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Peer-assisted Learning in Safety Education Courses to Increase the College Students' Achievement, Collaboration Ability and Satisfaction

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Abstract

Background and Aim: The safety education courses at colleges typically address specific events and crises reactively rather than proactively cultivating an ongoing culture of "active safety." Traditional lecturing methods dominate, often failing to engage students personally or foster critical awareness and skills. This study explores the implementation of Peer-Assisted Learning (PAL) in safety education to enhance learning outcomes for physics majors at Guangxi Normal University for Nationalities. The aims are to: (1) assess the impact of PAL on students' academic achievement in safety topics, (2) evaluate the development of cooperative skills, and (3) gauge improvements in student satisfaction with the learning process.

Materials and Methods: Thirty students from a freshman physics class participated. They engaged in PAL throughout the course. Data were collected via pre-tests and post-tests, surveys, and interviews, then analyzed using SPSS to evaluate changes in learning achievement, cooperative abilities, and satisfaction levels.

Results: The study found that students who participated in PAL significantly improved in all three areas. Test scores increased markedly post-intervention, indicating enhanced understanding and retention of safety education content. Additionally, there was notable advancement in students' abilities to collaborate effectively and marked increases in their overall satisfaction with the educational experience.

Conclusion: PAL effectively enhances safety education courses' educational outcomes. By actively engaging students and encouraging peer interaction, PAL can significantly boost academic achievement, develop cooperative skills, and increase student satisfaction, suggesting its broader applicability in educational strategies within college settings.

Keywords: Peer-Assisted learning; Learning achievement; Cooperative ability; Learning satisfaction

Introduction

In China, the safety education work for college students is completed by their colleges and universities. College students face the diversity and complexity of the social environment and various safety issues hidden in life, and their ability to foresee, judge, and respond is weak. Internet-related surveys show that: 16% of college students have illegally used electrical appliances in their dormitories; 35% of college students do not know how to use fire extinguishers; about 24% of college students have no awareness of safety precautions; Call 119 for the fire alarm, but are at a loss as to how to eliminate fire hazards, escape from the scene, evacuate, and how to effectively prevent the spread of fire. These all show that college students in my country cannot generally effectively respond to unsafe incidents (Jiang & Cai, 2017).

The safety education of college students has gradually been paid more attention by colleges and universities and has become a campus culture construction and compulsory course for colleges and universities. However, judging from the actual effect of safety education on college students, it is not very optimistic. It is still in the stage of classroom education based on safety education theory. Students only attend classes to complete the class and do not know how to deal with safety problems in real life. Incidents of students being violated or violated often occur: On the morning of November 14, 2008, a fire broke out in the girls' dormitory of Shanghai Business School. Four girls jumped from the 6-story dormitory to escape, and all died on the spot; on January 19, 2011, a college student from the Shijiazhuang Institute of Information Engineering committed suicide due to "overwhelming job-seeking pressure"(Xiao, 2011). Colleges and universities do not pay enough attention to the safety education of college students. The actual safety education courses for college students are taught intensively when freshmen enter school, and then each college conducts a safety education class once a semester. The content of the lectures is also a brief introduction to various security knowledge, or a temporary course is arranged according to some security time nodes and special events. The safety education courses for college students do not run through the whole process of university education and teaching (Jiang & Cai, 2017), making the safety education work

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of our country's colleges and universities become after the start of school, holidays, and special events, educational work with a certain timeliness, rather than a work that truly guides students to improve their awareness of prevention and cultivates students' awareness of "active safety". In the process of safety education, the traditional teaching methods of lecturing, indoctrination, and duck-feeding are still adopted, which ignores the real learning needs of students and cannot arouse students' sense of crisis. Students feel that those are all about other people's affairs, and have nothing to do with oneself, resulting in the inability to effectively improve students' learning achievement, cooperative ability, and learning satisfaction.

