The Development of Collaborative Learning Model for Enhancing Learning Engagement among College Students

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Abstract

This article aimed to study 1) the effectiveness of the collaborative learning model in improving college students' learning engagement; 2) the impact of the collaborative learning model over a 6-week intervention period; and 3) the sustained effects of the model on students' engagement at a one-month follow-up. The sample comprised 50 first-year undergraduate students from Chongqing Normal University. Participants were recruited through voluntary participation and were randomly assigned to either an experimental group or a control group. Data were collected using a Learning Engagement Questionnaire, which demonstrated high internal consistency. The study employed a randomized controlled pretest-post-test design. Data analysis was conducted using descriptive statistics alongside one-way and two-way repeated measures analysis of variance (ANOVA). The research results were as follows:

1. The experimental group showed a significant increase in learning engagement after the intervention and at the follow-up stage, with a p-value < 0.05. This indicated that the collaborative learning model effectively enhances students' engagement levels.

2. The learning engagement of the experimental group was significantly higher than that of the control group, both immediately after the intervention and at the one-month follow-up. The results demonstrated that the improvement in engagement was immediate and sustained, underscoring the collaborative learning model's lasting impact on students' learning behaviors.

In conclusion, the collaborative learning model was an effective way to get college students more interested in learning, with benefits that lasted both in the short and long term. Beyond these outcomes, the findings also suggested practical implications for higher education

practice and policy, particularly in encouraging the adoption of collaborative pedagogies to strengthen student motivation, persistence, and overall academic success.

Keywords: Learning engagement; Collaborative learning model; Higher education; Quasi-experimental study

Introduction

The importance of learning engagement in higher education has increasingly become a central concern for researchers and educators, given its well-documented links to academic performance, motivation, and student retention (Fredricks, Blumenfeld, & Paris, 2004). Learning engagement broadly refers to the degree to which students actively invest in their learning processes, encompassing behaviours such as participating in class discussions, collaborating with peers, and persisting with academic tasks. Recent data from the National Center for Education Statistics (2023) indicate that more than 60% of college students reported experiencing disengagement in their studies. Such disengagement is strongly associated with diminished learning outcomes and elevated attrition rates (Tinto, 2012).

One promising pedagogical response to this challenge is the collaborative learning model, where students work collectively to achieve shared learning goals. Research suggests that this approach fosters motivation, deeper learning, and the development of transferable skills such as communication, teamwork, and critical thinking (Johnson, 2009). Nevertheless, despite its widely recognized benefits, important questions remain about the specific mechanisms through which collaborative learning promotes engagement, especially in increasingly diverse and hybrid learning contexts (Garrison, Anderson & Archer, 2010). Understanding these mechanisms is critical for designing more effective instructional strategies.

Existing scholarship has documented that collaborative learning can enhance achievement, persistence, and engagement (Barkley, Cross & Major, 2014; Smith et al., 2009). However, the effectiveness of collaborative learning models can vary significantly across disciplines, learning environments, and student populations. Topping (2015), for instance, highlights the necessity of adapting collaborative approaches to accommodate cultural and social diversity, as well as differing academic backgrounds. Despite these insights, gaps remain regarding how best to implement collaborative learning to ensure meaningful engagement across both face-to-face and online classrooms.

The present research paper aims to investigate the impact of collaborative learning strategies on student engagement in higher education. Building on the gaps identified in prior studies, this research seeks to evaluate the role of the Collaborative Learning Model (CLM) in enhancing learning engagement among college students. In line with the stated objectives, the study is guided by the following research questions and hypotheses:

Research Questions (RQs):

1. To what extent does the implementation of the collaborative learning model enhance learning engagement among students in the experimental group after the intervention?

2. How do learning engagement levels differ between the experimental group, which receives the collaborative learning intervention, and the control group, which continues with traditional instruction, both immediately after the intervention and at the follow-up stage?

3. Are improvements in learning engagement sustained one month after the conclusion of the collaborative learning intervention?

Research Hypotheses (Hs):

H1: Students in the experimental group will demonstrate significantly higher learning engagement scores after the intervention compared to their pretest results.

H2: The experimental group will show significantly greater engagement than the control group, both at the immediate post-test and at the follow-up stage.

H3: The positive effects of the collaborative learning model on learning engagement will persist at the one-month follow-up, indicating longitudinal benefits.

In doing so, this study not only evaluates the short-term and sustained impacts of CLM but also contributes to the theoretical understanding of how structured peer collaboration fosters student engagement. The findings are expected to provide both theoretical insights into engagement research and practical implications for designing effective pedagogical interventions in higher education.

Research Objectives

To assess the effectiveness of the collaborative learning model in promoting learning engagement among college students, this study pursued the following objectives:

1. To investigate the extent to which the implementation of the collaborative learning model enhances learning engagement among students in the experimental group following the intervention period.

