

Enhancing Analytical and Critical Thinking Skills through Reflective and Collaborative Learning: A Quasi-Experimental Study

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Abstract: In the context of contemporary higher education, cultivating students' analytical and critical thinking capabilities is essential for their achievement in both academic and professional arenas. Conventional pedagogical approaches frequently fail to adequately support the advancement of these sophisticated cognitive competencies. Recent studies suggest that reflective and collaborative learning methodologies can significantly strengthen these skills. Nevertheless, there remains a paucity of research concerning the overall effects of these educational strategies on university students. This initial investigation seeks to fill this void by assessing a blended instructional model that combines reflective and collaborative learning techniques to enhance the analytical and critical thinking abilities of students at Yunnan University of Traditional Chinese Medicine. The results indicate that this holistic approach not only improves cognitive skills but also fosters a more engaging and effective educational atmosphere. This research provides empirical validation for the incorporation of reflective and collaborative learning, offering valuable insights for curriculum design and instructional practices within higher education.

Keywords: Analytical thinking; Critical thinking; Reflective learning; Collaborative learning; Quasi-experimental study.

1. Introduction

In today's evolving landscape of higher education, fostering analytical and critical thinking skills has emerged as a crucial objective. These competencies empower students to tackle complex problems, make informed decisions, and contribute significantly to their respective fields. However, traditional teaching methods often fall short in cultivating these advanced cognitive abilities effectively. Recent advancements in educational theory suggest that integrating reflective and collaborative learning methodologies can substantially enhance these skills[1].

This study aims to address these gaps by evaluating the effectiveness of an instructional strategy that integrates reflective and collaborative learning to enhance analytical and critical thinking skills. The primary research questions guiding this investigation are: (1) To what extent does the integrated approach improve students' analytical thinking skills? (2) How does it enhance their critical thinking skills? (3) What are students' perceptions of the effectiveness of this instructional method?

This research is significant as it seeks to provide empirical evidence supporting the integration of reflective and collaborative learning. Demonstrating the efficacy of this combined approach could influence curriculum design and instructional practices, thereby advancing more effective educational strategies in higher education. Beyond academia, fostering these critical thinking skills equips students to excel in their professions and engage as informed citizens in an increasingly complex global environment.

2. Literature Review

2.1. The Latest Research Progress

Recent studies have explored the efficacy of reflective and collaborative learning in diverse educational contexts.

Community of Inquiry framework emphasizes the significance of reflective and collaborative methods in facilitating profound and meaningful learning experiences. This framework highlights the interconnectedness of cognitive, social, and teaching presence in promoting advanced levels of thinking.

Reflective learning has been widely studied for its impact on critical thinking. [2] he conducted a longitudinal study indicating that reflective learning practices significantly enhance students' critical thinking abilities over time. Similarly[3],it's meta-analysis demonstrated that reflective learning strategies lead to improved knowledge retention and application. Integrating reflective and collaborative learning has been proposed as a method to maximize the benefits of both approaches. Zhu&Baylen explored the integration of these methods in a digital learning environment, finding substantial improvements in students' analytical and critical thinking skills[4]. Their research suggests that combining reflective and collaborative practices creates a more engaging and effective learning experience.

2.2. Existing Problems and Future Research Directions

Integrating reflective and collaborative learning holds significant promise for improving analytical and critical thinking skills in higher education. Although existing research underscores the potential benefits of these approaches, considerable gaps and challenges persist. Future research should focus on conducting longitudinal studies, developing standardized frameworks, and identifying the specific mechanisms by which these methods enhance higher-order thinking skills. Additionally, investigating the role of technology and the applicability of these methods in various educational contexts can yield deeper insights and assist educators in designing more effective instructional strategies. Addressing these gaps can enhance pedagogical approaches

that promote analytical and critical thinking skills in higher education.

3. Methodology

3.1. Research Design

We employed an equivalent control group design with a significance level (α) set at 0.05. After the first instructional management plan, we conducted pre-tests for the experimental and control groups separately to assess their basic analytical thinking skills and critical thinking skills for subsequent comparative analysis. The study lasted for 20 instructional management plans, and after the 20th instructional management plan, we conducted a post-test to evaluate the therapeutic effect of the instructional approach.

3.2. Research Variables

Research variables are composed of: Independent variable is instructional approach that categorized in two conditions, the first learning based on collaborative learning and reflective learning and the second context was assigned with learning through the traditional approach. Dependent variables are analytical thinking and critical thinking skills of students.

