Impacts of Two Collaborative Learning by Teaching Approaches on University Students' Engagement, Motivation, and Metacognition

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Abstract

Collaborative learning by teaching (CLBT) is an active learning approach that integrates collaborative learning with the learning-by-teaching strategy, aiming to enhance student engagement and knowledge acquisition in university settings. However, it challenges many university students as it demands collaborating autonomously and regulating the collaborative learning process. Some students may struggle with task execution and process management. To address this challenge, socially shared regulation scaffolding can be integrated to support CLBT. This study proposed a socially shared regulation scaffolding called Task Guidance Scaffolding (TGS), which divides CLBT tasks into four stages—goal setting, planning, monitoring, and evaluation—and provides specific guiding questions at each stage to help students complete the CLBT learning process. Using a two-group case study design, this research investigated the effects of CLBT and socially shared regulation scaffolding-supported CLBT on university students. Results indicated that both approaches positively affected students' group engagement, motivation, and metacognition. The study emphasizes the potential benefits of CLBT and its integration with socially shared regulation scaffolding on university students, providing practical implications for educators and future research.

Keywords: collaborative learning by teaching, socially shared regulation scaffolding, group engagement, motivation, group metacognition

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Introduction

In traditional Chinese university classrooms, teacher-centered instruction remains prevalent, which often restricts students from actively involving in the classroom (Zhou & Tsai, 2023). In response, educators have tried to implement and innovate student-centered teaching methods, such as game-based learning (Hu, 2024), collaborative learning by teaching (Zhou et al., 2019), project-based learning, problem-based learning, and flipped classrooms to promote engagement and interaction. Notably, collaborative learning by teaching (CLBT) is an active learning approach that combines collaborative learning with the learning-by-teaching strategy, requiring students to work in groups to select themes, gather information, and organize content for peer teaching, thereby enhancing their engagement and knowledge acquisition. However, CLBT requires students to plan, monitor, and evaluate collaborative processes by themselves, which may pose challenges for those unfamiliar with their tasks. Thus, socially shared regulation scaffolding can be integrated to offer necessary guidance and support for CLBT implementation.

As a widely adopted tool in collaborative learning, socially shared regulation scaffolding guides students to adjust behavioral and metacognitive conditions together in collaborative tasks, enabling them to manage and improve their entire collaborative process through provided guidance or feedback. However, its application within CLBT and the effect of CBLT have not been thoroughly studied. This exploratory, two-group case study attempts to investigate the effects of CLBT and socially shared regulation scaffolding-supported CLBT on university students, focusing on the following research questions:

RQ1. Does CLBT and socially shared regulation scaffolding-supported CLBT improve university students' group engagement?
RQ2. Does CLBT and socially shared regulation scaffolding-supported CLBT improve university students' motivation?
RQ3. Does CLBT and socially shared regulation scaffolding-supported CLBT improve university students' group metacognition?

Method

To deepen understanding of the research issues and generate meaningful insights, this study adopted a case study design, gathering and analyzing quantitative data. The subsequent sections further detail the participants and study context, task guidance scaffolding (TGS), the design of TGS-supported CLBT activities and CLBT activities, as well as the methodologies employed for data collection.