2. To conduct a comparative analysis of learning engagement levels between the experimental group, which received the collaborative learning intervention, and the control group, which did not, both during the intervention phase and at the follow-up stage, in order to determine the relative effectiveness of the model in fostering sustained student engagement.

3. To examine the longitudinal impact of the collaborative learning model by evaluating whether improvements in students' learning engagement are sustained one month after the conclusion of the intervention.

Literature Review

1. Learning Engagement (LE)

Learning engagement (LE) has emerged as a central construct in contemporary educational research because of its close association with student achievement, persistence, and well-being. It is broadly defined as the degree of attention, curiosity, interest, and effort that students dedicate to the learning process (Pintrich, 2003). Scholars generally conceptualize LE as multidimensional, consisting of behavioral, emotional, and cognitive engagement (Fredricks et al, 2004).

Behavioral engagement encompasses students' visible participation in academic activities, such as effort, attendance, and involvement in discussions. Fredricks et al. (2004) stressed that it reflects compliance with classroom rules and active involvement in tasks. Empirical studies have shown that students with higher behavioral engagement tend to demonstrate better academic performance and lower dropout rates (Klem & Connell, 2004).

Emotional engagement refers to students' affective reactions, including interest, enjoyment, sense of belonging, and positive interactions with peers and instructors. Kahu (2013) proposed that emotional engagement is crucial for persistence, particularly in higher education, where students often struggle with motivation and adaptation. Research indicates that supportive learning environments significantly improve students' emotional connection to learning (Reschly et al., 2008).

Cognitive engagement involves the mental effort students invest in understanding, analyzing, and applying knowledge. Pintrich (2003) highlighted that it is closely tied to self-regulated learning, while Topping (2015) demonstrated that peer tutoring strengthens higher-order thinking skills and critical reflection.

Overall, LE represents a comprehensive construct that integrates students' observable behaviors, emotional investment, and cognitive strategies. Despite the breadth of research, many

studies focus disproportionately on behavioral aspects, with fewer exploring how emotional and cognitive engagement develop and interact within structured pedagogical frameworks.

2. Collaborative Learning Model (CLM)

The Collaborative Learning Model (CLM) provides a systematic pedagogical approach designed to enhance learning through structured peer interaction and shared responsibility. Its theoretical roots lie in social constructivism, particularly Vygotsky's (1978) notion that knowledge is co-constructed through social interaction, and in social interdependence theory (Johnson, 2009), which highlights how positive interdependence fosters cooperation.

CLM is characterized by several key features:

1) Structured group interaction: Students work in small groups with clearly defined goals and interdependent roles.

2) Shared responsibility: Learning outcomes depend on the contributions of all members, ensuring accountability.

3) Active problem-solving: Students engage in dialogue, critical thinking, and collaborative tasks that require negotiation of meaning.

4) Classic works such as Slavin (1995) and Barkley et al. (2014) illustrated practical techniques for implementing collaborative learning, while Smith et al. (2005) emphasized that collaborative pedagogies improve both academic performance and interpersonal skills. More recent evidence strengthens these claims. For example, Chen et al. (2018) found in a meta-analysis that collaborative learning significantly enhances both achievement and engagement, particularly in digital learning environments. Similarly, Järvelä et al. (2020) demonstrated that CLM settings encourage self-regulated learning behaviors and active participation.

However, much of the existing research treats collaborative learning as a general practice rather than a clearly articulated model. There is limited exploration of how variations of CLM influence specific learning outcomes across different educational contexts. This suggests the need to refine and test CLM as a pedagogical framework tailored to enhance multidimensional engagement.

3. Linking the Collaborative Learning Model and Learning Engagement

A growing body of empirical research has attempted to link CLM directly with student engagement. Studies consistently show that CLM fosters behavioral engagement by encouraging active participation in group discussions and tasks. Smith et al. (2005) documented how structured collaborative practices improved classroom involvement and persistence. Similarly, Chen et al.

(2018) reported that collaborative environments strengthen participation and reduce passive learning behaviors.

Evidence also suggests that CLM enhances emotional engagement by fostering a sense of belonging and mutual support. Klem and Connell (2004) found that students who perceive supportive peer and teacher relationships are more emotionally connected to learning. Tinto (2012) further argued that collaborative learning communities play a crucial role in retaining students in higher education by promoting motivation and commitment.

With respect to cognitive engagement, collaborative tasks require deeper processing, negotiation of meaning, and reflection. Järvelä et al. (2020) highlighted that collaborative settings stimulate metacognition and self-regulation, both central to cognitive engagement. Topping's (2015) systematic review of peer tutoring also confirmed that collaborative strategies facilitate critical thinking and advanced cognitive skills.

