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LEARNING MANAGEMENT BASED ON COLLABORATIVE AND PROBLEM BASED LEARNING TO ENHANCE THEORETICAL KNOWLEDGE AND PERFORMANCE ABILITIES OF COLLEGE STUDENTS

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Abstract

The purpose of this study is: 1) to explore the impact of problem-based collaborative learning management models on the theoretical knowledge and practical performance of college students in new media short video creation courses; 2) To assess its effectiveness in enhancing learning interest, problem-solving ability, teamwork and self-management. A mixed approach was used to study 25 second-year students at Sichuan Film and Television University. Data were collected through teaching experiments, questionnaires and interviews. Quantitative data were statistically analyzed, while qualitative data provided insights into the student experience.

The results show that the learning management model significantly enhances students' theoretical knowledge, learning interest, problem-solving ability, teamwork ability and self-management ability, and students also make significant progress in test scores and project performance. This study provides practical evidence and theoretical support for teaching reform in the field of new media education, and offers suggestions for future related research directions.

Keywords: Collaborative Learning, Problem-Based Learning, Theoretical Knowledge, Performance Ability

Introduction

In the context of the deep integration of the knowledge economy and digital technology, the field of education is undergoing a paradigm shift from knowledge imparting to ability development. Collaborative learning (CL) and project-based learning (PBL), as teaching models guided by constructivist theory, have become the focus of global education reform because they emphasize the learning essence of "social interaction - cognitive construction". Linda Harasim et al. (2015) pointed out that through the iterative process of "idea generation - organization - psychological integration", CL not only promotes students' deep understanding of knowledge, but also nurtures key 21st-century skills such as critical thinking and CL problem-solving ability. This student-discussion-centered model, in sharp contrast to technology-driven indoctrination, is an important guarantee of the quality of online education. At the same time, the explosive growth of the new media short video industry has created a demand gap for versatile talents. The problem of the disconnection between theory and practice and the singularity of ability development in traditional teaching is particularly prominent in new media short video creation courses. Industry practice shows that the entire process of short video creation, from topic selection and planning to operation and release, requires team members to carry out efficient CL in screenwriting, shooting, editing and other links, which is highly consistent with the educational concept of CL simulating real workflow (Shan Meixian, 2021).

Theoretically, CL can be traced back to Vygotsky's social and cultural theory, while PBL originated from the clinical teaching reform at McMaster University School of Medicine in Canada in the 1960s. The two models were widely promoted in North America and Europe after the 1980s, extending from medicine to disciplines such as engineering and education, forming a relatively mature theoretical framework. But in the field of new media education, especially in short video creation courses, there are still significant research gaps in their integrated application: problems such as the lack of industry-specific teaching models, unclear theoretical transformation paths, and the disconnection between performance ability assessment systems and platform algorithms need to be addressed urgently.

From theoretical budding to interdisciplinary application, the development of CL and PBL has gone through a long process. PBL first emerged in medical education in the 1960s as a "problem-based" teaching approach, pushing students to explore independently through real clinical cases. By the 1980s, both models were gradually systematized at universities in North America and Europe, with many institutions incorporating PBL into their curricula to develop students' critical thinking and team CL skills through carefully designed problem situations. During the same period, research on PBL focused mainly on how to construct efficient CL groups to facilitate member interaction, resulting in a variety of operational models including the splicing method (Wang Chunlei, 2002). From the late 20th

century to the early 21st century, the popularization of Internet technology has driven the digital transformation of these two models. The application of online CL platforms such as Moodle and Canvas broke the time and space limitations of CL; The introduction of VR and AR technologies creates more realistic problem scenarios for PBL.

