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Developing an Integration of Sports and Health Teaching Programs to Improve the Physical and Mental Health of Primary School Students

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Abstract

Background and Aims: At present, China's school physical education focuses on the teaching of sports knowledge and skills, ignoring the individual student's interest in sports activities and health education needs, in recent years, the national education department has required that schools should integrate health education into physical education teaching, but the effect is not obvious, resulting in part of the students' aversion to physical education learning and aversion to emotion, the relevant surveys show that teenagers' rates of myopia, obesity and other indicators are rising year by year The study shows that the myopia rate, obesity rate and other indicators of adolescents are increasing year by year, which seriously affects the physical and mental health of adolescents. From the interdisciplinary perspective of kinesiology and health education, this study aims to develop and implement a teaching program that integrates physical education and health education to improve the physical and mental health of fifth-grade elementary school students. The specific objectives were to improve students' physical skills and health knowledge and to promote their overall physical and mental health development through integrally designed program content.

Methodology: This paper adopts the methods of literature, questionnaire survey, expert interview, and comparative experimental method, and analyzes the G*power software to determine the sample size, conducts questionnaires, physical fitness, psychological, and other pre-tests on the samples, and screens out 60 students aged between 10 and 11 years old in two fifth-grade classes of Jinzhou Elementary School to be the subjects of the experimental experiment: class 1 is the experimental group of 30 people, including 14 boys, girls 16 students; class 2 is the control group of 30 students, of which 13 are boys and 17 are girls. A before-and-after comparison experimental design was used to assess the effect of the new teaching program through tests such as the integrated physical education and health teaching program, students' physical fitness testing instruments, psychometric scales, mean, standard deviation, t-test statistics, and so on.

Results: The experimental results showed that the teaching program integrating physical education and health education had a significant positive effect on improving the physical fitness and mental health of primary school students. This is manifested in the significant improvement of students' BMI, lung capacity, motor skills, and mental health indicators.

Conclusion: The physical education and health integration teaching program proposed in this study not only effectively improves the physical and mental health of primary school students, but also provides new ideas and methods for the reform and development of elementary school education. The empirical results of this study provide a basis for future related research and have certain application value and academic contribution.

Keywords: Primary school students; Physical health; Mental health; Integration of physical and health education; Teaching program

Introduction

Since the early days of the founding of New China, the physical education model in China's schools has emphasized the teaching of physical education knowledge and skills, with a relative lack of knowledge about health education (Qi et al, 2022). However, this model has, to a certain extent, neglected the individual student's interest in physical activity and the diversity of needs such as health knowledge, resulting in some students' aversion and disgust to physical education learning（Ding & Jiang, 2023). At the end of the 20th century, with the promulgation of the Standards for Physical Education and Health Curriculum and the Standards for Students' Physical Fitness and Health, school physical education began to emphasize the promotion of students' overall healthy development, especially the cultivation of psychological and social adaptability (Hao & Zeng, 2009).

The survey on the physical health status of primary and secondary school students in Guangzhou shows that the physical health problems of children and adolescents are becoming more and more

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prominent, which are mainly reflected in the decline of physical fitness, the increase in obesity rate, the rising rate of myopia, and the emergence of psychological problems, such as anxiety and depression (Guangming.Net, 2023), which shows that the integration of health education and subject education in school education and teaching is imminent (Hu, 2017). To cope with the above problems, education departments and schools have taken corresponding measures by gradually introducing comprehensive health education courses, integrating health knowledge, nutritional guidance, psychological counseling, and social interaction skills development into physical education teaching (Li, 2019). This not only helps to improve students' physical fitness and health, but also enhances their self-management and social adaptability, and promotes their all-round development.

In recent years, the 2020 National Research Report on Students' Physical Fitness and Health released by the State General Administration of Sport shows that school physical education has a significant impact on students' physical and mental health (General Administration of Sport of China, 2020). Meanwhile, Wang and Li (2019) explored the role of elementary school physical education in promoting students' mental health development in the Study on the Impact of Primary School Physical Education Teaching on Students' Mental Health Development, providing empirical data and analysis. By analyzing the relationship between physical fitness level and sports participation of primary and secondary school students, Li and Zhang (2021) put forward suggestions to strengthen the integration of physical education and health education in their study on the correlation between physical fitness level and sports participation of primary and secondary school students.