In China, the research on Peer-Assisted Learning started relatively late. Through classification and comparison, it is found that the main research contents include: (1) Theoretical research, such as the concept, characteristics, and strategies of Peer-Assisted Learning, representative articles such as Zuo Huang, Huang Fuquan's two articles" The Meaning of the Peer-Assisted Learning and the Research on It "(Zuo & Huang, 2010) and " The Progress and Prospective of Peer-Assisted Learning Research in Foreign Countries", discussed in detail the theoretical content of Peer-Assisted Learning and related research progress(Zuo & Huang, 2008). (2) The practice research, this part of the study is more, Han Xiaona carried out an experimental study on mutual aid groups in the practical research of carrying out Peer-Assisted Learning in physics teaching in senior high school (Han, 2017). Jin Erhong elaborated on the current situation of Peer-Assisted Learning in the practice and theory of Peer-Assisted Learning, analyzed the reasons, and also put forward the strategy of Peer-Assisted Learning (Jin, 2012). Guo Yaowei conducted a detailed study on the effect of feedback on Peer-Assisted Learning to help practice research on the practice of Peer-Assisted Learning in high school physics exercise classes (Guo, 2015).

Relevant studies (Correa et al., 2009) show that the Peer-Assisted Learning method can give full play to the active interaction between students in classroom teaching and carry out cooperative learning, which can make students become "teaching guides" in and out of the classroom, and teachers become teaching guides and improve the teaching effect. Therefore, the author uses the Peer-Assisted Learning method in the safety education course of college students to enhance learning achievement, cooperative ability, and learning satisfaction through their participation and mutual help among classmates.

Objectives

1. To explore applying the Peer-Assisted Learning method in the safety education course of college students to enhance college students' learning achievement of physics majors in Guangxi Normal University for Nationalities.

2. To explore applying the Peer-Assisted Learning method in the safety education course of college students to enhance college students' cooperative ability of physics majors in Guangxi Normal University for Nationalities.

3. To explore applying the Peer-Assisted Learning method in the safety education course of college students to enhance college students' learning satisfaction of physics majors in Guangxi Normal University for Nationalities.

Literature review

1. Impact and Scope of PAL Globally:

Globally, PAL has been extensively studied across various disciplines, demonstrating significant impacts on student performance and engagement. Research by Yarhands Dissou Arthur and colleagues highlights how PAL, alongside motivational factors and teaching quality, influences performance in mathematics by enhancing student interest and engagement (Arthur et al., 2022). The scope of PAL has expanded beyond traditional academic subjects to include areas such as sports, law, business studies, environmental science, and medicine, indicating its versatility and adaptability to diverse educational settings.

2. PAL Research in China:

In China, PAL research was initiated later but has seen substantial theoretical and practical advancements. Theoretical explorations by Zuo Huang and Huang Fuquan have detailed PAL's characteristics and strategic applications, addressing its integration into the Chinese educational system (Zuo & Huang, 2008; 2010). Practical applications have been explored by researchers like Han Xiaona,

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who implemented PAL in high school physics teaching, and Guo Yaowei, who assessed its effectiveness in high school physics exercises, providing feedback on its educational impact (Han, 2017; Guo, 2015).

3. Challenges and Opportunities in Safety Education through PAL:

Despite the proven effectiveness of PAL in various fields, its application within safety education in Chinese colleges remains limited. The existing literature indicates a focus on sporadic, event-driven safety training, which often fails to instill continuous and proactive safety awareness among students. This reveals a critical gap in applying PAL to create more engaging and continuous safety education programs that can better prepare students for real-life safety challenges (Jiang & Cai, 2017).

4. Synthesizing PAL for Enhanced Safety Education:

The integration of PAL into safety education offers a promising avenue for enhancing the effectiveness of these programs. By leveraging peer support and collaborative learning, safety education can transition from traditional didactic methods to more interactive, student-centered learning processes. This approach not only aligns with global educational trends but also meets the specific needs of safety education in China, where enhancing practical skills and ongoing awareness is crucial (Jin, 2012).

Through the literature review, it is found that the research directions and methods of Peer-Assisted Learning are different in different disciplines. Domestic research on the theory and practice of "Peer-Assisted Learning" is constantly developing. The research on the practical direction is still relatively scattered and has not yet formed complete and systematic results. There are very few practical studies on Peer-Assisted Learning in the safety education course of college Students.

Conceptual Framework

The Conceptual framework is shown in Figure 1.

