

The Profound Impact of Informatization Reform of College Physical Education Courses on Network Ideological and Political Education Based on Data Analysis

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ABSTRACT

In higher education, physical education courses and ideological and political education are often carried out independently, lacking effective integration and interaction. This paper explores the informationization reform of physical education courses in universities and evaluates its impact on online ideological and political education. First, interdisciplinary integration and informationization methods are used to optimize the physical education course design and integrate ideological and political education content. Then, an online learning platform is constructed to break the limitations of time and space, encourage students to deeply understand the ideological and political education content in physical education teaching, and provide real-time feedback and personalized learning support. Multimedia technology is also adopted to enhance students' understanding and internalization of sportsmanship and ideological and political education concepts. Students' learning behavior and ideological and political education absorption in physical education courses are individually evaluated through data analysis. Finally, the profound impact is evaluated through experiments. The results indicate that the informationization reform of physical education courses in universities significantly improves students' participation and knowledge mastery and effectively promotes the improvement of students' ideological and political literacy, with the average score increasing by about 14%. These results provide strong empirical support for future teaching design and also provide valuable experience for further exploring the deep integration of physical education courses and online ideological and political education.

Keywords: Online Ideological and Political Education, University Physical Education Course, Informationization Reform; Multimedia Technology; Data Analysis

1. Introduction

At present, the computer penetration rate of students in colleges and universities is quite high, and the

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network has a large information capacity, fast dissemination speed, wide coverage, and a high degree of openness and interactivity, which enables students to understand the society, the world, acquire knowledge and master skills more widely and quickly [1-3]. The network era endows students with the characteristics of proficiency in network applications, active thinking, vigor, and a strong spirit of exploration [4]. On the other hand, most of them have not experienced the hard life and have been pampered by their elders since they were young, and they are easily affected by the negative influence of the Internet in terms of their political standpoints, values, behavioral norms and attitudes towards life [5]. It is foreseeable that students are enjoying the benefits of network technology such as convenience, speed and diversity of communication methods in the process of ideological and political education, but they are also facing the disadvantages and challenges from network technology [6-7].

As an important discipline in higher education, physical education has its own specificity in terms of cultural foundation, behavioral awareness and psychological quality, which are common to other professions [8]. With the rapid development of information technology, the Internet has become an important platform for people to obtain information and exchange ideas. Therefore, colleges and universities, as an important position for training socialist builders and successors, must follow the pace of the times and promote the reform and innovation of physical education curriculum informatization [9]. Ideological and political education in the network environment enriches the form of its media dissemination, but also mobilizes student initiative and teacher-student communication enthusiasm, and brings a greater impact on the effectiveness of ideological and political education in colleges and universities [10-12]. In the face of the new phenomenon of students' deep contact with the network in colleges and universities, ideological and political educators should update their concepts, face up to the network, change their educational concepts, strengthen their ideological guidance, and open communication channels to adapt to the needs of talent cultivation in colleges and universities under the new situation [13-16].

The main purpose of this paper is to comprehensively examine the significant impact of the informationization reform of PE courses on the network IAPE pattern in the context of universities. By adopting data analysis, text analysis, and multimedia teaching strategies while optimizing course design and implementing teaching effect feedback mechanisms, this paper aims to systematically study how informationization teaching practices can promote the deep-rooted integration and effective dissemination of IAPE within the framework of PE courses. The empirical research results show that the informationization reform improves the teaching effect of IAPE and is vital in cultivating students to form appropriate values and enhance their sense of social responsibility in participating in PE. The main contribution of this paper is that it provides innovative and practical approaches and theoretical frameworks that can help enrich and guide the practice of IAPE, especially in the field of PE courses at the university level. This analysis illustrates the transformative potential of informationization in reshaping educational practice and improving students' ideological and political awareness in PE.

2. Specific Implementation of Informationization Reform

2.1. Course Design Optimization

Figure 1 presents the relevant process of course design optimization. In Figure 1, the objective of the course design is to make it clear that PE courses should cultivate students' physical fitness and undertake the responsibility of IAPE. Based on this, the course content is divided into basic PE skills (improvement of students' physical fitness) and IAPE content (socialist core values, collectivist spirit, and patriotic feelings).

An interdisciplinary integration approach is adopted to ensure that IAPE is no longer a simple "add-on" content but is integrated into every PE activity and teaching link. When conducting outdoor expansion activities, situational tasks related to patriotism education are designed. Teamwork allows

students to experience the spirit of collectivism in the process of completing the tasks and strengthens their national concepts and social responsibilities.

In addition, the “case teaching method” and the “scenario simulation method” are applied to the course modules. By analyzing actual social problems and historical events and combining them with the characteristics of sports, students can be organized to carry out debates and role-playing activities so that they can realize their understanding of real-life problems in PE activities, cultivate critical thinking, and be guided to form correct values.

According to the individual differences and interest characteristics of students, the modules are refined, and personalized learning paths are provided for students through the informationization platform. PE course modules of different difficulty and content depth are designed for students of different grades and professional backgrounds, allowing them to choose modules for learning independently.