In addition, Chen and Liu (2022), in "Implementation Status and Optimization Strategies of Primary School Physical Education and Health Curriculum," analyzed in detail the implementation status of the elementary school physical education and health curriculum and put forward specific optimization strategies and suggestions. The importance of physical activity in preventing and controlling myopia is emphasized by the latest data and policy recommendations provided by the National Health and Wellness Commission in the National Report on Prevention and Control of Myopia among Young People in 2023 (National Health and Wellness Commission, 2023).

In summary, recent studies have demonstrated the limitations of the traditional physical education model and the importance of integrated physical education and health education (Ministry of Education of the People's Republic of China,2022). In particular, the integrated role of physical education is becoming more and more significant in terms of mental health and the development of social adaptability (Qin & Qin, 2018). Therefore, it is especially necessary to develop a physical education and health integration teaching program that affects the physical and mental health of elementary school students. This study aims to fill the gap in the lack of health education integration in the current physical education model and to verify whether the integrated teaching program has a significant impact on the physical and mental health development of elementary school students. Does it increase elementary school students' sports participation? Does it improve elementary school students' motor skill levels? Through the experimental research of the experimental group and the control group before and after comparison, it is verified that the integration teaching program has a significant teaching effect than the traditional teaching program, and the research results will provide a more comprehensive and scientific teaching program for school physical education to promote the overall healthy development of the students, to meet their individual needs, and to enhance their interest and participation in sports activities.

Objectives

The purpose of this study was to examine the overall effects of a physical education and health integration program on the physical and mental health of elementary school students. Through the development and implementation of the physical education and health integration teaching program, the researcher used the comparative analysis method of the experimental group and the control group to compare the pre-and post-test scores between the groups and within the groups, to assess the effect of the teaching program on primary school children's participation in sports and the enhancement of their motor

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skills. Ultimately, the comprehensive effect of this integrated teaching program in promoting the physical health and mental health of primary school students was verified.

Literature Review

To comprehensively grasp the development and research results of this research field, the researchers conducted a systematic review and integration of domestic and international literature, focusing on the core concept of physical education and health integration education and its importance, the research frontiers of physical education, the progress of exploration of health education, the current status of the practice of physical education and health integration pedagogy at home and abroad, the far-reaching impact of integration teaching programs on students' physical and mental health, the interdisciplinary The seven core topics are developed, including the theoretical support of integrated teaching strategies, and the theory of students' physical and mental development. Through an in-depth literature review and analysis of the current situation, the theoretical framework of PE and health-integrated education is comprehensively outlined, and a three-dimensional picture of the current implementation status is presented, as well as a description of its development and trends at home and abroad.

The literature review not only reveals the remarkable effectiveness and unique value of the integrated education model in promoting the overall development of student's physical and mental health, enhancing their social adaptability, and cultivating good health habits but also points out the limitations and challenges faced by the current research and practice, which provides valuable references and inspirations for the subsequent research and practice.