3.3. Research Population and Sample

Research population are higher education students who are studying at Yunnan Medical Health College in Chinese, in the academic year 2023, that assigned with the total of 120 students. Research Samples composed of two groups of students those are studying in higher education of Yunnan Medical Health College, to identify in experimental group and control group which are 30 and 32 students respectively, that assigned through cluster random sampling method.

3.4. Research Instructional Model

The instructional model combines collaborative learning and reflective learning to create a dynamic educational framework (see Figure 1). Students are organized into diverse teams, leveraging their collective strengths to explore topics deeply and solve complex challenges. Following each collaborative endeavor, students engage in reflective exercises, evaluating their contributions and refining their problem-solving strategies. Through integration and presentation, students demonstrate their collective understanding, fostering a collaborative spirit while honing individual analytical thinking and critical thinking skills.

(1) Step 1: Establish Goals and Themes

The teacher clearly defines the learning objectives and themes for the course, ensuring they align with the desired analytical and critical thinking outcomes. Students are introduced to these goals and themes at the beginning of the course. This includes a detailed explanation of what is expected from them and how the learning activities will help achieve these goals. Students articulate their learning expectations and identify their initial understanding of the course themes through a preliminary discussion or survey.

(2) Step 2: Team Formation

The teacher forms diverse teams, considering students' backgrounds, skills, and interests to ensure a variety of perspectives within each group. Group sizes are kept small (3-5 members) to facilitate effective collaboration and communication. An ice-breaking activity or a team-building exercise is conducted to help students become comfortable

with their team members and establish a positive group dynamic.

(3) Step 3: Exploration Phase

Each team researches the assigned theme, collecting relevant information from various sources such as textbooks, academic journals, online resources, and expert interviews. Teams share their existing knowledge and preliminary findings with one another through structured discussions or presentations. The teacher provides guidance on effective research methods and sources, ensuring that students understand how to evaluate the credibility and relevance of the information they gather.

(4) Step 4: Collaborative Practice

Teams collaboratively work on problem-solving tasks or projects related to the course themes. These tasks are designed to challenge their analytical and critical thinking skills. Each team member is assigned specific roles or responsibilities to ensure active participation and accountability. The teacher monitors the group activities, providing support and feedback as needed to facilitate productive collaboration and effective problem-solving. Tools such as collaborative software, online discussion forums, and shared digital workspaces may be used to enhance teamwork and coordination.

(5) Step 5: Reflection and Discussion

After completing their tasks, teams reflect on their collaborative process and outcomes. This reflection includes evaluating what worked well, what challenges they faced, and how they could improve. The entire class participates in a reflective discussion, where each team shares their experiences, insights, and solutions. The teacher facilitates this discussion, encouraging students to critically analyze their experiences and learn from each other's perspectives. Students may use reflection journals or digital logs to document their thoughts and progress throughout the course.

(6) Step 6: Integration and Presentation

Teams integrate their findings and solutions into a comprehensive work or presentation. This involves synthesizing the information they have gathered and the conclusions they have drawn. Each team presents their integrated work to the class, showcasing their collective understanding and problem-solving strategies. The teacher and peers provide constructive feedback on the presentations, focusing on the depth of analysis, the clarity of arguments, and the effectiveness of the solutions proposed. Presentations may include various formats such as reports, multimedia projects, or interactive demonstrations.

(7) Step 7: Summary and Evaluation

The teacher and students jointly review the learning process, summarizing the goals achieved and the outcomes obtained. Students evaluate their own learning and the overall effectiveness of the instructional model. This may involve completing self-assessment questionnaires or participating in focus group discussions. The teacher provides a summary of the course, highlighting key insights and areas for improvement based on the students' feedback.

(8) Step 8: Reflection and Feedback

The teacher guides students in reflecting on the entire teaching process, considering their learning outcomes and personal growth. Individual and team feedback sessions are conducted, where the teacher provides tailored feedback to each student and team, acknowledging their strengths and suggesting areas for improvement. Continuous improvement is encouraged by discussing how the skills and knowledge

gained can be applied in future learning scenarios or professional contexts.

3.5. Ethical issues

Before commencing this study, we obtained consent from Yunnan Medical Health College in China and Nakhon Phanom University in Thailand. Subsequently, we provided detailed research information to school administrators and teachers participating in the intervention study, and obtained their consent.

4. Results

4.1. Participants

The study sample consisted of college students from Yunnan Medical and Health College in China. Participants in both the experimental and control groups had an average age of approximately 19.5 years, with ages ranging from 19 to 20 years. The gender distribution of participants was as follows:

Table 1. Participants information

Items	Number	Number(Male)	Number(Female)
Sample size	62	33	29
Experimental group	30	18	12
Control group	32	15	17

4.2. Analysis of Homogeneity

Initially, an independent samples t-test was performed on the pre-test scores of both treatment groups. The average scores on the pre-test among students in the experimental

group were found to be similar to those of the control group and displayed no significant disparity. As illustrated in Table 2, the t-test outcomes ($t=-0.74$, $t=-1.04$, $p>0.05$) did not attain statistical significance, suggesting that the variations in the pre-test scores between the treatment groups were minimal.