In the course design, project-based learning (PBL) and situational teaching methods are incorporated, and situational cases based on actual social problems and PE activities are designed to help students achieve knowledge transfer and improve their thinking during participation. Taking marathon training as an example, in addition to physical training for students, an IAPE module with the theme of “long-distance running spirit” is designed in combination with Chinese traditional culture and history. By analyzing the deeds of historical long-distance runners, students are encouraged to understand the spirit of perseverance, unity, and hard work and internalize it as their personal code of conduct.

PBL enables students to strengthen independent learning and teamwork, master relevant knowledge and skills, continuously deepen their understanding of the socialist core values in the process, and enhance their sense of social responsibility.

Teachers are regularly organized to participate in informationized education technology training and IAPE concept seminars to help them understand the dual objectives in course design and improve their ability to innovate teaching. In the classroom, teachers stimulate students’ active thinking and participation through guided teaching, discussion-based teaching, and interactive teaching, thereby enhancing the effectiveness of IAPE. Meanwhile, the informationization platform provides teachers with rich teaching resources and tools to help them be more flexible and innovative in designing courses.

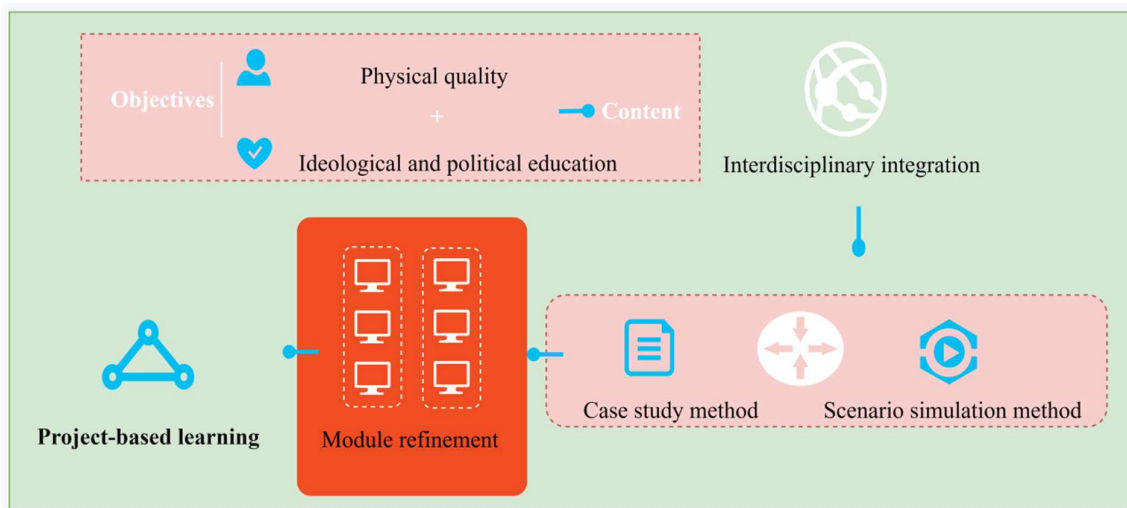


Fig. 1. Relevant process of course design optimization

2.2. Online Platform Construction

An interactive and fully functional online learning platform is constructed to break the time and space

limitations of the traditional teaching models and improve the interactivity and learning effect outside the classroom. Figure 2 presents details.

The architecture design of the platform in Figure 2 revolves around the three core functions of “resource sharing,” “interactive communication,” and “process feedback” to ensure that teachers and students can communicate and interact with each other efficiently on the platform. The platform’s functional modules include a course resource area, discussion area, interactive live streaming area, homework and test area, and data analysis area, aiming to enhance the penetration effect of IAPE through diversified interactive forms and improve the overall quality of PE.

The course resource area is designed to display the teaching content of PE courses, IAPE materials, and related learning resources. Teachers upload videos, teaching materials, and case analysis materials according to the course progress, and students can access and study on their own at any time. Through the combination of reading materials and video explanations related to IAPE, students’ understanding and internalization of concepts such as the socialist core values and the spirit of collectivism are strengthened.

The discussion area has discussion sections with different themes, covering course content, ideological and political issues in physical exercise, and current hot topics. Students can post their opinions, ask questions, and make comments here. They can interact with teachers and classmates to promote the collision of ideas and knowledge sharing. Teachers can regularly post discussion topics or classroom activities to enable students to conduct in-depth ideological and political discussions outside of PE classes.

In the teaching process of each PE item, corresponding IAPE cases are used and presented through text, pictures, and videos.

The interactive live streaming area recommends online live teaching, special lectures, and interactive question and answer (Q&A) activities. Through the live streaming function, teachers explain the content of PE in real-time and interact with IAPE elements to solve students’ learning problems. The interactive Q&A session in the live streaming can effectively enhance students’ sense of participation and enable teachers to discover students’ learning confusion during the interaction and provide timely supplements and guidance.