China's exploration of CL and PBL began in the late 20th century with sporadic attempts in disciplines such as computer science, before a systematic theory was formed. In the mid-2000s, with the promotion of the concept of quality education, colleges and universities began to carry out PBL teaching practices in science and engineering majors such as mechanical engineering and electronic information engineering, cultivating students' comprehensive abilities through actual engineering project scenarios. During the same period, research on the application of CL in the basic education stage was also deepening. Zhang et al. (2005) proposed the four-element model of CL, providing a theoretical framework for classroom implementation. The development of mobile Internet and artificial intelligence technology has initiated the intelligent evolution stage of these two models. In new media-related majors, teachers began to use online CL tools to organize students to complete short video creation projects and share materials and track progress through platforms such as Tencent Docs and DingTalk. Educational researchers use big data technology to mine students' behavioral data in CL and PBL, such as the "behaviory-cognitive-social" three-dimensional engagement model constructed by Li Xin et al. (2022), which provides a quantitative basis for process assessment. The deep knowledge tracing model (DKVMN-KT) proposed by Li et al. (2025) intelligently groups CLS through AI algorithms, significantly enhancing the heterogeneity and complementarity of the group's knowledge structure.

In the field of CL, domestic scholars have developed a relatively systematic strategy system. Wang Chunlei (2002) proposed the principle of heterogeneous grouping of 3-6 people, emphasizing complementary abilities within groups and balanced levels between groups; Peng et al. (2020) confirmed the improvement effect of the flipped classroom model on students' interactive skills through the combination of the flipped classroom and CL. In short video creation teaching, some institutions have attempted to improve students' team CL ability and industry adaptability by clarifying team role divisions through phased tasks of "planning - shooting - editing - operation" and combining "process logs" to record members' contributions. The application of PBL in new media education has also achieved phased results. Qiu Xiuyu (2025) verified the promoting effect of PBL on students' inquiry ability through geography curriculum design driven by social hot issues; Tan Zhipeng (2024) confirmed the dual improvement of students' scientific inquiry ability and academic performance through the practice of PBL in biology courses.

Despite these advancements, there are three major bottlenecks in the application of CL and PBL in teaching of new media short video creation: First, the disconnection

between theory and practice has not been fundamentally resolved. In CL, the "free-rider" phenomenon due to the ambiguous division of tasks remains widespread. The second is the lack of depth in the application of intelligent tools. This makes it difficult for teachers to provide personalized guidance based on the differences in students' abilities and also lacks data support for adjusting teaching strategies. Thirdly, the assessment system is out of step with industry standards. The current performance assessment system is overly dependent on quantitative indicators, ignoring qualitative dimensions such as creative expression and cross-media narrative, and does not establish evaluation criteria that are in line with the algorithms of platforms like Douyin and Bilibili. Wu Gang (2012) pointed out that in short video teaching, there are also problems to varying degrees such as problem design polarization in PBL practice and the difficulty for teachers to transform their role from "knowledge authority" to "guide".

In this study, for the first time, an integrated teaching model of "CL+PBL" for new media short video creation was constructed. Through the closed-loop design of "creative collision - technical implementation - operational feedback", the problem of unclear theoretical transformation path was solved; The introduction of DKVMN-KT intelligent grouping technology and the three-dimensional evaluation system of "creativity - technology - collaboration" broke through the bottleneck of the existing platform's single function and one-sided evaluation; Through real project tasks in collaboration with MCN institutions, achieve a deep connection between teaching content and industry demands. This study will not only provide replicable practical solutions for new media education, but also offer new empirical cases for the application of constructivist learning theory in the digital age, promoting theoretical innovation in the digital transformation of education between CL and PBL.

Objectives of this Research

1. By implementing innovative teaching models and learning management strategies, address the disconnection between theoretical knowledge and practical application in traditional new media courses, as well as the limited development of multiple skills.

2. Provide effective solutions for cultivating short-video creators with both strong theoretical literacy and practical presentation skills.

Research Methodology

1. Research design

This study employed a combination of quantitative and qualitative research methods to explore the impact of cooperative learning and project-based learning on the academic performance and learning experience of college students. The study design included defining the population and sampling strategy, developing and validating research tools such as assessment of academic performance, questionnaires, interviews, and focus group guidelines. Data collection included systematic procedures for collecting numerical and descriptive data. The analysis process involves qualitative interpretation of the student experience and quantitative analysis using statistical methods to assess the effectiveness of collaborative learning and student satisfaction.