Conceptual Framework

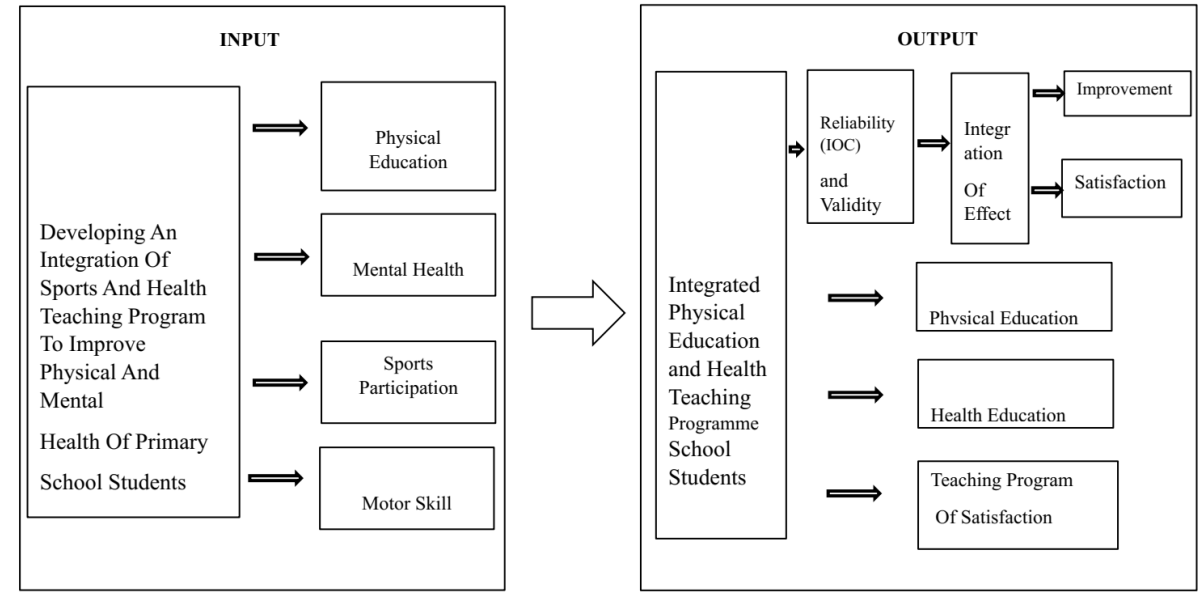

Figure 1 Conceptual Framework

Methodology

Population and sample

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Table 1 Experimental subjects

Groups	Number	Male	Percent (%)	Female	Percent (%)
experimental group	30	14	46.70	16	53.30
control group	30	13	43.30	17	56.70

The researcher used G*power3.1 to analyze the sample size needed in the study based on the number of students in the region, drawing on the findings of Williamson (2020) and others, preset the effect size of independent samples t-test for the analysis of variance d=0.8 (Cohen,1988), and preset the statistical test power 1-β=0.8 with a significance level of 0.05, combined with the Checking the references, it is concluded that this study needs 30 subjects in each group, and the two groups total 60 people, through random sampling method, 49 people in class V1 were selected as the experimental group, and 47 people in class V2 were selected as the control group from the fifth grade of Jinzhou Elementary School in Nansha District, Guangzhou City, China.

To ensure the similarity of the experimental group and the control group in the initial conditions, before the experiment, the students of the two classes were tested before the experiment, and the test items were body mass index BMI, lung capacity, 50-meter run, seated forward bending, 1-minute rope skipping, 1-minute sit-ups, 50-meter × 8 round-trip running and other 7 items and mental health were tested, and the test scores were standardized and converted into rankings, and finally 30 students were selected as the experimental subjects from the two classes. 30 students were selected as experimental subjects, thus increasing the reliability and accuracy of the experimental results. A 12-week experimental study was conducted. With the above population and sample design, the interfering factors can be effectively controlled, and reliable results can be obtained in the study of the impact of physical education and health integration teaching programs on fifth-grade students in elementary school.

Research tools：

Physical Education and Health Integrated Teaching Program

Development of an integrated teaching program, which is the core intervention of the study, aimed at combining physical activity with health education, to improve the physical and mental health of the students.

The physical education and health integration program pilot study was implemented for 12 weeks, with three classes per week, each class lasting 40 minutes, with a 5-minute preparation portion, a 30-minute basic portion (including 20 minutes for the main material and 10 minutes for the supplementary material), and a 5-minute ending portion (including 4 minutes for relaxation and 1 minute for a summary).

Questionnaire: A questionnaire was designed to assess the overall health of the students, including physical activity level, dietary habits, sleep quality, and so on. The questionnaire (reliability coefficient R=0.873, P<0.01, expert judgment method was used to test the validity of the questionnaire, the structure is reasonable and clear, and overall has a high degree of validity) was pre-tested before the start of the experiment and post-tested after the end of the experiment. There are about 1000 students in the fifth grade of elementary school in the region, and the total number of students in 6 classes of the fifth grade in the school where the experiment is to be conducted is 282 students, considering the total number of 1000 students in the fifth grade, the researcher determines the required sample size according to the sample size formula proposed by Krejcie and Morgan, and the researcher needs to distribute the questionnaire to at least 278 students, and 282 questionnaires were distributed (Krejcie & Morgan,1970).