The homework and test area has homework submission and online test modules. After completing PE classes, students can submit relevant homework or take tests through the platform to test their mastery of PE knowledge and IAPE content. This function helps students consolidate course content and allows teachers to track students’ learning progress and mastery in real-time.

The data analysis area automatically collects students’ learning data on the platform, including login frequency, learning time, interaction participation, and homework submission and visualizes students’ learning trajectories and behavior patterns. Teachers can adjust teaching strategies based on data feedback to ensure students’ learning progress and the effective realization of IAPE goals.

The platform sets up various feedback channels (messages, personal messages, and questionnaires). Teachers and students can give feedback to each other and make improvements and adjustments.

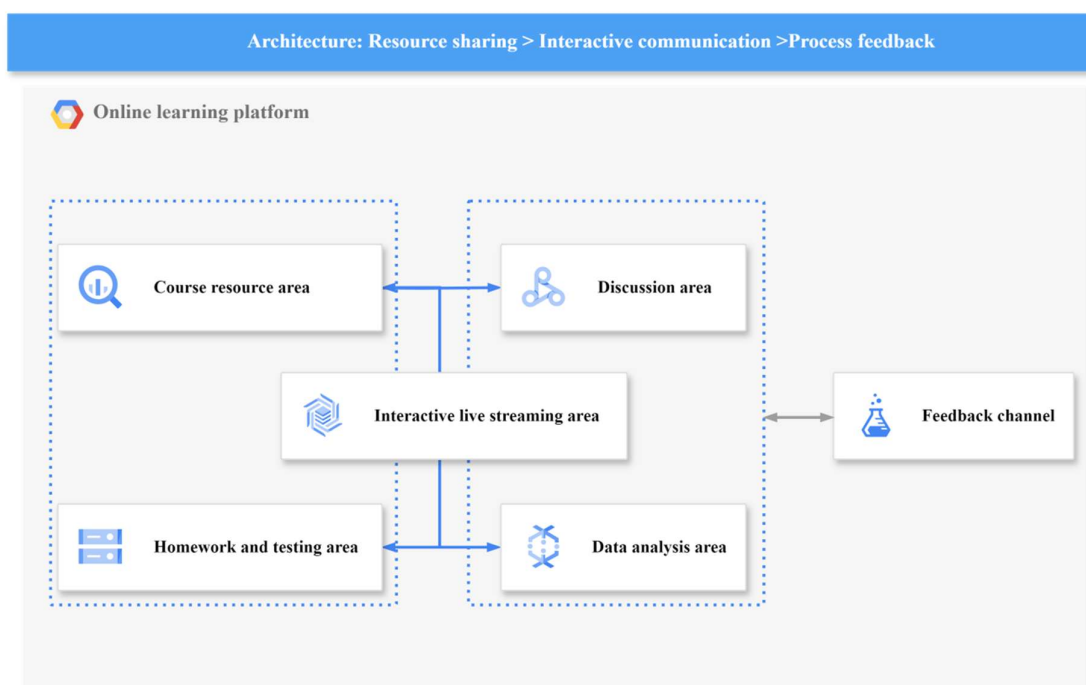


Fig. 2. Online learning platform construction

2.3. Multimedia Teaching Application

Figure 3 shows the links of multimedia teaching application. In Figure 3, a special video is produced to vividly display the IAPE content related to PE events. After each video, relevant questions are set to encourage students to think about the IAPE concepts conveyed in the video. In addition, the integration of sportsmanship and IAPE can be explained through various video forms, such as short videos and documentaries.

As a highly expressive multimedia form, animation can restore abstract IAPE content through specific scenarios, making it easier for students to understand and accept. In PE courses, using animation to explain some complex IAPE content can allow students to perceive the value of IAPE more intuitively through the dual stimulation of vision and hearing.

When explaining sports ethics, competition rules, and fair competition, situational animated short films are designed. Through the behavior of virtual characters in sports competitions, the consequences of improper behavior are simulated, and examples of positive behavior are shown through comparison so as to guide students to form correct values and behavioral norms.

When teaching large-scale group projects, students can enter virtual sports scenes with the help of virtual reality (VR) equipment, experience the competition process in person, and feel the importance of teamwork. In this process, the system provides situational feedback related to IAPE through real-time data analysis. In addition, when students are learning sports skills, augmented reality (AR) technology is used to superimpose IAPE content in the students' field of vision in real-time, reminding students to focus on the cultivation of values such as teamwork and fair competition in sports.