Participants and Study Context

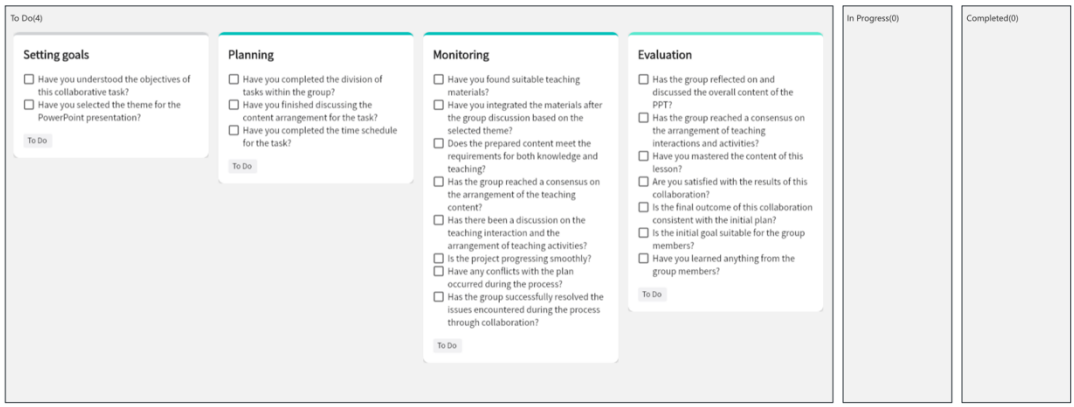
The study was conducted during the fall semester of the 2024–2025 academic year at a normal university in China. Two classes were selected: a CLBT group of 30 students and a TGS-supported CLBT group of 41 students. The CLBT group engaged in CLBT activities without TGS, while the TGS-supported CLBT group engaged in CLBT activities supported by TGS. These students, who were enrolled in the "Modern Educational Technology" course, voluntarily consented to participate in the research. The course, aligned with the prescribed textbook "Modern Educational Technology," covered topics such as the design of PowerPoint and the design of micro-lecture, etc. Before the study, the average GPA of students from both classes over the 2022–2024 period was analyzed, with a corresponding p-value greater than 0.05 ($t = 0.35$, $p = 0.73$), indicating no significant difference in academic performance between

the two classes. To ensure balanced and diverse groups within each class, students were allocated to three to four members using a descending 'S' curve based on their GPA (Chen & Chiu, 2016; Jang, 2010; Yang & Heh, 2007).

Task Guidance Scaffolding

Figure 1 illustrates the task guidance scaffolding, which is a socially shared regulation scaffolding designed to help students set goals, make plans, and monitor and evaluate the entire collaborative process in CLBT. To support the shared regulation in CLBT, this scaffolding, created by using the task card template on the BoardMix platform, comprised three panels: To Do, In Progress, and Completed. The “To Do” panel contains four cards that align with the stages of socially shared regulation: setting goals, planning, monitoring, and evaluation and each card includes guiding questions for each stage. During the task, participants could regulate their learning by checking off the guiding questions and moving cards across panels based on their progress. Additionally, they could set deadlines or fill in summaries of task-related content as needed to facilitate their collaborative tasks in this scaffolding.