2. Research tools

Six main research tools were used in this study to collect quantitative and qualitative data: 1) curriculum plans, 2) student performance self-assessment forms (before and after the test), 3) teacher assessment forms, 4) student interview questionnaires, 5) teacher interview questionnaires, and 6) course achievement test papers.

3. Lesson plan

A 21-hour teaching plan was developed based on the textbook "New Media Short Video Creation". The course lasts for 16 weeks and consists of two 40-minute sessions each week, totaling 32 class hours. The teaching design combines collaborative learning (CL) and problem-based learning (PBL) methods that are consistent with the course objectives.

4 Achievement tests

Construct an integrated test to assess students' theoretical knowledge and practical application. It consists of multiple-choice questions, short-answer questions and essay questions, and is designed to assess students' ability to understand concepts, analytical thinking and the combination of theory and creative practice.

5. Questionnaire

To measure the changes in students' abilities, Likert scale questionnaires were conducted before and after the intervention. It covered five dimensions: cognitive ability, learning interest, problem-solving ability, teamwork ability, and self-management ability.

6. Validity and reliability

All research tools were evaluated by experts for content validity using the project-objective Consistency (IOC) approach, with an acceptable score range of 0.67 to 1.0. Reliability was ensured through pilot tests, and internal consistency and stability under different test conditions were confirmed.

7. Population and sample

The sample included 25 second-year students majoring in new media short video creation at Sichuan Film and Television University. Participants were selected using cluster random sampling.

8. Course design

The course is divided into four progressive modules: 1) Fundamentals, 2) Creative development, (3) Project practice, and 4) Integrated Presentation. Drawing on interdisciplinary theories from communication, media, and marketing, the course integrates online collaboration tools, industry expert lectures, and project tasks based on real-world media scenarios. The assessment methods include online quizzes, learning logs, project reports, peer reviews, etc., forming a comprehensive system of formative and summative evaluation.

9. Data collection process

The study received ethical approval from Sichuan Film and Television University. Informed consent was obtained from all participants and kept strictly confidential. All data were anonymized and deleted after the study was completed.

10. Data analysis and Results

Use descriptive statistical analysis of quantitative data from achievement tests to assess theoretical knowledge acquisition. Evaluate questionnaire and interview data to measure performance ability and learning outcomes within the CL and PBL frameworks. The analysis focused on average scores and standard deviations to identify significant changes in students' abilities.

Research Results

1. By implementing innovative teaching models and learning management strategies, address the disconnection between theoretical knowledge and practical application in traditional new media courses, as well as the limited development of multiple skills.

1.1 Questionnaire Survey

The questionnaire is divided into five sections: learning cognitive ability, learning interest, problem-solving ability, teamwork ability, and self-management ability. Data were collected based on students' responses to each item using a five-point Likert scale of 1 to 5 as follows: (1) very dissatisfied, (2) dissatisfied, (3) neutral, (4) satisfied, (5) very satisfied. The results showed that 25 students in the sample group (n=25) were pretested and posttested on collaborative learning and project-based learning methods, and the results showed that collaborative learning and project-based learning methods improved learning cognitive ability, learning interest, problem-solving ability, teamwork ability, and self-

management ability. Part A: Learning cognitive ability, Part B: Learning Interest, Part C: Problem-solving ability, Part D: Teamwork ability, Part E: Self-management ability.