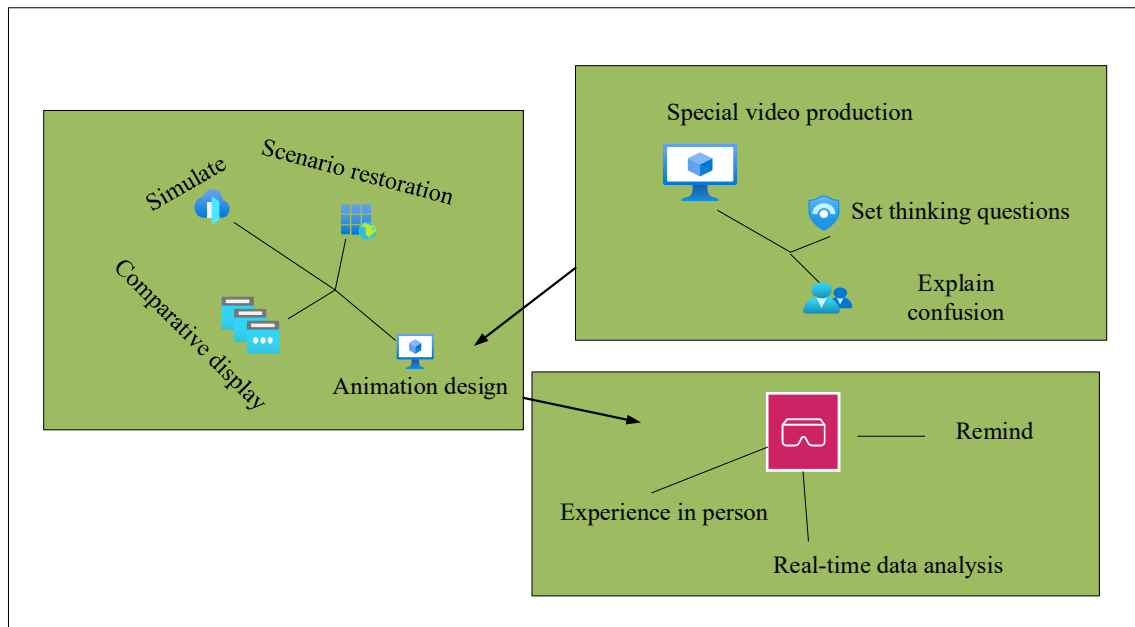


Fig. 3. Links of multimedia teaching application

2.4. Data Analysis Feedback

Statistical analysis methods are used to classify and compare students' learning behaviors and to analyze students' activity, study time, and participation in the course. From these data, students who are more active in the learning process and students who have problems with insufficient participation and lagging learning progress can be found out. These data help teachers evaluate students' acceptance of course content, especially their absorption of IAPE content.

Homework scores and test results are analyzed to assess students' mastery of the combined content of PE and IAPE. By comparing scores vertically (monthly or semester-by-semester changes) and horizontally (differences in scores between different classes and different course modules), teachers can more accurately judge the teaching effect of course content and the penetration depth of IAPE.

Text analysis technology is adopted to analyze the language content of students in discussion forums and homework comments, especially the emotional tendencies related to IAPE. By analyzing the keywords and emotional colors in students' speeches through natural language processing (NLP) technology, teachers can understand students' ideological attitudes and emotional changes, thereby effectively evaluating the actual impact of IAPE.

Through learning data analysis, a personalized learning trajectory report is generated for each student, showing the student's learning path, knowledge mastery, and participation in the course. Teachers provide students with targeted guidance and feedback, adjust teaching strategies, and ensure that students improve comprehensively in PE and IAPE based on this personalized data.

Based on data analysis, teachers provide personalized learning feedback to each student, focusing on students with slow learning progress and low participation and helping them improve through additional tutoring or resource recommendations. Figure 4 shows the specific learning behaviors of randomly selected student IDs (Identity documents).

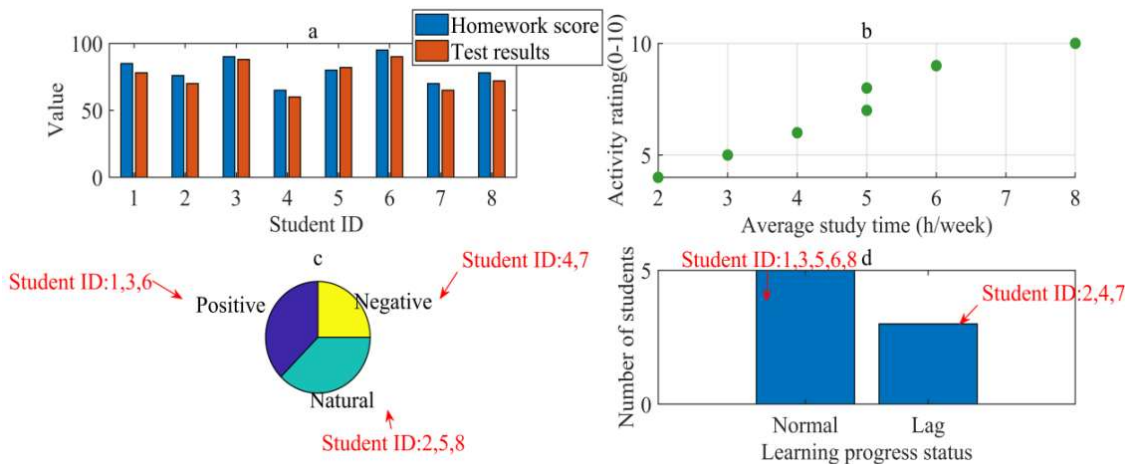


Fig. 4. Analysis of students' learning behavior

Figure 4 shows that, overall, students' performances vary. Differences in activity levels, study time, and grades affect their learning emotions and progress, which reflect different learning needs and the importance of personalized guidance.