Table 2. Comparison of pre-test

Item Classification	Group	M	SD	t	df	p
Analytical thinking skills	Experimental Group	75.83	7.70	-0.74	61	0.47
	Control Group	77.28	7.80			
Critical thinking skills	Experimental Group	75.38	7.44	-1.04	61	0.31
	Control Group	77.31	7.24			

* $P<0.05$

4.3. Hypothesis Testing

4.3.1. Hypothesis Testing I

College students who engaged in an instructional approach

incorporating collaborative and reflective learning exhibited higher post-intervention levels of analytical and critical thinking skills compared to their pre-intervention levels.

Table 3. Comparison of pre-test and post-test in the experiment group

Students' Scores in Different Tests	M	SD	t	df	p
Pre-test of analytical thinking skill	75.83	7.70	-22.66	29	0.000*
Post-test of analytical thinking skill	87.37	6.11			
Pre-test of critical thinking skills	75.38	7.44	-22.73	29	0.000*
Post-test of critical thinking skills	87.53	6.42			

* $P<0.05$

A Paired Sample T-Test was conducted on the same cohort of students to assess whether there existed a significant discrepancy in the average test scores between two assessments administered at distinct time intervals. The results of the Paired T-Test presented in Table 3 unveil a noteworthy disparity in scores between the two assessments: $t(29) = -22.66$, $t(29) = -22.73$, with $p < 0.05$. On average, students achieved higher scores on the second assessment compared to the initial one. Notably, with mean differences (MD) of 11.54 and 12.15, and pooled standard deviations approximately 6.91 and 6.93 respectively, the effect sizes (d) were calculated to be 4.14 and 4.15. These effect sizes, as delineated by Cohen (1988), indicate a large effect size.

Consequently, students who participated in the instructional approach centered around collaborative learning and reflective practices demonstrated heightened levels of both analytical thinking and critical thinking skills post-learning, compared to their pre-learning levels.

4.3.2. Hypothesis Testing II

College students who participated in the instructional approach based on collaborative learning and reflective learning showed significant differences in post-analytical thinking and critical thinking skills compared to the control group.

Table 4. Comparison of post-test scores between experimental and control Groups

Item Classification	Group	M	SD	t	df	p
Analytical thinking skills	Experimental Group	87.37	6.11	3.47	61	0.000*
	Control Group	81.25	7.62			
Critical thinking skills	Experimental Group	87.53	6.42	3.77	61	0.000*
	Control Group	81.48	6.23			

*P<0.05

An Independent Sample T-Test was conducted to evaluate significant differences between instructional approaches (specifically, an approach based on collaborative learning and reflective practices versus traditional teaching methods) concerning college students' analytical thinking and critical thinking skills. As depicted in Table 4, a notable disparity in test scores for both analytical thinking and critical thinking skills emerged among the sampled students based on the differing teaching approaches, with $t(61) = 3.47$ and $t(61) = 3.77$, respectively, and $p < 0.05$. On average, students engaged in the instructional approach grounded in collaborative learning and reflective practices exhibited superior performance in analytical thinking and critical thinking skills compared to those subjected to traditional teaching methods.

With a mean difference (MD) of 6.12 and 6.05, and pooled standard deviations approximately 6.87 and 6.33 respectively, the effect sizes (d) were calculated to be 0.88 and 0.96, aligning with Cohen's (1988) criteria for a large effect size. Consequently, students participating in the instructional approach based on collaborative learning and reflective practices demonstrated heightened levels of both analytical and critical thinking skills in contrast to those enrolled in traditional teaching methods.

5. Conclusion

Integrating reflective and collaborative learning holds significant promise for enhancing analytical and critical thinking skills in higher education. The results of this study offer empirical support for the effectiveness of this combined approach, showing considerable improvements in students' cognitive abilities. Nevertheless, addressing the limitations and investigating the proposed future research directions are essential for furthering our understanding and

implementation of these instructional methods.

By conducting longitudinal studies, standardizing frameworks, exploring the integration of technology, and investigating the role of teacher training, future research can provide deeper insights and help educators design more effective instructional strategies. Ultimately, enhancing analytical and critical thinking skills through reflective and collaborative learning can equip students to excel in their professions and engage as informed citizens in an increasingly complex global environment.

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