Physical fitness testing instruments:

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Physical fitness testing instruments for students, including height and weight testing instruments, lung capacity testing instruments, chronograph stopwatches, seated forward bending testing instruments, and jump rope testers.

Functional Movement Screen abbreviated as FMS: Research and Innovation by Gray Cook (Cook & Burton, 2006) and Lee Burton, the famous physical therapist and training expert in the United States in the 1990s, aimed to establish a bridge between physical training and sports medicine, which is widely used in the prevention of sports injuries and rehabilitation. The FMS adopts a four-level scale of 0,1,2,3, with a score of 21 out of 14. 14 points is the basic score, and subjects with a score lower than 14 points will be at risk during exercise training. 0 points is pain during the test, 1 point is that the subject can't complete the whole movement or can't keep the starting posture, 2 points is that the subject can complete the movement under the compensatory effect but the quality of the completion is not high, and 3 points is that the subject can complete the movement correctly and with high quality. Complete the movement.

Mental health testing tool: the Hopkins Symptom Check List-25 (HSCL-25) psychometric scale was used to assess the mental health status of the students. The reliability test Alpha value of this scale is between 0.83-0.91; the validity test r value is 0.87, 95% CI (Ashaba S, et.al, 2018).

Research Methods

Literature method: combing and analyzing the relevant physical and health education theories, practical experience, and evaluation research results at home and abroad, and refining the methods and experiences suitable for the research of this topic to provide support for this study.

Questionnaire survey method: a quantitative research method was adopted, using a structured questionnaire on the physical education and health of Jinzhou primary school students in Nansha District, Guangzhou City. This sample size was sufficient to represent a total of 1000 fifth-grade students in the whole region. Experts were organized to assess the questionnaire for IOC.

Expert interview method: experts and scholars in related fields are invited to conduct interviews to communicate and provide guidance on the exploration of the impact of the integrated teaching program of physical education and health on the physical and mental health of primary school students in Guangzhou City, to obtain accurate and practical information and suggestions.

Delphi method for teaching program

Nineteen experts with more than 10 years of experience in the fields of physical education, health, and educational psychology are to be invited to conduct three rounds of Delphi surveys to identify the elements of the teaching program that have a high degree of agreement among the experts' opinions. Based on the experts' recommendations and ratings, the final program for the physical education and health integration teaching program will be determined.

Experimental Method:

The purpose of this study was to investigate the comprehensive effects of a physical education and health integration teaching program on the physical and mental health of fifth-grade elementary school students. Through the systematic measurement of key indicators such as the Physical Education and Health Status Questionnaire, Body Mass Index (BMI), Lung Capacity, 50-meter Dash, Seated Forward Bend, 1-minute Rope Skipping, 1-minute Sit-up, 50-meter x 8 Round Trip Running, the Mental Health Scale (HSCL-25), and Functional Movement Screening (FMS) for students in two classes, we verified whether the Physical Education and Health Integration Teaching Intervention could significantly improve students' physical and mental health, aiming to clarify the effectiveness of the physical education and health integration teaching program in improving students' physical health and mental health.

Research Process

The research was conducted in the following steps, detailed as follows:

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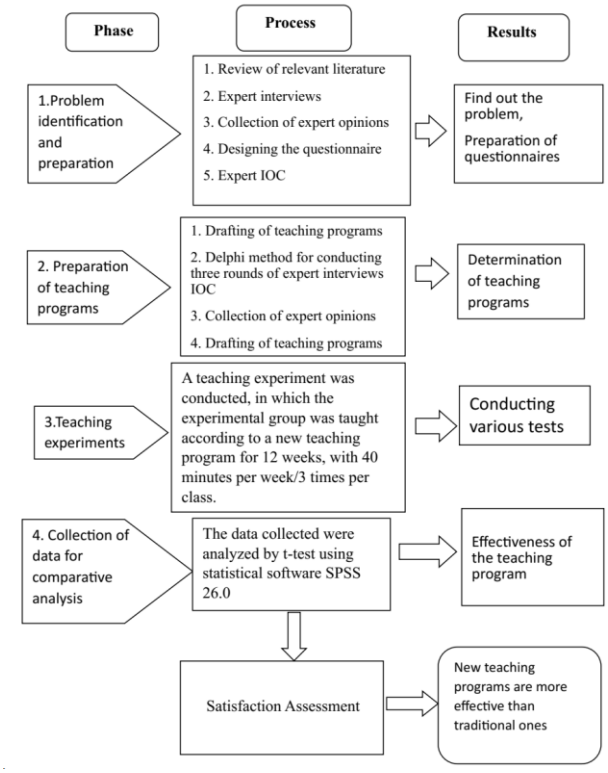