Targeted personalized feedback continues to be provided based on students' learning behavior analysis. Table 1 lists details.

Table 1. According personalized feedback from students (unit: times)

Student ID	Course module	Participation status	Learning progress status	Personalized feedback
1	Physical education	15	Normal	Consider increasing practical activities
2	Ideological and political education	10	Lagging	Provide additional tutoring
3	Integration	12	Normal	Continue to maintain
4	Physical education	5	Lagging	Recommend learning resources
5	Ideological and political education	9	Normal	Increase discussion and interaction
6	Integration	20	Normal	Continue to pay attention to
7	Physical education	8	Lagging	Provide targeted tutoring
8	Ideological and political education	11	Normal	Increase opportunities for participation

In Table 1, the personalized feedback of student No.1 is to consider increasing practical activities. The student No.2 recommends to provide additional tutoring. The feedback of student No.3 is to continue to maintain. The personalized feedback of student No.4 is to recommend learning resources because of his negative emotional tendency and lagging learning progress. The feedback of student No.5 is to increase discussion and interaction. The student No.6 performs well and needs continuous attention. The student No.7 has a negative emotional tendency and lags behind in learning progress and needs targeted tutoring. The student No.8 recommends to increase participation opportunities.

According to the students' behavior data on the platform, the course content and teaching methods

are adjusted promptly. In addition to short-term classroom adjustments, data analysis feedback can also provide guidance for students’ long-term development. Based on students’ long-term learning behavior data, personalized learning plans are customized for students to help them maintain their motivation to learn after the course ends. It can also promote the improvement of students’ overall quality through a continuous feedback mechanism.

In data analysis and feedback, it is crucial to ensure the privacy and security of student data. The platform must strictly abide by relevant laws and regulations to ensure that all data collection, storage, and use meet privacy protection requirements.

3. Profound Impact Assessment

3.1. Student Participation

Students from a certain university are divided into two groups, totaling 500 people, of which 250 are in the experimental group and 250 are in the control group. The experimental group receives the integrated teaching of PE courses and online IAPE after the informationization reform (G1), while the control group receives traditional independent PE courses and IAPE (G2).

The experimental time is one semester, totaling 16 weeks, with 1 class per week and each class lasting 2 hours. Before and after the experiment, questionnaires are conducted on the two groups of students, including students’ interest in the course content (C1), willingness to participate (C2), and classroom interaction (C3). A 5-point Likert scale is used (1=strongly disagree and 5=strongly agree), as displayed in Table 2.

Table 2. Questionnaire survey results (unit: points)

Group	Questionnaire project	Average score	Notes
G1	C1	4.5	Students’ interest is increased.
	C2	4.7	Most students are willing to participate.
	C3	4.6	The classroom atmosphere is active.
G2	C1	3.2	The interest is low.
	C2	3.0	There is a lack of willingness to participate.
	C3	3.1	The interaction is less.

In Table 2, overall, the experimental group scores close to full marks. These data strongly prove that the teaching method of the experimental group can stimulate students’ interest in learning, enhance their willingness to participate, and promote active interaction in the classroom compared with the control group.

The teaching supervisor observes and records each class and evaluates students’ participation in the class, including speaking, asking questions, and group discussions, as shown in Figure 5.

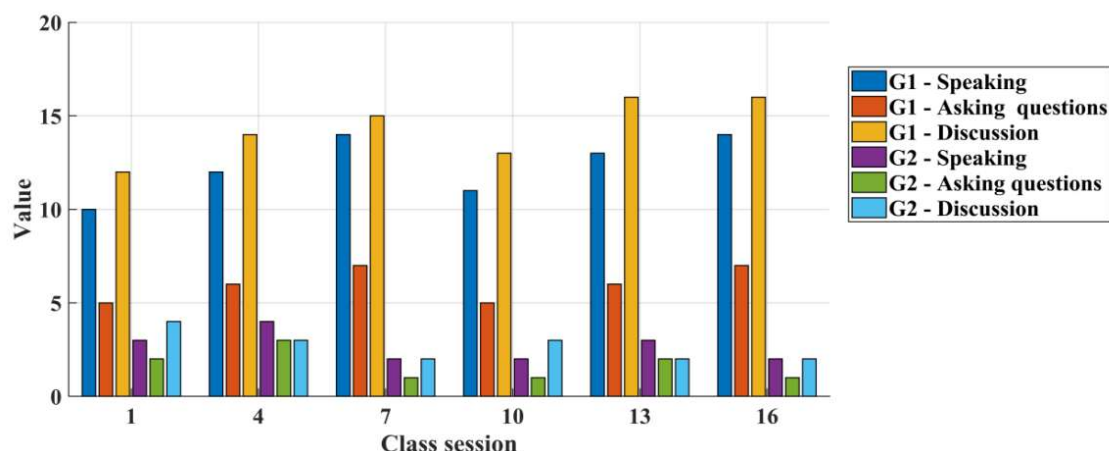


Fig. 5. Overview of observation records (unit: times)