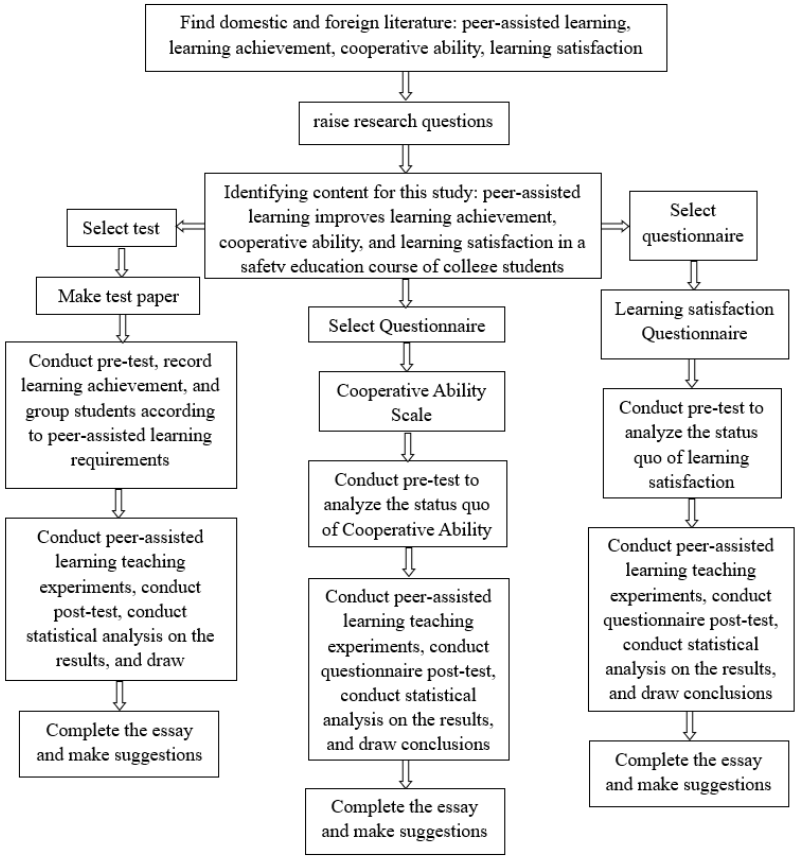

Figure 1. Conceptual Framework**; Note:** Constructed by the author

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Methodology

This research investigates the efficacy of Peer-Assisted Learning (PAL) in improving achievement, cooperative ability, and satisfaction within a safety education course for college students. The study is organized into three phases:

1. Phase 1 Preparation before teaching experiments:

Literature Review and Theoretical Framework: Gather and analyze existing literature on PAL, learning achievement, cooperative ability, and learning satisfaction to establish a solid theoretical base for the study.

Course Design: Develop and refine the safety education course curriculum integrating PAL methods tailored for college students. This includes expert review and validation of the teaching design to ensure its applicability and comprehensiveness.

Materials Preparation: Collaborate with faculty to create and refine the safety education test papers specifically designed for this study, ensuring they assess the targeted educational outcomes effectively. Validate these materials for reliability, difficulty, and differentiation.

Instrument Development: Construct and validate questionnaires and interview protocols that will assess cooperative abilities and learning satisfaction. These instruments will be reviewed by subject matter experts to ensure their reliability and validity.

Participant Preparation and Grouping: Profile the participants based on pre-test results and other relevant characteristics (e.g., academic performance and learning behaviors). Participants will be categorized into three groups:

Type A: High-achieving students

Type B: Average students

Type C: Students facing learning challenges

These students will then choose peers from different or the same categories to form heterogeneous (Type I) or homogeneous (Type II) PAL groups, facilitating diverse interaction dynamics. Each group will consist of matched pairs, and all groups will undergo a briefing session to familiarize them with PAL activities.

2. Phase 2 Teaching experiment process:

Implementation: Implement the PAL-informed safety education course with Class 1 students of the physics program. During this phase, continuous observation and documentation of student engagement and interaction will be conducted to assess the practical application of PAL strategies.

Observation and Adjustment: Monitor the dynamics and effectiveness of peer interactions and learning processes in real time. Adjustments will be made as necessary to maximize the educational impact and student involvement.

3. Phase 3 After the teaching experiment is over:

Testing and Feedback Collection: Administer post-tests to evaluate knowledge acquisition and conduct follow-up questionnaires and interviews to assess changes in cooperative abilities and satisfaction levels among students.

Data Analysis: Utilize SPSS to perform descriptive and inferential statistical analyses on the collected data to determine the effectiveness of the PAL approach in enhancing learning outcomes.