Despite these promising findings, gaps remain. Many studies examine single dimensions of engagement or specific collaborative strategies without integrating them into a coherent model. There is limited empirical research on how CLM can be systematically designed and tested to target all three dimensions of LE simultaneously. This gap points to the need for developing a structured CLM that explicitly enhances behavioral, emotional, and cognitive engagement in higher education contexts.

In summary, the literature demonstrates that Learning Engagement is a multidimensional construct essential for academic success, with behavioral, emotional, and cognitive dimensions clearly defined and empirically supported (Fredricks et al., 2004; Pintrich, 2003; Kahu, 2013). The Collaborative Learning Model is grounded in strong theoretical foundations and has proven effective in fostering participation, motivation, and deeper learning (Slavin, 1995; Vygotsky, 1978; Chen et al., 2018). Prior research confirms that CLM enhances engagement, but most studies remain fragmented, focusing on single dimensions or specific practices. The knowledge gap lies in the absence of a systematically developed CLM aimed at enhancing all three engagement dimensions in college students. The present research seeks to fill this gap.

Conceptual Framework

The present study is an investigation into the dynamics of learning engagement in collaborative learning environments. The researcher has defined the research conceptual framework in accordance with the three-component model of engagement (behavioral, emotional and cognitive engagement) proposed by Fredricks et al. (2004). This has been combined with Vygotsky's social constructivism theory and Engagement Theory developed by Greg Kearsley and Ben Shneiderman. The amalgamation of these frameworks will facilitate a more profound comprehension of the manner in which diverse forms of engagement interact within collaborative settings and exert an influence on the overall learning outcomes. The integration of these theories enables a holistic approach to the examination of the factors that enhance or hinder student participation, motivation, and cognitive processing within group learning activities.

The details are as follows:

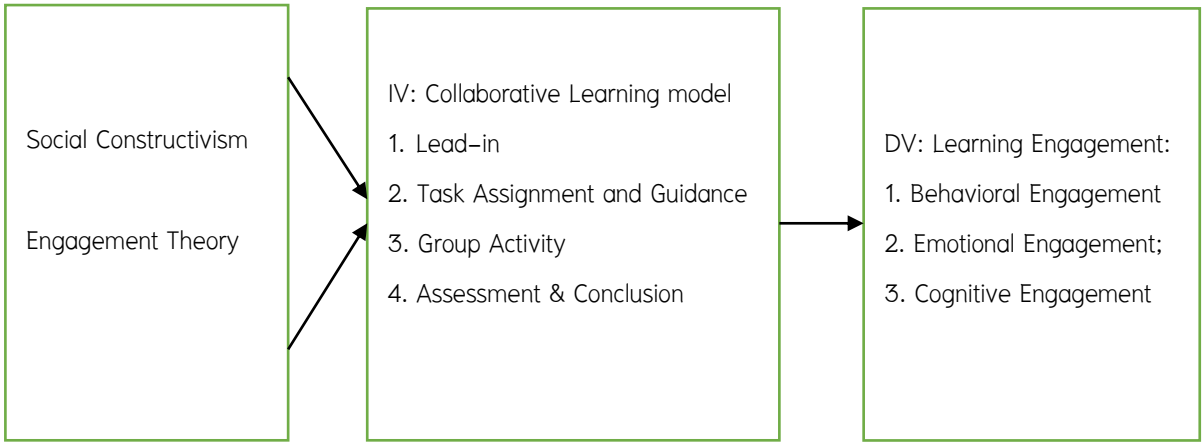


Figure 1 Conceptual Framework

Research Methodology

Participants

The study was conducted with 50 first year undergraduate students from Chongqing Normal University. Participants were drawn from a larger pool of 654 students, who initially completed the Learning Engagement Questionnaire (LEQ). To ensure focus on students with lower engagement, the 50 students with the lowest engagement scores were selected. They were then randomly assigned into two groups: the experimental group (n = 25) and the control group (n = 25). Efforts were made to balance the groups to ensure comparable baseline engagement levels.

Research Design

A randomized control-group pretest–posttest design was adopted. The research included four systematic phases:

Pretest (T1): Baseline engagement levels were measured using the LEQ.

Experimental Period: The experimental group participated in 14 collaborative learning sessions (90 minutes each, over six weeks), while the control group continued with traditional lecture-based instruction.

Post-test (T2): Both groups completed the LEQ again after the intervention to assess immediate effects.

Follow-up (T3): One month after the intervention, the LEQ was re-administered to both groups to evaluate the sustainability of the effects.

This design enabled the comparison of immediate and longer-term impacts of the Collaborative Learning Model (CLM).