In Figure 5, the number of G1 students' speakings changes relatively steadily, reaching a maximum of 14 times. The numbers of their asking questions and discussions show an upward trend. The number of discussions reaches a peak of 16 times in the last two sessions, showing that the participation of this group is high and gradually increases. In contrast, the numbers of G2 students' speakings and asking questions are lower, with a maximum of only 4 times of speakings, 3 times of asking questions, and 4 times of discussions, and the overall participation is low. These changes indicate that G1 students are more active in classroom activities, which may be related to their teaching strategies or students' motivation for participation.

Through the interactive learning platform constructed, statistics are collected on the frequency of students logging in to the platform, the number of times they participate in discussions, and the number of assignments they submit. The questionnaire survey results are summarized, and the participation score of each group is calculated. A comparative analysis is performed. Figure 6 presents the analysis results.

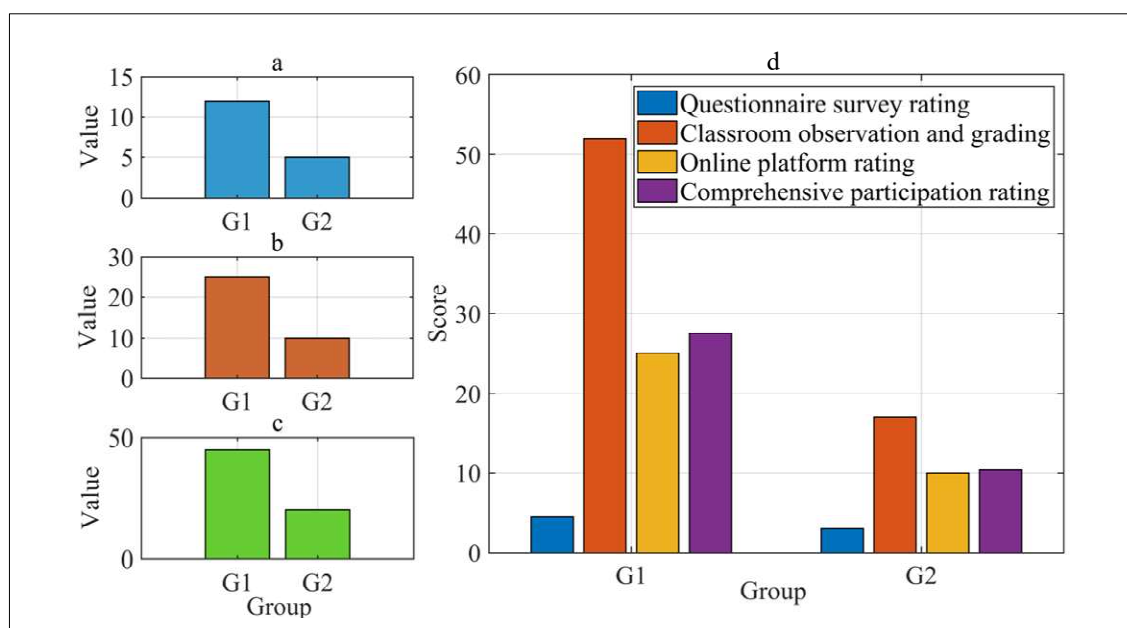


Fig. 6. Online platform access data and comprehensive participation score

(a) Average login frequency of students on the platform (unit: times); (b) Average number of discussions students participate in on the platform (unit: times); (c) Number of assignments

submitted by students on the platform (unit: times); (d) Comprehensive participation score (unit: points)

Figure 6 shows the online platform access data and comprehensive participation scores. According to Figure 6(a), 6(b), 6(c), and 6(d), it is obvious that the experimental group students show higher enthusiasm and initiative in the online learning environment. This significant gap further shows that the teaching methods after the informationization reform effectively promote students' learning initiative and sense of responsibility. These data together reflect that through the innovative education model, students' online learning participation is significantly improved, providing strong empirical support for future teaching design.

3.2. Knowledge Mastery

The experimental objects in section 4.1 are still used. A midterm exam is conducted in the 8th week. The content covers the knowledge related to PE courses and IAPE. The question types include multiple-choice questions, fill-in-the-blank questions, and short-answer questions. The total score is 100 points.

The final examination is held in the 16th week. The content is similar to that of the midterm examination and focuses on testing students' comprehensive understanding of knowledge and their ability to apply it.

A 5-minute in-class quiz is conducted at the end of each class to quickly assess students' understanding of the content of the class. The total score is 10 points, and the average score of each student is calculated.