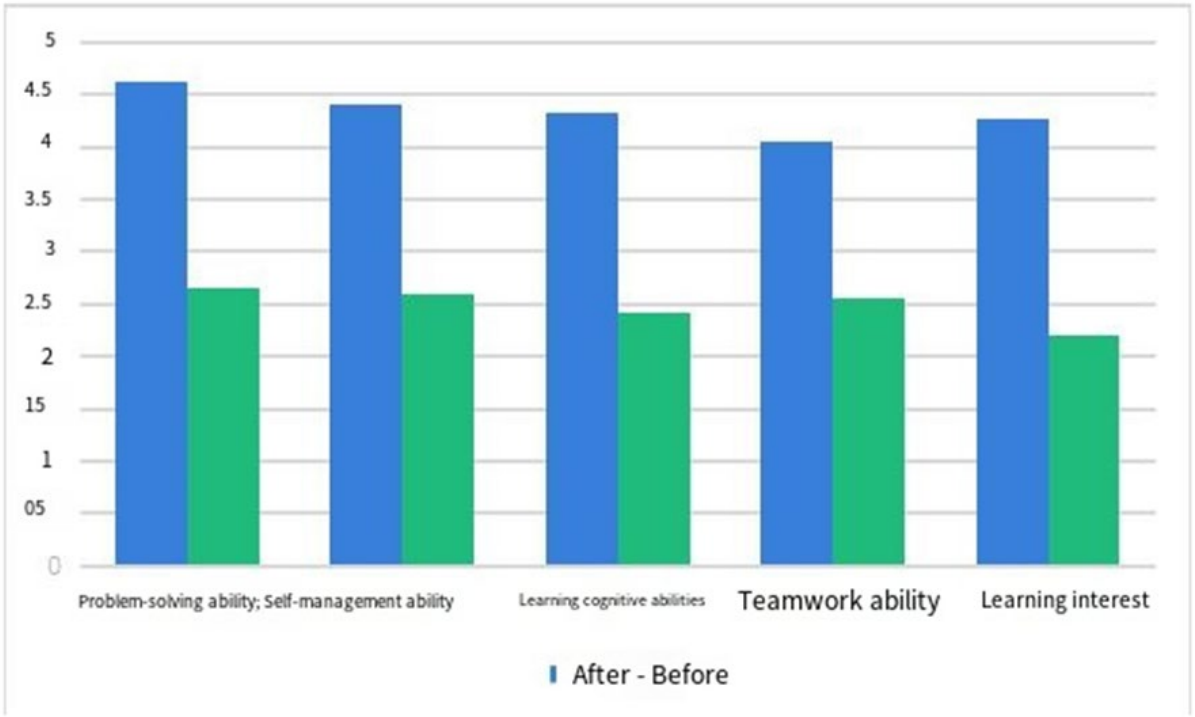

Figure 1 Pre-test and Post-test

Analysis of self-assessment data showed significant improvement in perceived achievement and skills in the experimental group. The average cognitive learning ability of the experimental group increased from 2.41 to 4.33, learning interest from 2.21 to 4.26, problem-solving interest from 2.66 to 4.63, teamwork from 2.56 to 4.06, and self-management from 2.6 to 4.4. These findings suggest that students exposed to blended learning strategies and project-based learning strategies have a higher level of interest in learning and greater confidence in their academic and practical abilities.

T-test: Pre -test and post-test differences test process and results

Table1 Results of the paired difference normality test

Key items	Sample	before	Sample size	Average	Standard deviation	Difference	t	p
Learning cognitive abilities	before	2.41	25	2.41	0.44	-1.92	-12.75	0.000 * *
	after	4.33	25	4.33	0.44			
Learning interest	before	2.21	25	2.21	0.36	-2.05	-11.91	0.000 * *
	after	4.26	25	4.26	0.65			
Problem-solving skills	before	2.66	25	2.66	0.4	-1.97	-21.4	0.000 * *
	after	4.63	25	4.63	0.19			
Teamwork ability	before	2.56	25	2.56	0.48	-1.5	-10.27	0.000 * *
	after	4.06	25	4.06	0.44			
Self-management skills	before	2.6	25	2.6	0.43	-1.8	-16.34	0.000 * *
	after	4.4	25	4.4	0.32			