Figure 2 Research Process

Data collection

In this study, data was collected through the following methods:

Questionnaire survey:

Sample size: the population of this study is the fifth-grade students of elementary school, the number of this region is about 1000 people. The actual sample selected was 6 classes of fifth grade, totaling 282 students, according to the sample size formula proposed by Krejcie and Morgan, the researcher needed to distribute questionnaires to 278 students, and 282 questionnaires were distributed.

Reliability and validity: the reliability coefficient of the questionnaire is R=0.873, P<0.01. The validity of the questionnaire was examined by using the expert judgment method, and the results show that the questionnaire is reasonably structured and clear, and it has high validity.

Pre-test and post-test: the pre-test was conducted before the beginning of the experiment and the post-test was conducted after the end of the experiment to assess the effectiveness of the teaching program.

Physical health test:

Test items: including body mass index (BMI), lung capacity, 50-meter sprint, seated forward bending, 1-minute rope skipping, 1-minute sit-up, and 50-meter × 8 round trip running.

Testing instruments: using height and weight testing instruments, lung capacity testing instruments, timing stopwatch, sitting forward bend testing instruments, jump rope tester, etc.

Functional Movement Screening (FMS) :

Scoring Standard: FMS adopts four levels of scoring: 0, 1, 2, and 3, with a full score of 21 points and 14 points as the basic score. 0 points indicate pain during the test, 1 point indicates that the subject is unable to complete the whole movement or unable to maintain the starting posture, 2 points indicate that the subject can complete the movement under compensatory effect but the quality of the completion is not high, and 3 points indicate that the subject can complete the movement correctly and with high quality.

Mental Health Tests:

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Hopkins Symptom Checklist (HSCL-25): the HSCL-25 is a 25-item instrument used to screen for symptoms of anxiety and depression. The first 10 items assess anxiety symptoms and the last 15 items assess depressive symptoms. Each question has four response categories ("not at all," "a little," "quite a bit," and "very much"), rated on a scale of 1 to 4.

Scores were calculated: the total score was the mean of all 25 items and the depression score was the mean of the 15 depression items, with higher scores indicating more severe symptoms.

Data analysis

Descriptive statistical analysis methods

Descriptive statistical analysis of the data of the experimental group and the control group, testing the students in the experimental group and the control group, comparing the mean and standard deviation of the two groups of students, describing the performance and progress of the experimental group and the control group in the experimental period, mainly using the statistical methods of mean, standard deviation, frequency distribution and other statistical methods to present the data.

Analyzing Methods of Pre-test and Post-test Comparison

This study will use pre-test and post-test comparison methods to analyze the data, including comparing the changes between the experimental group and the control group before and after the experiment, as well as the differences in performance between the two groups. It will help to reveal whether the physical education and health integration teaching program has a significant effect on students' physical and mental health aspects.

Statistical Software SPSS 26.0 Analysis Methods

The statistical software SPSS 26.0 was used to analyze the data in depth. The t-test for independent samples was used to compare the differences in performance between the experimental group and the control group after the experiment; the paired-samples t-test was used to examine the changes between the two groups of students before and after the experiment respectively, to comprehensively assess the effect of the integrated teaching program of physical education and health.

Results

Results of the questionnaire

To comprehensively grasp the current development of the current situation and problems in the field of integration of physical education and health education for fifth-grade students in elementary schools in the region, the researcher finalized the questionnaire through literature review and problem refinement, expert interviews and questionnaire preparation, and expert IOC, the researcher distributed the questionnaires to the school's 282 students in six classes of the fifth grade, and the recovery of the questionnaires were 282, all of which were valid, and the validity rate of the recovery reached 100 percent. The researcher used descriptive statistical analysis to synthesize and analyze the collected data, to explore in depth the actual impact of physical education and health integration teaching on students' physical and mental health.