Table 1 Randomized Pretest-Posttest -Follow Up Design

Group	Pretest	Experiment	Post-test	Follow-up
ER	T_1	X	T_2	T_3
CR	T_1	—	T_2	T_3

The meaning of the symbols is as follows:

E	Experimental group
C	Control group
R	Random assignment
T1	Testing prior to the intervention experiment (Pretest)
T2	Test following intervention experiments (Post-test)
T3	Test one month after the experiment (Follow-up)
X	Treatment: Implementing the learning engagement model in the class to experiment
—	No treatment

Instruments

This research employed Learning Engagement Questionnaire (LEQ) as the instrument. The Learning Engagement Questionnaire served as the primary instrument to assess student engagement. It was adapted from established frameworks (Appleton et al., 2006) and tailored to

the Chinese higher education context. The questionnaire consisted of 36 items covering three dimensions:

Behavioral Engagement (13 items; e.g., "I actively participate in classroom discussions.")

Emotional Engagement (13 items; I enjoy participating in interactive class activities (e.g., role-play, debates).")

Cognitive Engagement (13 items; e.g., "I explore new learning strategies when I face difficulties.")

All items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A pilot test (n = 102) confirmed the reliability of the instrument, with Cronbach's α = 0.94 overall, and Index of consistency (IOC) calculated from their ratings ranged from 0.8 to 1.0.

Procedure

After the pretest, the experimental group took part in collaborative learning activities designed around four stages: lead-in, guided task assignment, small-group collaboration, and reflection/feedback. These sessions emphasized interaction, teamwork, and problem-solving. The control group continued with traditional lecture-based sessions. At the end of the intervention, both groups completed the LEQ again (T2). The follow-up (T3) was conducted a month later to test whether changes in engagement were maintained.

Data Analysis

Quantitative data were processed using SPSS 26.0. First, descriptive statistics were generated to examine baseline comparability. Then, repeated-measures ANOVA was employed to evaluate within-group changes across the three time points, while a mixed-design ANOVA tested differences between groups. Qualitative reflections and observation notes were thematically analyzed to provide context for the quantitative trends. Statistical significance was set at $p < .05$.

Ethical Considerations

All participants were informed in advance about the purpose, process, and possible risks of the study, and each signed a written informed consent form before participation. Their involvement was entirely voluntary, and they were reminded that they could withdraw from the study at any point without penalty or negative academic impact.

To protect privacy, participants' names and identifying information were not recorded, responses were anonymized, and data were stored securely with access restricted to the research team.

Research Results

The objective of the present study was to evaluate the impact of the collaborative learning model on the learning engagement of college students. The findings demonstrated that the collaborative learning model had a positive influence on students' engagement levels. Specifically, the experimental group demonstrated sustained enhancement in the following domains during the one-month follow-up period:

Objective 1. The results showed that a significant increase in learning engagement was observed after the implementation of the collaborative learning model, as well as during the follow-up period, compared to pre-intervention levels, with a significance level of 0.05.

Table 2 One-way ANOVA for the Experimental Group

The experimental group demonstrated a significantly higher level of learning engagement than the control group, both immediately following the intervention and during the follow-up phase, with a significance level of 0.05.

In this study, the researcher used a one-way ANOVA to compare the learning engagement of college students in the experimental group before the experiment (Pretest), after the experiment (Post-test), and follow-up.

Table 2 One-way ANOVA for the Experimental Group

Components	Point	Mean	Std. Deviation	F	P	LSD
Behavioral Engagement	Pretest	1.752	0.038			2>1,3>1
	Post-test	2.060	0.099			
	Follow up	2.100	0.091			
Emotional Engagement	Pretest	1.695	0.037			2>1,3>1
	Post-test	1.907	0.077			
	Follow up	1.940	0.104			
Cognitive Engagement	Pretest	1.958	0.050			2>1,3>1
	Post-test	2.175	0.100			
	Follow up	2.187	0.104			
Learning Engagement	Pretest	1.802	0.017	9.999	0.001	2>1,3>1
	Post-test	2.047	0.041			
	Follow up	2.076	0.048			

The results from one-way repeated measures ANOVA provide clear evidence of significant improvements across all dimensions of learning engagement (LE) following the implementation of the Collaborative Learning Model (CLM). The findings demonstrate positive changes sustained over time, with no significant decline during the follow-up phase.

Behavioral Engagement

Mean scores for behavioral engagement increased from 1.752 at pretest to 2.060 at post-test, and further to 2.100 at follow-up, indicating a consistent upward trajectory. The LSD post-hoc comparisons confirmed that both post-test and follow-up means were significantly higher than pretest levels ($p < 0.05$), while the difference between post-test and follow-up was not significant. The slightly higher standard deviations at post-test (0.099) and follow-up (0.091) compared to pretest (0.038) suggest greater variability in student participation after the intervention. Overall, these results indicate that CLM successfully enhanced students' active participation and sustained behavioral engagement over time.