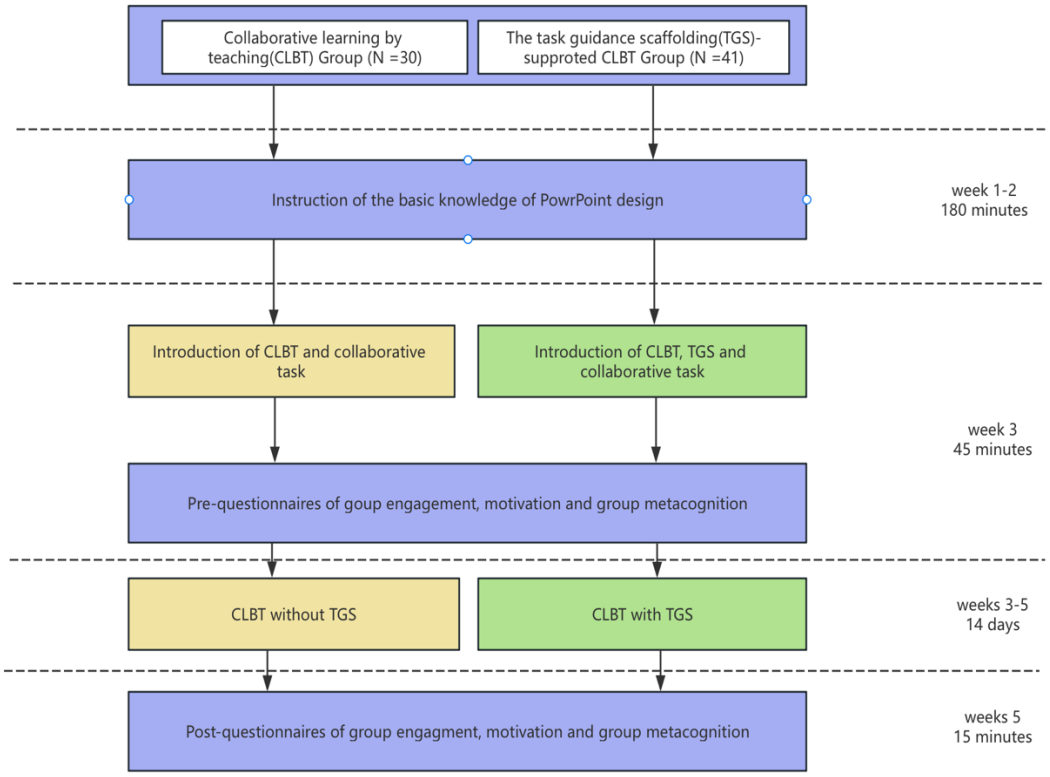
Figure 1
Task Guidance Scaffolding



The Treatment of Two CLBT

Figure 2 illustrates the procedures of the experiment, which spanned 5 weeks. In the first two weeks, the teacher delivered the foundational knowledge on PowerPoint through two 90-minute classes, supplemented with additional materials for self-study. In week 3, the teacher provided the task guidelines in a 5-minute introduction, outlining requirements for students to complete collaborative tasks based on PowerPoint and prepare for the classroom presentation. A 25-minute training session was conducted to support task implementation. The TGS-supported CLBT group was trained in collaborative learning by teaching and a socially shared regulation strategy, while the CLBT group focused exclusively on CLBT. Both groups filled out a 15-minute pre-test questionnaire measuring motivation, engagement, and metacognitive skills within the context of collaborative learning. From weeks 3 to 5, students independently selected topics according to their group assignments and embarked on collaborative learning by teaching tasks for 14 days. By the fifth week, each group conducted a 5–6-minute teaching presentation in class and completed the post-test questionnaires during a 90-minute class. The teaching processes were videotaped by the teacher and subsequently evaluated by two teaching assistants using a standardized grading rubric.

Figure 2
Procedures of the Experiment



Data Collection

To evaluate the impact of CLBT with or without TGS support on group engagement, motivation, and group metacognition, this study delivered a student self-perception questionnaire to collect quantitative data. The questionnaire consisted of three dimensions: group engagement, motivation, and group metacognition. Moreover, group engagement was measured using a self-perception group engagement scale developed and validated by Xu et al. (2024) in a collaborative learning context at the undergraduate level. The scale comprised 31 items, scored on a five-point Likert-type scale from “never” (1 point) to “always” (5 points) and a nine-point semantic differential scale, ranging from “negative” (−4 points) to “positive” (4 points). In this study, Cronbach’s alpha values for the group engagement scale were 0.943 in the pre-test and 0.975 in the post-test, validating the scale’s applicability for assessing student engagement in this research context. Motivation was assessed using 8 items from the scale developed by Pintrich et al. (1993), recorded on a five-point Likert-type scale from strongly disagree (1 point) to strongly agree (5 points). The scale’s validity and reliability were established in collaborative learning by teaching context at the undergraduate level (Zhou & Tsai, 2023). Moreover, the motivation scale’s Cronbach’s alpha values in this study were 0.814 in the pre-test and 0.903 in the post-test, which indicated the scale’s suitability for assessing student motivation in this research context. The metacognition scale, developed by Biasutti and Frate (2018), included 20 five-point Likert-type items. Designed for collaborative learning contexts at the undergraduate level, the scale selected from strongly disagree (1 point) to strongly agree (5 points). The Cronbach’s alpha values of this scale were 0.956 in the pre-test and 0.966 in the post-test, demonstrating the scale’s validity for assessing group metacognition in the present study.

Results

Analysis of Group Engagement

The paired sample t-tests were conducted to evaluate the pre-test to post-test changes in group engagement among university students across two groups, with results displayed in Table 1. The results demonstrated a significant increase in engagement in the CLBT group ($t = 3.401$, $p < 0.01$) and the TGS-supported CLBT group ($t = 3.452$, $p < 0.01$) after students participated in the treatment activities, indicating that both approaches can significantly enhance students' engagement.

Analysis of Motivation

Using the same paired sample t-tests measured by pre-test and post-test data, the study evaluated the motivation of university students. Table 1 shows a significant improvement in motivation in the CLBT group ($t = 2.102$, $p < 0.05$) and the TGS-supported CLBT group ($t = 4.315$, $p < 0.001$) after the treatment activities. These results suggested that the CLBT and TGS-supported CLBT could considerably boost students' motivation.