The researcher analyzed the current situation of physical education and health of primary school students from four dimensions: basic situation, health knowledge and skills, health behaviors, and the current status of health education in schools, and the results showed that elementary school students' interest in learning health knowledge was low, with only 16.0% expressing interest, probably because the current way of health education was not enough to attract students' interest. Elementary school students' health habits and choice of leisure activities reflect that there is room for improving healthy lifestyles, and it was found that a good phenomenon is that primary school students generally recognize the importance of exercise and have a positive attitude towards physical activities of 86.2%.

Results of Expert Interviews

This study used expert interviews to explore in-depth the impact of the physical education and health integration teaching program on the physical and mental health of fifth-grade students in Jinzhou Primary School in Guangzhou City. The interviews covered nine experts from physical education, health

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education, and related fields, including six physical education teachers and three mental health experts, which ensured that professional insights and suggestions were obtained from multiple perspectives.

The results of the expert interviews indicate that the physical education and health integration teaching program has a significant positive impact on the physical and mental health development of primary school students. By implementing the above recommendations, the effectiveness of the teaching program can be further enhanced to help students develop a healthy lifestyle and improve their physical and mental health, as well as their social skills. In addition, strengthening the professional training of teachers, optimizing the content and structure of the curriculum, and establishing an effective evaluation and feedback mechanism are essential for the successful implementation of the program and the achievement of its intended goals.

Delphi Method Results and Analysis

To explore the program of integrating physical education and health teaching and to solve specific problems in physical education teaching, the researcher used the Delphi method to conduct three rounds of expert interviews. To ensure the authority and validity of the research results, a group of 19 experts were invited to this study, covering the fields of physical education, health, and educational psychology. These experts all had more than 10 years of experience in the relevant fields and had titles of intermediate or above. Specifically, they included nine sports experts (three with senior titles, four with associate titles, and two with intermediate titles), five health experts (two with associate titles, and three with intermediate titles), and five educational psychologists (two with associate titles, and three with intermediate titles). Such a mix of experts aims to ensure diversity and complementarity of perspectives, thus providing comprehensive and in-depth insights into the study.

Based on the preliminary literature review, expert interviews, and the researcher's research results, the researcher designed a preliminary draft PE and health integration teaching program containing key elements as the basis of the expert Delphi survey, and in terms of Delphi's indicator screening, based on the relevant literature, the mean value of the importance score of 4.0 or the coefficient of variation CV=0.25 as the cut-off value (the value of the coefficient of variation is usually between between 0 and l, with smaller values indicating less divergence). Indicators with a mean importance score ($\bar{X}$< 4.0 or CV>0.25) were removed after discussion and agreement by the research team (Li Chuangwei,2021).

Through the three rounds of Delphi method expert interviews, experts reached a consensus on 14 key elements of the integrated physical education and health instruction program, thereby finalizing and optimizing the program. This process not only strengthened the theoretical foundation and practical guidance of the instruction program but also provided solid expert support and guidance for subsequent teaching experiments and implementation.

Comparative Analysis of Physical Fitness Data Between Experimental and Control Groups

1) Pre-Experiment Comparison of Physical Fitness Indicators Between the Experimental Group and the Control Group

Table 2 Pre-Experiment Physical Fitness Indicators of the Experimental Group and the Control Group

Variables	MEAN ± SD		t	p
	Experimental group	Control group		
BMI	13.60±2.33	13.20±2.31	0.67	0.51
Lung Capacity (ml)	11.27±1.40	11.42±1.79	-0.36	0.72
50 m sprint (second)	14.61±1.82	14.53±1.34	0.19	0.85
Seated Forward Bend （cm）	8.08±0.90	8.30±1.23	-0.79	0.43
One-minute jump rope (pcs)	8.10±0.89	8.27±1.15	-0.63	0.53
One-minute sit-ups (pcs)	15.30±1.23	15.39±1.44	-0.27	0.79
50 m× 8 round trip run (second)	7.92±0.86	7.70±0.76	1.06	0.30

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From Table 2, it was found that before the experiment, an independent sample t-test revealed no significant differences between the experimental group and the control group in terms of BMI, lung capacity, 50 m sprint, sit-and-reach, one-minute jump rope, one-minute sit-ups, and the 50 m×8 shuttle run across seven aspects ($p>0.05$). This indicates that the physical fitness conditions of both the experimental group and the control group are comparable, permitting the progression of the experiment.