Emotional Engagement

Emotional engagement also demonstrated a notable improvement, with mean scores rising from 1.695 at pretest to 1.907 at post-test and 1.940 at follow-up. The LSD test revealed significant differences between pretest and both post-test and follow-up scores ($p < 0.05$), confirming the effectiveness of CLM in fostering positive emotional connections to learning. The gradual increase suggests that students developed greater interest, motivation, and a sense of belonging throughout the intervention period, with these gains maintained during the follow-up.

Cognitive Engagement

Cognitive engagement showed a steady and sustained enhancement, with mean scores progressing from 1.958 at pretest to 2.175 at post-test and 2.187 at follow-up. The LSD analysis indicated that both post-test and follow-up means were significantly higher than pretest ($p < 0.05$). The standard deviations remained stable between post-test (0.100) and follow-up (0.104), reflecting consistent intellectual investment among students. These findings suggest that CLM effectively promoted deeper cognitive processing, problem-solving, and reflective learning practices.

Learning Engagement (Composite Dimension)

For the composite measure of learning engagement, mean scores increased from 1.802 at pretest to 2.047 at post-test and 2.076 at follow-up. The repeated measures ANOVA revealed a highly significant main effect of time ($F = 9.999$, $p = 0.001$), with LSD tests confirming that both

post-test and follow-up scores were significantly higher than pretest. The relatively low standard deviation at pretest (0.017) compared to post-test and follow-up (0.041–0.048) suggests greater initial homogeneity, with increased variability following the intervention possibly reflecting individualized responses to collaborative activities.

Collectively, these results demonstrate that the Collaborative Learning Model (CLM) intervention had a significant positive impact on students' learning engagement across behavioral, emotional, and cognitive dimensions. The sustained improvements observed at follow-up indicate that the effects were not only immediate but also durable over time. Notably, behavioral engagement exhibited the largest increase, underscoring the effectiveness of structured collaborative strategies in promoting active student participation.

These findings highlight the value of integrating CLM into instructional design to foster comprehensive learning engagement in higher education. By supporting students' active involvement, emotional investment, and cognitive effort, CLM offers a robust approach for enhancing academic success and promoting long-term student development.

Table 3 Correlation Analysis of college students' learning engagement before the experiment (Pretest), after the experiment (Post-test), and follow-up (1M Later) (n=25).

When there is a relationship between variables that cannot be directly interpreted as causal, this relationship is referred to as a correlation. This study employs Pearson correlation to analyze the relationships among the various variables.

Table 3 Correlation Analysis for Learning Engagement

	Pretest	**Post-test**	**Follow-up**
Pretest	1		
Post-test	.362**	1	
Post-test	.393**	.661**	1

** Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficients for the learning engagement pretest, post-test, and follow-up data are 0.362, 0.393, and 0.661, respectively. The corresponding p-values are all below 0.01, indicating significant statistical significance, which confirms that there is a significant correlation among the three sets of data regarding learning engagement.

Objective 2. The results showed that no significant increase in learning engagement in the control group which didn't received the collaborative learning model, as well as during the follow-up period, compared to experimental group which is with a significance level of 0.05.

Table 4 ANOVA Analysis for Comparison between Control Group and Experimental Group

Components	Group	Time	Mean	Std. Deviation	Level
Behavioral Engagement	Control Group	Pretest	1.747	0.054	low
		Post-test	1.78	0.139	low
		Follow up	1.773	0.129	low
	Experimental Group	Pretest	1.757	0.054	low
		Post-test	2.34	0.139	Medium
		Follow up	2.427	0.129	Medium
Emotional Engagement	Control Group	Pretest	1.67	0.052	low
		Post-test	1.71	0.109	low
		Follow up	1.647	0.147	low
	Experimental Group	Pretest	1.72	0.052	low
		Post-test	2.103	0.109	Medium
		Follow up	2.233	0.147	Medium
Cognitive Engagement	Control Group	Pretest	1.963	0.07	low
		Post-test	1.967	0.142	low
		Follow up	1.933	0.147	low
	Experimental Group	Pretest	1.953	0.07	low
		Post-test	2.383	0.142	Medium
		Follow up	2.44	0.147	Medium
Learning Engagement	Control Group	Pretest	1.793	0.024	low
		Post-test	1.819	0.059	low
		Follow up	1.784	0.068	low
	Experimental Group	Pretest	1.81	0.024	low
		Post-test	2.276	0.059	Medium
		Follow up	2.367	0.068	Medium

The table above presents the pretest, post-test, and follow-up results of the experimental and control groups on behavioral engagement, emotional engagement, and cognitive engagement. These results indicate moderate to high levels of enhancement. Conversely, the alterations in these domains within the control group were comparatively negligible, maintaining at minimal

levels. These findings underscore the efficacy of the enhanced collaborative learning model in fostering heightened engagement in learning among participants.