Analysis of Group Metacognition

As displayed in Table 1, this study quantitatively investigated university students' group metacognition by the paired sample t-tests including pre-test and post-test in two groups. Significant improvements were similarly observed in the CLBT group ($t = 2.843$, $p < 0.01$) and the TGS-supported CLBT group ($t = 3.486$, $p < 0.01$) after students participated in the treatment activities. Such findings indicated that both approaches exert a significantly positive influence on students' group metacognition.

Table 1
Results of Paired Sample t-Tests on Group Engagement, Motivation, and Group Metacognition

Dimensions	Groups	n	Pre-test		Post-test		*t*
			Mean	SD	Mean	SD	
Group engagement	TGS-supported CLBT group	41	3.116	0.737	3.496	0.763	3.452**
	CLBT group	30	3.233	0.695	3.623	0.739	3.401**
Motivaition	TGS-supported CLBT group	41	3.707	0.506	4.055	0.551	4.315***
	CLBT group	30	3.817	0.467	4.000	0.441	2.102*
Group metacognition	TGS-supported CLBT group	41	3.809	0.453	4.102	0.551	3.486**
	CLBT group	30	4.093	0.465	4.275	0.445	2.843**

Note. *$p < .05$; **$p < .01$; ***$p < .001$.

Discussion

The statistical results for RQ1 revealed significant improvements in students' engagement in both CLBT and TGS-supported CLBT groups after completing the treatment activities. This aligns with existing research highlighting CLBT's role in promoting active engagement in the collaborative process (Zhou et al., 2019). A potential explanation is that CLBT necessitates a

deeper understanding of the material, thereby encouraging active participation. In addition, TGS-supported CLBT provided more detailed guidance and approaches to facilitate collaboration. This result is consistent with prior studies that socially shared regulation can improve students' engagement (Zhou & Tsai, 2023).

The results of RQ2 demonstrated that both CLBT and TGS-supported CLBT positively influenced student motivation. This improvement may stem from CLBT's requirement for students to teach their classmates, which likely encouraged a deeper understanding of knowledge and enhanced enthusiasm, as supported by prior research (Zhou et al., 2019). In addition, TGS-supported CLBT promoted motivation by fostering confidence through guided support. This result is consistent with prior studies showing that a socially shared regulation tool could prompt co-regulation in the group and raise awareness of individual motivation and emotions (Järvenoja et al., 2020).

To answer research question RQ3, the results showed that CLBT and TGS-supported CLBT promoted a remarkable improvement in students' group metacognition after they completed the treatment activities. This result is in line with prior studies, indicating that CLBT has the potential to improve students' learning capabilities and teamwork skills, thereby enabling them to regulate groups' collaborative process and improve group metacognition (Zhou et al., 2019). There is a possible explanation for this result: CLBT improved students' engagement and motivation, enabling them to regulate and adjust collaborative processes effectively, which improved students' group metacognition. Additionally, TGS could help students plan, monitor, and evaluate collaborative process, facilitating more effective peer teaching based on CLBT. This result is consistent with prior studies demonstrating that the group metacognitive scaffolding could improve students' group metacognition (Zheng et al., 2019).

Conclusion

This study explored the impacts of CLBT and socially shared regulation scaffolding-supported CLBT on the engagement, motivation, and group metacognition of university students. Results suggested that both approaches appeared to be effective pedagogical approaches in enhancing these aspects. These findings provided valuable insights for higher education practitioners to implement CLBT and socially shared regulation scaffolding-supported CLBT in classroom settings. Despite the study having generated findings with theoretical and practical implications, some limitations should be considered. For example, the sample size was small and was recruited only from one university, and the teaching duration for students in the research design was rather brief. Additionally, the implementation period was confined to merely five weeks. For a deeper comprehension of how CLBT and socially shared regulation scaffolding-supported CLBT function in different contexts and subjects, future research should expand the sample size, extend group teaching time in the research and experimental period, and compare students' learning process and results in both CLBT and socially shared regulation scaffolding-supported CLBT.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine, or correct the content in the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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