Evaluation and Reflection: Analyze feedback and overall results to identify strengths and areas for improvement in the teaching methodology and course design. Reflect on the implications for future teaching practices and potential adjustments to the PAL framework.

This revised methodology section provides a clear and detailed description of the procedures, tools, and participant grouping strategies, ensuring that the study's design is robust and comprehensive. It integrates the initial requirements more explicitly, focusing on the systematic preparation, execution, and analysis phases of the research.

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Results

1. Analysis of Pre-test and Post-test Pairing Sample Results

This study adopts SPSS statistical software to match the tested sample T-test of the pre-test and post-test score data collected by the collected university safety education， as shown in Table 1 and Table 2.

Table 1 Pre-test and Post-test paired Samples statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair1 Post-test	89.8333	30	5.42716	.99086
Pre-test	65.7667	30	7.26201	1.32586

From the data of Table 1: Before the experiment, the Pre-test Mean of the research object was 65.7667 points; after the experiment, the Post-test Mean of the research object was 89.8333 points.

Table 2 Pre-test and Post-test paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair1 Post-test-Pre-test	24.06667	4.79176	.87485	22.27740	25.85594	27.509	29	.000

From Table 2, it can be seen that the average of the research objects after the experiment increased by 24.06667 points, Sig. (2-tailed) = 0.000, less than 0.05, and the difference between 95% was between 22.27740 and 25.85594. It shows that there is a statistically significant difference in the learning achievement of the research subjects. Therefore, it shows that the use of the Peer-Assisted Learning method improves college students' learning achievement.

2. Comparison of college students' cooperative ability between pre-test and post-test results

The researchers conducted a post-test on the students in the study using the Cooperative Ability Scale. After statistical analysis of the pre-test and post-test data, the comparison of the total mean score and the mean score of each dimension of the pre-test and post-test is shown in Table 3.

Table 3 Comparison of cooperative ability between pre-test and post-test

cooperative ability dimension	pre-test mean	post-test mean
cooperative ability	3.14	4.21
cooperative cognition	3.13	4.18
cooperative emotion	3.21	4.24
cooperative intention	3.06	4.14
interpersonal mutual assistance	3.12	4.20
emotional regulation	3.21	4.27
conflict management	3.11	4.20
organizational management	3.14	4.20

As shown in Table 3, the total cooperative ability mean score is 4.21, which is at a high level. The mean score of the cooperative cognitive dimension is 4.18, the dimension of cooperative emotion is 4.24, the dimension of cooperative intention is 4.14, the dimension of interpersonal mutual assistance is 4.20, the dimension of emotional regulation is 4.27, the dimension of conflict management is 4.20, and the dimension of organization management is 4.20; The mean score of each dimension has been improved, and the

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cooperative ability has developed from a medium level to a high level (Wang, 2020), which shows that the Peer-Assisted Learning method can effectively improve the cooperative ability of college students.

3. Comparison of college students' learning satisfaction between pre-test and post-test results

The researchers conducted a post-test on the students in the study using the learning satisfaction questionnaire. After statistical analysis of the pre-test and post-test data, the comparison of the total mean score and the mean score of each dimension of the pre-test and post-test is shown in Table 4. The mean score of the post-test of college students' learning satisfaction is 4.26, indicating that the effect is very good. The mean score of the classroom teaching satisfaction dimension is 4.16, indicating that the effect is good; the mean score of the learning gain satisfaction dimension is 4.37, indicating that the effect is very good; the mean score of each dimension has improved, and the learning satisfaction has developed from the average effect to the very good effect (Zhang, 2022). This shows that the Peer-Assisted Learning method can effectively improve the learning satisfaction of college students.

Table 4 Comparison of learning satisfaction between pre-test and post-test

Learning satisfaction dimension	pre-test mean	post-test mean
Classroom teaching satisfaction	3.08	4.16
Learning gain satisfaction.	3.17	4.37
Learning satisfaction	3.12	4.26

Discussion

According to the results of the study, it could be discussed as follows;

1. Peer-assisted learning can effectively improve the learning achievement of the safety education course of college students.