The average scores of the experimental group and the control group in the midterm and final exams are counted and compared. The scores of the in-class quizzes in each class are recorded, and the average scores and standard deviations of the experimental group and the control group are calculated to evaluate the students' knowledge mastery. Figure 7 displays the results.

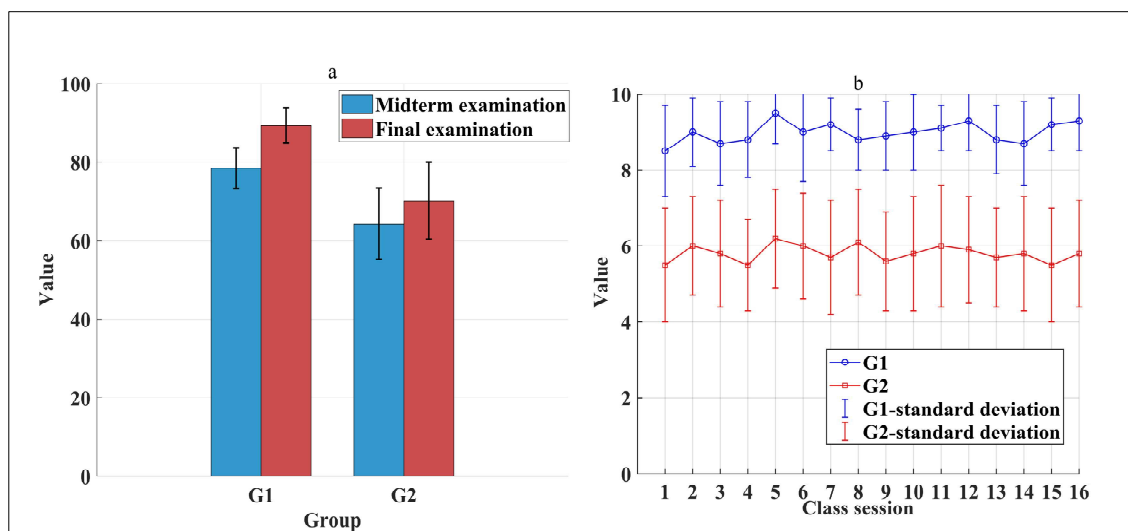


Fig. 7. Knowledge mastery

Figure 7 (a) Average scores in midterm and final exams (unit: points); (b) Average scores and standard deviations of in-class quizzes for each class (unit: points)

Figure 7 shows the mastery of knowledge in detail. In Figure 7(a), the experimental group's average score at the end of the semester increases by about 14% compared to the midterm. In Figure 7(b), the experimental group's average score and standard deviation of the in-class quiz in each class are better.

3.3. Ideological and Political Literacy

Before the experiment, a baseline test of ideological and political literacy is conducted. The test content includes ideological and political theory knowledge questionnaire (multiple-choice questions, fill-in-the-blank questions), value cognition assessment (Likert scale), and understanding and recognition of national policies (multiple-choice questions). The experimental group incorporates IAPE content into the course and uses multimedia teaching and interaction platforms for teaching. A 2-hour PE course is arranged every week, and the course includes explanations and discussions on IAPE-related content. An online platform is used for after-class discussions, and teachers and students share their thoughts and insights through real-time communication. A group discussion is held every two weeks to conduct in-depth discussions on the ideological and political theme of the week and submit a discussion report.

In the 8th week, a midterm ideological and political literacy test is conducted with the same content as the pre-test to evaluate mid-term progress. In the 16th week (at the end of the experiment), a final ideological and political literacy test is conducted with the same content as the pre-test to evaluate overall improvement. The test results are collected, and the scores of the 250 students in the three tests are recorded. Figure 8 presents details.