In summary, the control group maintains low levels of engagement across all dimensions and time points, with no significant changes. In contrast, the experimental group exhibited significant increases in engagement across all dimensions to moderate high levels during the post-test and follow-up phases after the intervention. This finding suggests that the intervention exerts a favourable and enduring influence on behavioral, emotional, cognitive, and overall learning engagement in the experimental group. The interaction effect of time and group is evident, with the intervention demonstrating clear advantages over time in the experimental group, while the control group is less affected by time.

Table 5 Mauchly's Test of Sphericity

Within Subjects Effect	Value	F	Hypothesis df	Error df	Sig.
Time	Behavioral Engagement	0.811	9.819	2	0.007
	Emotional Engagement	0.794	10.833	2	0.004
	Cognitive Engagement	0.973	1.275	2	0.529
	Learning Engagement	0.924	3.739	2	0.154

Mauchly's test of sphericity was conducted to determine whether the covariance matrices of the repeated measures (across time points) met the assumption of sphericity. The results indicated significant findings for behavioral engagement ($p = 0.007$) and emotional engagement ($p = 0.004$), which suggest a violation of the sphericity assumption. Therefore, adjustments to the degrees of freedom for the within-subject effects of these two measures are necessary (e.g., using Greenhouse-Geisser or Huynh-Feldt corrections). In contrast, the results for cognitive engagement ($p = 0.529$) and learning engagement ($p = 0.154$) were not significant, indicating that the sphericity assumption was met for these measures, and no corrections are required.

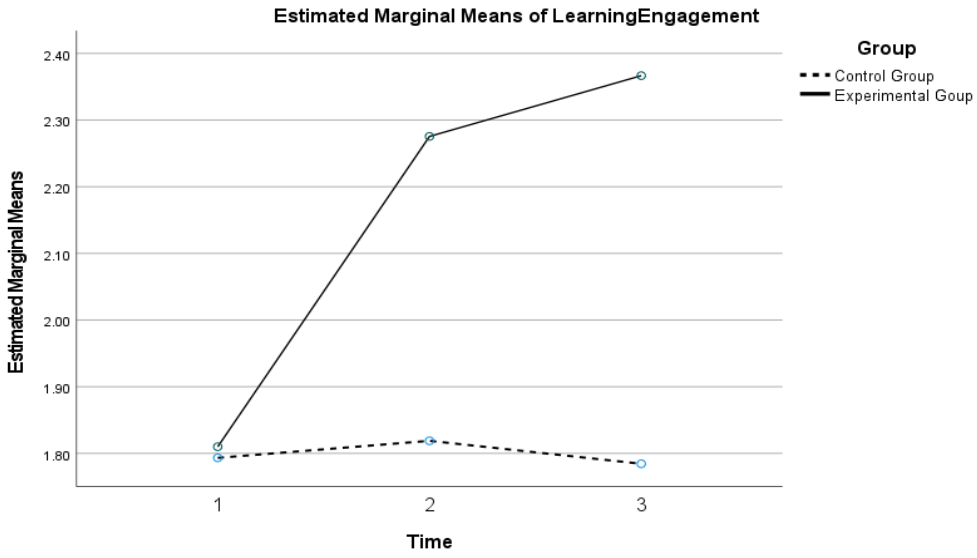
Objective 3. The results showed a more visual representation of the interaction effects of time and treatment on the study variables.

Table 6 Time/Multivariate Tests

Effect		Value	F	Sig.
Between Subjects	Intercept	0.990	1544.109	<0.001
	Group	0.448	12.441	<0.001
Within Subjects	Time	0.583	9.999	<0.001
	Time*Group	0.563	9.999	<0.001

The results of the multivariate tests for time effects indicate that, within the between-subject effects, the intercept term is significant ($p < 0.001$), suggesting a substantial baseline effect of the model. Additionally, the group effect is significant ($p < 0.001$), indicating that there are significant differences in the overall means of the dependent variable between the different control groups and the experimental group. In terms of within-subject effects, the main effect of time is significant ($p < 0.001$), indicating an overall difference in the means of the dependent variable across pretest, post-test, and follow-up measurements. Furthermore, the time X group interaction is significant ($p < 0.001$), suggesting that the effect of the group on the dependent variable varies over time.

Overall, the significant main effects of time, group, and the time X group interaction imply that learning engagement increases over time, with notable differences in learning engagement among the various groups that change over time.



Note: Group 1 (solid line) for experimental group, group 2 (dashed line) for control group.