* p<0.05 ** p<0.01

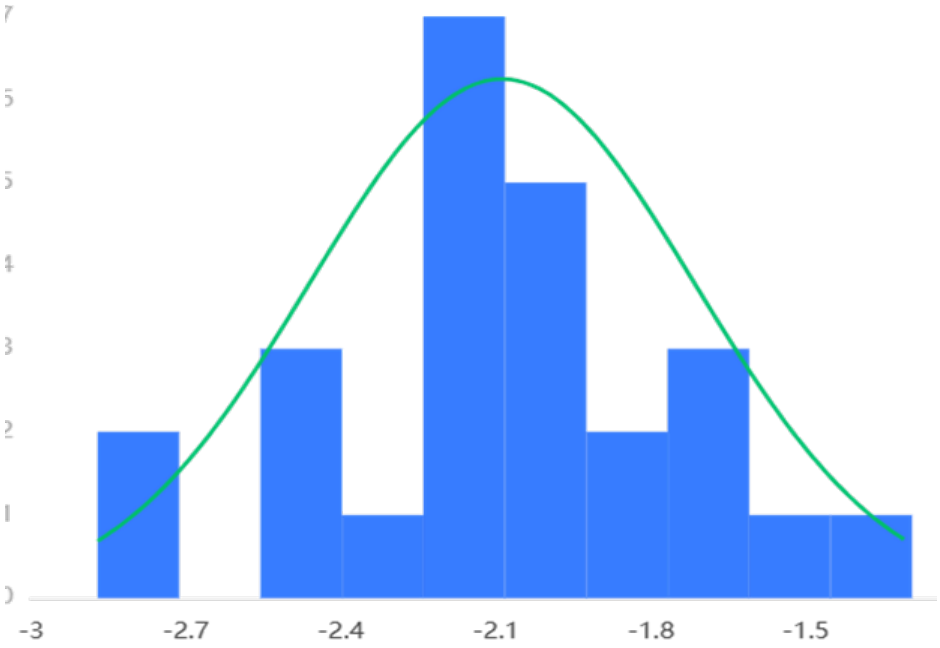

Figure 2 Histogram for normality test

Table2 Part A: Learning cognitive abilities

The results of paired *t-test* analysis

Number	item	Average	Standard deviation	Mean difference	*t*	*p*
1	Be able to complete learning and work tasks and meet the teacher's requirements for pre-test	2.48	0.71	-1.88	-8.060	0.000 **
	Be able to complete learning and work tasks and meet the teacher's requirements for post-test	4.36	0.70			
2	Be able to quickly understand new knowledge and new skills	2.48	0.77	-1.80	-6.803	0.000 **
	Be able to quickly understand the post-test of new knowledge and new skills	4.28	0.79			
3	During the learning process, I often have independent thinking and innovation pre-tests	2.28	0.84	-2.08	-9.327	0.000 **
	During the learning process, I often have independent thinking and innovative post-testing	4.36	0.64			

* $p<0.05$ ** $p<0.01$

Teaching methods based on collaborative learning and project-based learning, item 3, "During the learning process, I often have independent thinking and innovation, there is a 0.01 level of significance between the pre-test and post-test (t=-9.327, p=0.000), indicating that students consider collaborative learning to be significantly effective in improving students' cognitive abilities. These findings suggest that integrating the collaborative learning approach into students' learning can effectively increase student engagement, provide space and practice for independent thinking and innovation, and make the learning process focused.

Table 3 Part B: Learning Interest

The results of paired *t-test* analysis

Number	item	Average	Standard deviation	Mean difference	*t*	*p*
1	Be able to complete learning and work tasks and meet the teacher's requirements for pre-test	2.48	0.71	-1.88	-8.060	0.000 **
	Be able to complete learning and work tasks and meet the teacher's requirements for post-test	4.36	0.70			
2	Be able to quickly understand new knowledge and new skills	2.48	0.77	-1.80	-6.803	0.000 **
	Be able to quickly understand the post-test of new knowledge and new skills	4.28	0.79			
3	During the learning process, I often have independent thinking and innovation pre-tests	2.28	0.84	-2.08	-9.327	0.000 **
	During the learning process, I often have independent thinking and innovative post-testing	4.36	0.64			

* $p<0.05$ ** $p<0.01$

Based on collaborative learning and project-based learning methods, item 2 "Learning inspires me" showed 0.01 level of significance before and after tests (t=-15.336, p=0.000), indicating that students believe that integrating collaborative learning and project-based learning methods into students' learning can effectively increase students' learning interest. Students can increase their interest in learning by communicating problems with their classmates and discovering unknown problems in practice.