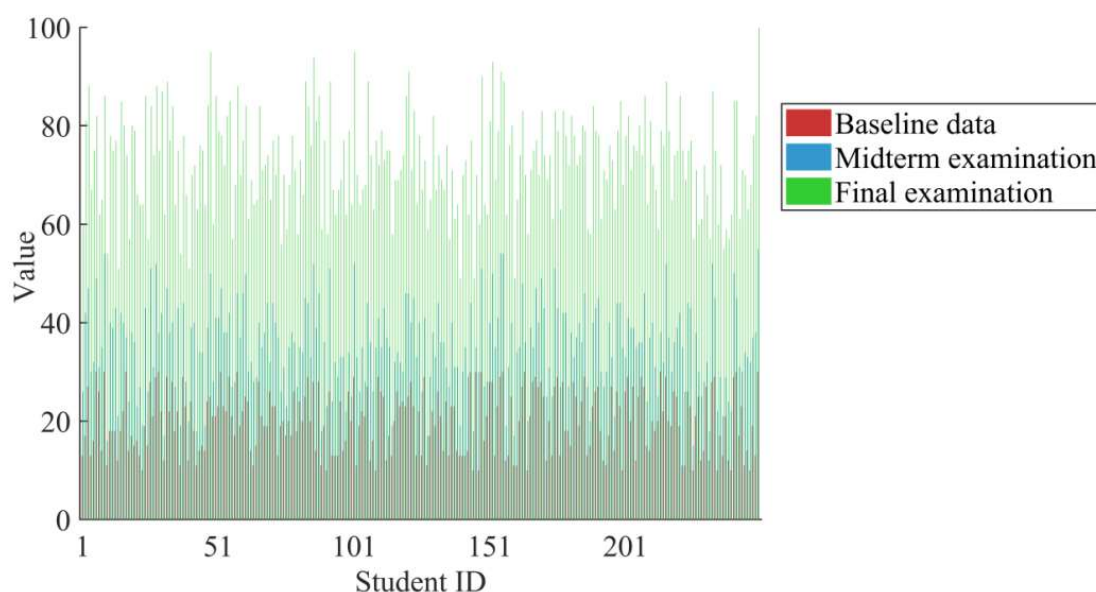


Fig. 8. Students' scores in three tests (unit: points)

Figure 8 includes three sets of data: baseline, midterm and final test scores, represented by red, blue, and green bars, respectively. The baseline test scores range from 10 to 30 points. The midterm scores increase by 5 to 25 points on the baseline. The final scores increase by 30 to 45 points on the midterm. These data show that each student's academic performance gradually improves over time. All students' final scores are generally higher than their midterm scores, and their midterm scores are also generally higher than their baseline test scores. The changes show that students' learning and mastery of ideological and political literacy are constantly improving, reflecting the effectiveness of teaching methods and students' efforts.

3.4. T-test

The null hypothesis (there is no significant difference in the ideological and political literacy test scores between G1 and G2) and the alternative hypothesis (there is a significant difference in the ideological and political literacy test scores between G1 and G2) are set.

The average final test scores of G1 and G2 are collected, and the number of experiments is set to 8.

Table 3 presents the scores.

Table 3. Average final test scores of G1 and G2 (unit: points)

Number of experiments	Group	Score	Group	Score
1	G1	70	G2	50
2		55		52
3		65		48
4		58		49
5		60		47
6		75		51
7		45		53
8		62		54

Table 3 details the average final test scores of the different groups for the 10 times, and the means and standard deviations are calculated based on these data.

The mean calculation formula of G1 is as follows:

$$M1 = \frac{70 + 55 + 65 + 58 + 60 + 75 + 45 + 62}{8} = 61.25 \quad (1)$$

The standard deviation (SD) calculation formula of G1 is as follows:

$$\begin{aligned}
 SD1 &= \sqrt{\frac{(x_i - M1)^2}{n-1}} \\
 &= \sqrt{\frac{(70-61.25)^2 + (55-61.25)^2 + (65-61.25)^2 + (58-61.25)^2}{7} + \frac{(60-61.25)^2 + (75-61.25)^2 + (45-61.25)^2 + (62-61.25)^2}{7}} \\
 &\approx 9.2
 \end{aligned} \quad (2)$$

The mean calculation formula of G2 is as follows:

$$M2 = \frac{50 + 52 + 48 + 49 + 47 + 51 + 53 + 54}{8} = 50.5 \quad (3)$$

The standard deviation calculation formula of G2 is as follows:

$$\begin{aligned}
 SD2 &= \sqrt{\frac{(x_i - M2)^2}{n-1}} \\
 &= \sqrt{\frac{(50-50.5)^2 + (52-50.5)^2 + (48-50.5)^2 + (49-50.5)^2}{7} + \frac{(47-50.5)^2 + (51-50.5)^2 + (53-50.5)^2 + (54-50.5)^2}{7}} \\
 &\approx 2.4
 \end{aligned} \quad (4)$$

The calculation formula of the t-value is:

$$t = \frac{M1 - M2}{\sqrt{\frac{SD1^2}{8} + \frac{SD2^2}{8}}} \approx 3.16 \quad (5)$$

The significance level $\alpha=0.05$ is chosen, and the degrees of freedom are 14. Based on the t-distribution table, the critical value (t-critical value) is found to be approximately 2.14.

Since the calculated t-value (3.16) is greater than the t-critical value (2.14), the null hypothesis is rejected, and it is believed that there is a significant difference in the ideological and political literacy test scores between the experimental group and the control group. This shows that the teaching method of the experimental group is effective in improving ideological and political literacy, supporting the accuracy and effectiveness of the experiment.

4. Conclusion

This paper optimizes the PE course design and integrates IAPE content through interdisciplinary integration and informationization methods, constructs an online learning platform, and applies multimedia technology to evaluate students' learning behavior and IAPE absorption in PE courses. The results show that the informationization reform has significantly improved the teaching effect of IAPE and promoted the formation of students' values and the enhancement of their sense of social responsibility. The shortcoming of this paper is that the scope of the experiment is limited. Future research can further expand the sample size and experimental scope and deeply explore the broader impact of the informationization reform of PE courses on online IAPE to enrich and improve the practice of IAPE.

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