2) Comparison of Physical Fitness in the Experimental Group Before and After the Experiment

Table 3 The comparison of Physical Fitness between the pretest and the posttest in the Experimental Group.

Variables	MEAN± SD		t	p
	Pretest	Posttest		
BMI	13.60±2.33	14.10±1.60	-0.97	0.34
Lung Capacity (ml)	11.27±1.40	11.71±1.02	-1.38	0.17
50 m sprint (second)	14.61±1.82	16.07±1.45	-3.44*	0.00
Seated Forward Bend （cm）	8.10±0.90	9.14±0.67	-5.07*	0.00
One-minute jump rope (pcs)	8.10±0.89	8.83±0.76	-3.40*	0.00
One-minute sit-ups (pcs)	15.30±1.23	16.25±1.55	-2.62*	0.01
50 m×8 round trip run (second)	7.92±0.86	8.25±0.82	-1.51	0.14

* $p<0.05$

From Table 3, the result of the comparison showed that there were differences in the experimental group before and after the experiment in terms of BMI, lung capacity, 50 m sprint, sit-and-reach, one-minute jump rope, one-minute sit-ups, and the 50 m× 8 shuttles run across seven aspects. Specifically, there were no significant differences in BMI, lung capacity, and the 50 m×8 shuttle run ($p>0.05$) between the experimental group and the control group. Significant differences were observed in the 50 m sprint, sit-and-reach, one-minute jump rope scores, and one-minute sit-ups in five aspects ($p<0.05$), with details as follows:

There was a very significant difference in the 50 m sprint for the experimental group ($t=-3.44$, $p=0.00$, $p<0.05$).

There was a very significant difference in the sit-and-reach for the experimental group ($t=-5.07$, $p=0.00$, $p<0.05$).

There was a very significant difference in the one-minute jump rope for the experimental group ($t=-3.40$, $p=0.00$, $p<0.05$).

There was a significant difference in the one-minute sit-ups for the experimental group ($t=-2.62$, $p=0.011$, $p<0.05$).

The comparison of physical fitness within the experimental group before and after the experiment revealed differences in three indicators, while five showed significant improvements. This indicates that the integrated teaching approach of physical education and health promoted an enhancement in the students' physical fitness levels.

3) Comparison of Physical Fitness in the Control Group Before and After the Experiment

Table 4 The comparison of Physical Fitness between the pretest and the posttest in the control group.

Variables	MEAN± SD		t	p
	Pre-test	Post-test		
BMI	13.60±2.33	14.40±1.22	-1.67	0.10

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Variables	MEAN± SD		t	p
	Pre-test	Post-test		
Lung Capacity (ml)	11.42±1.79	11.93±1.48	-1.21	0.23
50 m sprint (second)	14.53±1.34	15.21±1.05	-2.20*	0.03
Seated Forward Bend （cm）	15.39±1.44	15.34±1.27	0.15	0.88
One-minute jump rope (pcs)	8.27±1.15	8.88±0.88	-2.30*	0.03
One-minute sit-ups (pcs)	15.39±1.44	15.33±1.45	0.18	0.86
50 m×8 round trip run (second)	7.70±0.76	7.92±0.61	-1.22	0.23

* $p<0.05$

From the table 4, a comparison of physical fitness before and after the experiment in the control group, using the independent sample t-test, revealed that among seven indicators—BMI index, Lung Capacity, 50 m sprint, sit and reach, one-minute jump rope, one-minute sit-ups, and 50 m×8 shuttle run—two showed significant differences and five did not. Specifically:

There were no significant differences in five indicators: BMI index, Lung Capacity, 50 m sprint, one-minute sit-ups, and 50 m×8 shuttle run ($p>0.05$). In the control group, significant differences were observed in two indicators: sit and reach, and one-minute jump rope ($p<0.05$). In detail:

For Lung Capacity, the control group showed a significant difference, with an average value of 14.53 before the experiment and 15.21 after the experiment ($t=-2.20$, $p=0.03$, $p<0.05$). Similarly, for sit and reach, there was a significant difference with an average value of 8.27 before the experiment and 8.88 after ($t=-2.30$, $p=0.03$, $p<0.05$).