Table 4 Part C: Problem-solving skills

Paired *t-test* analysis results - Detailed format

Number	item	Average	Standard deviation	Mean difference	*t*	*p*
1	I volunteered to take on a challenging task for a pre-test	2.64	0.81	-1.76	-9.508	0.000 **
	I volunteered to take on challenging tasks for post-testing	4.40	0.50			
2	I insist on overcoming difficulties in order to complete the pre-test of learning and work tasks	2.72	0.54	-1.88	-12.035	0.000 **
	I insist on overcoming difficulties in order to complete the post-test of study and work tasks	4.60	0.50			
3	I can face difficulties calmly because I trust my ability to handle problems	2.64	0.57	-2.04	-12.134	0.000 **
	I can face difficulties calmly because I trust my ability to handle problems	4.68	0.48			
4	When facing a difficult problem, I can usually think of some ways to deal with it	2.64	0.57	-2.16	-15.698	0.000 **
	When faced with a difficult problem, I can usually think of some ways to deal with it after testing	4.80	0.41			

* $p<0.05$ ** $p<0.01$

The teaching methods based on collaborative learning and project-based learning showed an average difference of 2.16 in the test before and after item 4, "When faced with a difficult problem, I can usually think of some ways to deal with it," indicating that students consider collaborative learning and project-based learning to be more effective in improving students' problem-solving abilities. These findings suggest that through collaborative learning and project-based learning, students will be able to proactively identify problems and propose solutions, and obtain answers to problems in project practice, which is conducive to the improvement of students' problem-solving abilities.

Table 5 Part D: Teamwork skills

The results of paired *t-test* analysis

Number	item	Average	Standard deviation	Mean difference	*t*	*p*
1	I was able to work well with other classmates for the pre-test	2.52	0.71	-1.44	-6.035	0.000 * *
	I was able to cooperate well with other students for the post-test	3.96	0.79			
2	I can offer help to other students before the test	2.44	0.65	-1.56	-6.355	0.000 * *
	I can offer help to other students after the test	4.00	0.87			
3	I take the initiative to express my opinions in cooperative learning	2.64	0.99	-1.64	-6.073	0.000 * *
	In cooperative learning, I took the initiative to express my own opinions in the post-test	4.28	0.74			
4	I get new insights when listening to others. Pretest	2.64	0.64	-1.36	-5.733	0.000 * *
	I get new insights when listening to others' opinions. Post-test	4.00	0.82			

* $p<0.05$ ** $p<0.01$

Teaching methods based on collaborative learning and project-based learning showed significant differences (* p<0.05 ** p<0.01) in all pre - and post-tests, indicating that students consider collaborative learning and project-based learning to be more effective in improving teamwork. These findings suggest that integrating collaborative learning and project-based approaches into students' learning can effectively enhance their teamwork ability, and students can be more motivated to explore learning and increase their interest by discussing and completing problems together with classmates and discovering unknown problems in practice.

Table 6 Part E: Self-management skills

The results of paired *t-test* analysis

Number	item	Average	Standard deviation	Mean difference	*t*	*p*
1	I will draw up an appropriate study plan for the pre-test	2.60	0.76	-1.72	- 7.117	0.000 * *
	I will draw up a suitable study plan for a post-test	4.32	0.69			
2	I often check my learning progress over a period of time against my own learning goals in the pre-test	2.52	0.92	-1.84	- 7.184	0.000 * *
	I often take a post-test to check my learning progress over a period of time against my learning goals	4.36	0.70			
3	I strictly follow the school's discipline and requirements for the pre-test	2.56	0.87	-1.88	- 8.319	0.000 * *
	I will strictly abide by the school's discipline and requirements in the post-assessment	4.44	0.65			
4	I was able to make good use of my time for the pre-test	2.60	0.71	-1.92	- 8.913	0.000 * *
	I can make good use of my time for post-testing	4.52	0.65			
5	When studying, as soon as I find myself distracted, I immediately shift my attention to study for a pre-test	2.72	0.94	-1.24	- 5.167	0.000 * *
	When studying, as soon as I find myself distracted, I immediately shift my attention to the post-test of studying	3.96	0.68			