Time 1 for pretest, time 2 for post-test, time 3 for follow up (1M later)

Figure 2 Mean of Behavioral Engagement (experimental group + control group)

Figure 2 presented in the line graph illustrate the relationship between time (represented on the x-axis as time points: pretest, post-test and follow-up,) and the estimated marginal means (represented on the y-axis). Different lines correspond to different groups: the dashed line represents the control group, while the solid line represents the experimental group.

From the figure, there is a significant increase from pretest to post-test, and an upward trend continues from time post-test to follow-up, indicating a clear overall increase. This suggests that, over time, the experimental group experiences a substantial enhancement in learning engagement.

This graph clearly illustrates a significant time × group interaction, highlighting that the learning engagement of the experimental group is notably influenced by time, exhibiting a considerable increase, while the control group is minimally affected by time. This further underscores the effectiveness of the intervention (which differentiates the experimental group from the control group) in influencing learning engagement over time.

Discussions

The findings of this study provide substantial evidence in support of the hypothesis that the collaborative learning model is an effective tool for enhancing the learning engagement of college students. The experimental group demonstrated significant enhancements in learning engagement, both in the immediate aftermath of the intervention and during the one-month follow-up period. This sustained increase in engagement suggests that the collaborative learning model had a lasting impact on students' involvement in the learning process, highlighting its potential as a powerful pedagogical tool.

A pivotal factor in these favourable outcomes is the nature of the collaborative learning model itself. By emphasizing student interaction, group problem-solving, and shared responsibility for learning, the model fosters a more active and participatory learning environment. This pedagogical approach fosters engagement not only with the course material but also with one's peers, thereby promoting deeper understanding and retention. It is hypothesized that the peer interactions within group activities created an environment in which students felt more motivated and connected to the learning process, thereby increasing their overall engagement.

The marked enhancement evident in the experimental group in comparison to the control group indicates that the collaborative learning model exerts a more substantial influence than conventional, lecture-based instruction. The control group, which did not receive the collaborative

learning intervention, did not demonstrate such improvements, further emphasizing the efficacy of the collaborative approach in fostering sustained engagement. The elevated levels of engagement in the experimental group post-intervention and during the follow-up period imply that the model exerts a lasting influence on students' attitudes towards learning.

Furthermore, the one-month follow-up data underscores the efficacy of collaborative learning in fostering sustained engagement, even in the aftermath of the intervention's conclusion. This sustained impact suggests that the skills and strategies developed through collaborative learning may continue to influence students' learning behaviors long after the formal instruction has concluded. This lends further support to the model's value in promoting enduring academic success.

Limitations and Considerations

Despite these promising results, several limitations warrant attention. First, the cultural context may have influenced outcomes. The study was conducted in a collectivist educational environment, where collaboration and group harmony are often highly valued. This cultural predisposition may have amplified the effectiveness of collaborative learning, and future studies in more individualistic contexts should examine whether similar effects are observed.

Second, the potential role of instructor influence cannot be overlooked. Instructors facilitating the collaborative activities may have contributed to heightened engagement through their enthusiasm, guidance, or rapport with students. While the design attempted to standardize delivery, variations in teacher-student interaction could partially explain the positive outcomes.

Third, the possibility of a Hawthorne effect must be acknowledged. Students in the experimental group may have increased their engagement simply because they perceived themselves as receiving special attention or participating in an innovative instructional method. Although the persistence of gains at the one-month follow-up suggests that improvements were not purely temporary, disentangling these effects remains a challenge for future research.

Future Directions

To build on these findings, future research should explore how different variations of the collaborative learning model influence specific engagement domains, particularly emotional and cognitive engagement. It would also be valuable to examine disciplinary differences, as engagement may manifest differently in fields such as humanities versus STEM. Additionally,

longitudinal studies extending beyond one month could provide deeper insights into the durability of collaborative learning's impact.

New Knowledge from Research

The Knowledge from Research emphasizes the pathways through which the Collaborative Learning Model (CLM) influences learning engagement. By synthesizing results into a conceptual framework, the figure captures four interrelated aspects: the design of CLM activities, the mechanisms that drive student participation, the comparative differences between experimental and control groups, and the short- and long-term effects on engagement. This visual synthesis not only clarifies the outcomes of the current study but also contributes to the broader academic discourse by organizing the research evidence into an accessible and systematic structure.

Conclusion

The present study demonstrates that the collaborative learning model significantly enhances learning engagement among college students. The findings indicate that students in the experimental group exhibited significant enhancements in their engagement levels immediately following the intervention, with these effects being maintained one month later. The marked discrepancies between the experimental and control groups highlight the efficacy of collaborative learning in promoting active participation, motivation, and peer interaction, which are pivotal components of student engagement.

