect of STE on LEO, with an effect size of 0.280. The 95% confidence interval extends from 0.193 to 0.367, indicating a noteworthy direct influence of student engagement on learning outcomes. The t-value of 6.293 and a p-value of 0.000 confirm the statistical significance of this direct effect. Next, within the “OCM≥LEO” context, c’ denotes the direct effect, which signifies the overall impact of online classroom management on learning outcomes and is valued at 0.435. The 95% confidence interval ranges from 0.331 to 0.540, showing a direct connection between these two variables. The t-value of 8.175 and a p-value of 0.000 affirm the statistical significance of this direct effect. Finally, c within the “OCM≥LEO” pathway indicates the total effect, encompassing both direct and indirect effects, and it has a value of 0.606. The 95% confidence interval ranges from 0.513 to 0.700, reflecting the comprehensive influence of online classroom management on learning outcomes. The t-value of 12.650 and a p-value of 0.000 signify the statistical significance of this total effect. This table provides valuable insights into the mediation model's various pathways, allowing researchers to assess the significance of online classroom management, student engagement, and learning outcomes. The results offer substantial evidence to support the validity of this mediation model.

4.5. Discussion

The study results showed that student engagement is mediating in the relationship between online classroom management and student learning outcomes. Kim also pointed out in his research on student engagement that, in addition to the three core dimensions (behavioral participation, cognitive participation, and emotional participation), the influencing factors of student engagement also include the impact of student academic performance on engagement [34]. Many studies have found that effective online classroom management can increase student engagement, motivation, and academic performance. Numerous previous analyses are similar to this research result. For example, one study found that when instructors provided students with clear and timely feedback, it improved their confidence, engagement, and performance [35].

Another study found that instructors providing students with detailed instructions and guidance regarding online activities and assignments increased completion rates and resulted in higher grades [36]. Similar to this research result, in the education field, it is generally believed that there is a significant correlation between classroom management and learning engagement, particularly in how classroom management can significantly affect learning engagement. Other study showed that classroom management can positively promote and improve student engagement in learning [37]. Some studies also demonstrated that internal motivations such as interests, cultural communication, and personal growth and development are

significantly related to learning input. External motivations such as environment, social responsibility, and interpersonal relationships are also significantly associated with learning input.

5. CONCLUSION

This study examined the relationship between student engagement, classroom management, and learning outcomes. The article confirms that student engagement does play a mediating role in this relationship. Online classroom management is positively related to student engagement, online classroom management is positively associated with student outcomes, and student engagement is positively related to student outcomes. The findings are consistent with the research goals of this article, and future research efforts could consider more variables in the relationship between classroom management and student outcomes, study more locations, and include more diverse samples. This study not only validates existing theories but also contributes to improving the quality of online education.

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