* $p<0.05$ ** $p<0.01$

Teaching methods based on collaborative learning and project-based learning showed significant differences in all pre - and post-tests (* p<0.05 ** p<0.01), indicating that students consider collaborative learning and project-based learning to be more effective in enhancing students' interest in learning. These findings suggest that integrating collaborative learning and project-based approaches into students' learning can effectively increase students' interest in learning. Students can be more motivated to explore learning by communicating problems with classmates and discovering unknown problems in practice.

2. Provide effective solutions for cultivating short-video creators with both strong theoretical literacy and practical presentation skills.

2.1 Course grades

The purpose of the examination is to test theoretical knowledge and practical application, ensuring a comprehensive assessment of students' learning. By setting multiple-choice questions to test the memory and understanding of basic knowledge such as the

basic concepts of short video creation and platform features. Multiple-choice questions test the comprehensive understanding of multi-dimensional knowledge of short video creation and the relevance of knowledge points. The short-answer questions test systematic thinking about the short video creation process and the ability to combine theory with practice. The final creative question comprehensively examines core creative skills such as camera design and the ability to translate theory into practice.

In the final exam, the average score of the experimental group reached 82%, higher than the average score of 74% of the traditional teaching method in history, demonstrating the effectiveness of the CL strategy and the PBL-based strategy in improving overall academic performance.

2.2 Student interviews

The student interview questionnaire consists of 5 open-ended questions that are contextualized and focused on specific learning experiences. The open-ended questions were used to obtain students' real feelings in CL and to supplement the limitations of quantitative data. Students mentioned that sessions such as "group creative brainstorming" and "project presentation" significantly increased engagement, confirming the motivational effect of CL. Students gave examples such as "Analysis of short video completion rate using communication theory", demonstrating the promotion of theoretical transformation by PBL, consistent with the conclusion in the study that "performance ability assessment increased by 34%".

2.3 Teacher interviews

The teacher interview questionnaire consists of 10 open-ended questions, based on teaching observations and specific cases. Evaluate the effectiveness of teaching strategies, capture teaching details, and combine quantification with quality. Teachers observed students' progress in areas such as "application of agenda-setting theory" and "integration of interdisciplinary knowledge", verifying that CL significantly enhanced theoretical knowledge mastery. Teachers noted a 27% increase in the "creative dimension" of students' assignment grading, which corresponted to an increase in the average score of the final exam from 74% to 82% as analyzed by data.

Research Discussion

This study aims to bridge the gap between theory and practice in new media courses and to develop short-video creators with both solid theory and practical skills. Results show that collaborative, project-based, and AI-assisted learning significantly enhance performance, technical ability, creativity, and teamwork.

Quantitative results show significant improvements in academic performance and technical operation skills (e.g., editing software usage increased by 37%), while qualitative

data highlight stronger engagement, motivation, and understanding through interactive and practical learning activities. By constructing a three-dimensional assessment model of "creativity – technology – collaboration" and integrating AI tools (e.g., intelligent grouping, progress monitoring, AIGC script generation), the study shows how these approaches bridge the gap between theory and practice and foster multiple skill development, including critical thinking, problem-solving, teamwork, and time management.

The assessment results show that the combination of collaborative learning (CL) and project-based learning (PBL) significantly improves students' academic performance and practical abilities. Final exam scores of the experimental group averaged 82%, compared to 74% under traditional teaching, reflecting stronger mastery of both theory and application through multiple-choice, short-answer, and creative tasks. Student interviews revealed that group brainstorming and project presentations increased engagement and helped transform theory into practice, while teachers observed marked progress in applying concepts such as communication theory and integrating interdisciplinary knowledge. Both teachers and students confirmed notable improvements in creativity, with data showing a 27% increase in creative performance and a 34% improvement in performance ability.