The collaborative learning model's efficacy can be attributed to its emphasis on student-centred activities, where students actively collaborate, solve problems together, and engage with their peers in meaningful ways. This approach has been demonstrated to engender a more profound comprehension of the subject matter, whilst concomitantly cultivating a sense of community and responsibility. It is hypothesized that these phenomena have contributed to the heightened engagement that has been observed. Furthermore, the sustained impact of the model, as evidenced at the one-month follow-up, suggests that the benefits of collaborative learning extend beyond the immediate intervention period, engendering long-term positive effects on students' academic involvement. The findings provide substantial evidence that the collaborative learning model is a valuable strategy for enhancing learning engagement, particularly in higher education settings where student participation and motivation are crucial to academic success.

In conclusion, the present study corroborates the hypothesis that the collaborative learning model is an efficacious tool for enhancing learning engagement among college students. In view of the favourable and enduring outcomes observed, it is recommended that educational institutions incorporate collaborative learning strategies into their teaching practices to foster greater student involvement and improve overall academic performance. It is recommended that future studies explore the specific mechanisms through which collaborative learning influences engagement. Furthermore, it would be beneficial to ascertain whether the effects of collaborative learning vary across different disciplines or educational contexts.

Suggestions

1. it is recommended that future research endeavors explore the manner in which behavioral, emotional and cognitive engagement interact within collaborative learning environments. A comprehensive understanding of the interplay between these components could facilitate the development of more efficacious learning activities that simultaneously enhance engagement across all three domains.

2. It is imperative to investigate which group structures (e.g., homogeneous vs. heterogeneous) and task designs (e.g., problem–based learning, peer teaching) most effectively foster engagement. It is recommended that research be conducted on the manner in which disparate group dynamics exert influence on participation and cognitive effort in collaborative settings.

3. Given the increasing use of digital tools, further studies should examine how online collaboration platforms and interactive technologies influence engagement. Specifically, research could explore how these tools support behavioral, emotional and cognitive engagement, especially in remote or hybrid learning environments.

References

Appleton, J.J., Christenson, S.L., Kim, D., & Reschly, A.L. (2006) Measuring cognitive and psychological engagement: validation of the student engagement instrument. *Journal of School Psychology, 44*(5), 427–445. https://doi.org/10.1016/j.jsp.2006.04.002

Barkley, E. F., Cross, P., & Major, C. H. (2014). *Collaborative learning techniques: A handbook for college faculty.* (2nd ed.). New Jersey: Jossey–Bass.

Chen, P., Wang, T., Kirschner, P. A., & Tsai, C. C. (2018). The role of collaboration, computer use, learning environments, and supporting strategies in CSCL: A meta–analysis. *Review of Educational Research, 88*(6), 799–843. https://doi.org/10.3102/0034654318791584

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education, 13*(1–2), 5–9. https://doi.org/10.1016/j.iheduc.2009.10.003

Järvelä, S., Malmberg, J., Haataja, E., Sobocinski, M., & Kirschner, P. A. (2021). What multimodal data can tell us about the students' regulation of their learning process. *Learning and Instruction, 72*, 101203. https://doi.org/10.1016/j.learninstruc.2019.04.004

Johnson, D. W. (2009). *Reaching out: Interpersonal effectiveness and self–actualization*. (10th ed.). London: Pearson Education.

Kahu, E. R. (2013). Framing student engagement in higher education. *Studies in Higher Education, 38*(5), 758–773. https://doi.org/10.1080/03075079.2011.598505

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*(7), 262–273. https://doi.org/10.1111/j.1746–1561.2004.tb08283.x

National Center for Education Statistics. (2023). *The condition of education 2023. U.S. Department of Education, Institute of Education Sciences*. Retrieved from https://nces.ed.gov/pubs2023/2023123.pdf

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology, 95*(4), 667–686. https://doi.org/10.1037/0022–0663.95.4.667

Reschly, A. L., Huebner, E. S., Appleton, J. J., & Antaramian, S. (2008). Engagement and thriving in school. *Psychology in the Schools, 45*(5), 419–431. https://doi.org/10.1002/pits.20306

Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice*. Massachusetts: Allyn & Bacon.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of engagement: Classroom–based practices. *Journal of Engineering Education, 94*(1), 87–101. https://doi.org/10.1002/j.2168–9830.2005.tb00831.x

Tinto, V. (2012). *Completing college: Rethinking institutional action.* Chicago: University of Chicago Press.

Topping, K. J. (2015). The effectiveness of peer tutoring in higher education: A systematic review of the evidence. *Educational Psychology Review, 27*(1), 23–38. https://doi.org/10.1007/s10648-014-9267-7

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Massachusetts: Harvard University Press.