In the first week of the experiment, the research target conducted a pre-test of the safety education knowledge of college students. Then, Peer-Assisted Learning was applied to the safety education course of college students, and the 6-week experimental teaching was conducted. After the experimental teaching, the research objects were tested after the research objects. Finally, test results before and after experiments, sort out data forms and perform data analysis and discussion. Experimental data shows that the results of the post-test are significantly higher than the results of the pre-test. The analysis results show that Peer-Assisted Learning can effectively improve the learning achievement of the safety education course of college students. The research results of this paper are also consistent with the research results of Shen Zhengfu, Qi Yulong, Feng Lili, and Chen Xiaobin (Shen et al., 2014) et al. studied “Application of Peer-Assisted Learning in the Safety Education Course of Medical Students”, Peer-Assisted Learning can effectively improve the learning achievement.

2. Peer-assisted learning improves college students' cooperative ability in the safety education course of college students.

The results of the pre-test and post-test of the cooperative ability scale questionnaire were organized into a data table, and the data analysis and discussion were carried out. The total mean post-test score of college students' cooperative ability is 4.21, which is higher than the total mean score of college students' cooperative ability pre-test, which is 3.14. The mean score of each dimension has improved, and the cooperative ability has developed from a medium level to a high level. Therefore, Peer-Assisted Learning improves college students' cooperative ability in the safety education course of college students.

The research results of this thesis are consistent with Chen Yunjuan's research on how Peer-Assisted Learning can improve students' cooperative ability in high school physics exercises. Chen Yunjuan through the questionnaire survey method, explored her Peer-Assisted Learning to study the development of high school physics exercises and fully understood the students' awareness of mutual assistance and the status quo of mutual assistance. Carrying out Peer-Assisted Learning in the exercise class can improve students' mutual awareness, stimulate students' learning interest, enhance students' thinking ability and solve

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problems to solve problems the ability to promote students 'language expression and cooperation, and promote students' interpersonal communication ability (Chen, 2021).

3. Peer-assisted learning improves college students' learning satisfaction in the safety education course of college students.

The results of the pre-test and post-test of the learning satisfaction questionnaire are organized into a data table, and the data analysis and discussion are carried out. The total mean score of the post-test of college students' learning satisfaction is 4.26, which is higher than the total mean score of 3.12 on the pre-test of college students' learning satisfaction. The mean score of each dimension has improved, and the learning satisfaction has developed from average effect to very good effect. The Peer-Assisted Learning method can effectively improve the learning satisfaction of college students.

The research results of this paper are consistent with the research results of Shen Zhengfu, Qi Yulong, Feng Lili, and Chen Xiaobin (Shen et al., 2014) studied "Application of Peer-Assisted Learning in the Safety Education Course of medical students", enhanced the ability of medical students to solve practical safety problems and autonomous learning, and improved teaching satisfaction. Therefore, the Peer-Assisted Learning method can improve the learning satisfaction of college students.

Conclusion

This study has demonstrated the significant impact of Peer-Assisted Learning (PAL) within the context of safety education courses for college students. The findings can be summarized as follows:

1. Enhanced Learning Achievement: PAL has notably improved students' ability to grasp and retain knowledge about safety education, indicating its efficacy in elevating academic performance in this critical area.

2. Improved Cooperative Abilities: Through the implementation of PAL, students have developed stronger cooperative skills, which are essential for effective teamwork and problem-solving in safety-related scenarios.

3. Increased Learning Satisfaction: The introduction of PAL has led to higher levels of satisfaction among students, suggesting that this approach not only aids in learning but also enhances the overall educational experience.

Recommendation

After the experiment, the author reflects on the results of this experiment. The following suggestions are made on how teachers implement Peer-Assisted Learning in the safety education course of college students:

First of all, the use of Peer-Assisted Learning in the safety education course of college students is the main body of knowledge construction. Teachers should pay attention to role conversion, based on the long-term development of students, guide students, and change the previous conventional teaching methods.

Secondly, teachers should attach importance to the way of cultivating students' extra - Extra-peer-assisted learning. The classroom time is very limited. It is not enough to rely on the Peer-Assisted Learning of peers in the class. It is also necessary to unite and collect college students' safety education knowledge in unity and mutual assistance of college students. In particular, the theory is connected with the actual situation. Therefore, teachers should pay attention to reasonable arrangements of - Extra-peer-assisted learning to learn the tasks to better develop and exercise all aspects of students to promote their comprehensive development.

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