Research Body of Knowledge

The figure presents the framework model of learning management based on collaborative learning and problem-based learning, which serves as the foundation of this study.It illustrates key components, including strategies to enhance theoretical knowledge and performance abilities, as well as related instructional approaches designed for college students.

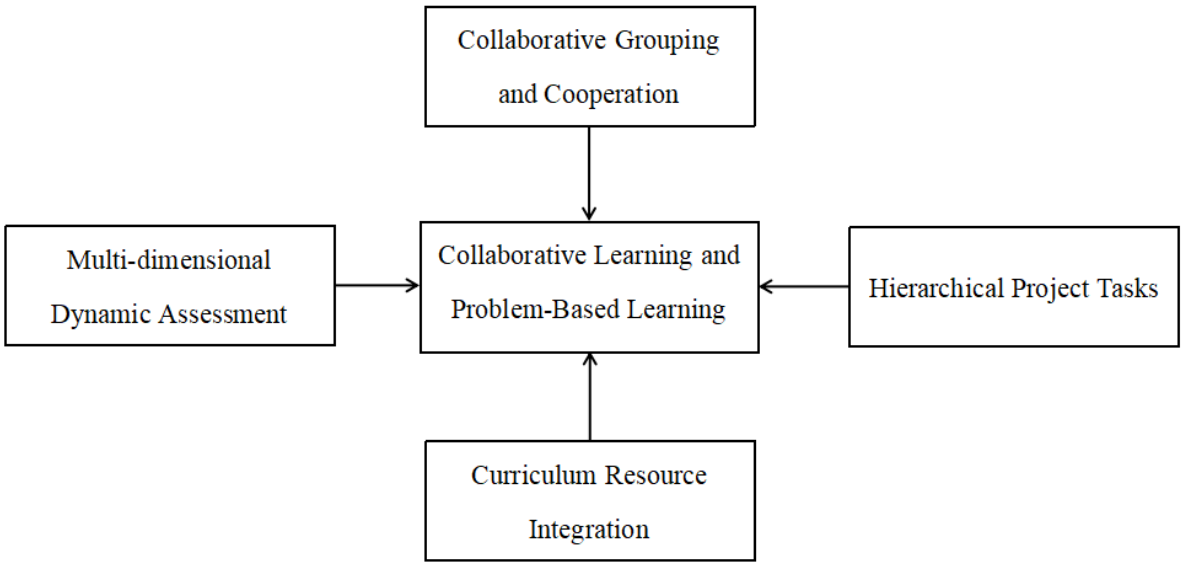

Figure 3 Research Body of Knowledge

Research Suggestion

1. Suggestions in practice

1.1 Expand collaborative and project-based learning in more courses and grades. This study focused only on a limited number of courses, but collaborative and project-based learning approaches can be applied to a wider range of topics and different grades to achieve more comprehensive learning outcomes.

1.2 Increase the use of multimedia tools and interactive elements. Positive feedback from students indicates that collaborative and project-based learning methods can create a feedback environment for learning. To maintain students' enthusiasm and engagement, teachers should incorporate more digital tools, interactive games and multimedia elements into vocabulary teaching.

1.3 Focus on the integration of multidisciplinary knowledge. While the collaborative and project-based learning approach is highly effective, students' basic knowledge structure restricts the development of this learning approach. Teachers should expand knowledge in combination with relevant subject knowledge and adopt the teaching method of "two teachers" to better improve the quality of relevant knowledge and ensure that students can better apply relevant subject knowledge in practice during the learning process. In this way, educators can give full play to the educational value of project-based learning.

2. Suggestions for research

2.1 Deepen the integration of intelligent tools with teaching: Develop a dynamic grouping system based on the DKVMN-KT model to track and monitor the distribution of students' attention in each stage of short video creation, automatically generate knowledge weak point repair solutions, and improve CL efficiency.

2.2 Build an industry demand-driven evaluation system: Develop algorithm docking plugins in collaboration with short video platforms, incorporate real operational indicators such as completion rate and interaction rate into the three-dimensional evaluation model, and enhance the fit between theoretical application and market demand.

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