The fact that out of the seven physical fitness tests conducted before and after the experiment in the control group, five did not show significant differences while only two did, suggests that there was some progress in the control group during this period. Although these improvements might not be as pronounced as those observed in the group adopting new teaching methods, these findings underscore that students' physical fitness can improve to a certain extent even under traditional physical education programs, albeit not as significantly as in the experimental group.

4) Comparison of Physical Fitness between the Experimental Group and the Control Group After the Experiment

Table 5 The comparison of Physical Fitness between experimental and control groups posttest.

Variables	MEAN± SD		t	p
	Experimental group	Control group		
BMI	14.10±1.60	13.70±1.88	0.89	0.38
Lung Capacity (ml)	11.71±1.02	11.39±1.48	0.96	0.34
50 m sprint (second)	16.03±1.51	15.09±0.92	2.89*	0.00
Seated Forward Bend （cm）	9.14±0.67	8.37±1.19	3.09*	0.00
One-minute jump rope (pcs)	8.81±0.75	8.86±0.86	-0.24	0.81

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Variables	MEAN± SD		t	p
	Experimental group	Control group		
One-minute sit-ups (pcs)	16.23±1.56	15.34±1.27	2.43*	0.02
50 m× 8 round trip run (second)	8.24±0.82	7.69±0.60	2.98*	0.00

* $p<0.05$

From Table 5, it is observed that after the experiment, a comparison of the physical fitness between the experimental group and the control group, using an independent sample t-test, revealed differences in 7 indicators: BMI, Lung Capacity, the 50 m sprint, seated forward bend, one-minute jump rope, one-minute sit-ups, and the 50 m× 8 shuttle run. The specific details are as follows:

There were no significant differences in three items between the experimental and control groups: BMI, Lung Capacity, and one-minute jump rope ($p>0.05$). However, significant differences were found in five items: the 50 m sprint, sit and reach, one-minute sit-ups, the 50 m×8 shuttle run scores, and the total test score ($p<0.05$), with specific conditions as follows:

After the experiment, the experimental and control groups showed a very significant difference in the 50 m sprint ($t=2.89$, $p=0.00$, $p<0.05$), with the experimental group's post-experiment average (16.03) being significantly higher than that of the control group (15.09).

A very significant difference was observed in the sit and reach for the experimental group ($t=3.09$, $p=0.00$, $p<0.05$), with the post-experiment average (9.14) significantly higher than that of the control group (8.37).

For the one-minute sit-ups, a significant difference was noted ($t=2.43$, $p=0.02$, $p<0.05$), with the experimental group's post-experiment average (16.23) significantly higher than that of the control group (15.34).

A very significant difference was found in the 50 m× 8 shuttle run ($t=2.98$, $p=0.00$, $p<0.05$), with the experimental group's post-experiment average (8.24) significantly higher than that of the control group (7.69).

On the total test score, a very significant difference was noted ($t=3.39$, $p=0.00$, $p<0.05$), with the experimental group's post-experiment average (84.26) significantly higher than that of the control group (80.45).

After the experiment, a comparison of eight physical fitness indicators between the experimental group and the control group showed that, although three items did not exhibit significant differences, the experimental group significantly outperformed the control group in five items. This indicates that the physical education and health-integrated Teaching Program is more effective in enhancing students' physical fitness levels.

Physical Education and Health Integrated Teaching Program: 12-Week Program Test Analysis

The experimental and control groups participated in a 12-week study covering six instructional topics: 50 m sprint, gymnastics, basketball, soccer, jump rope, and a 50 m shuttle run project. Each instructional topic was taught over two weeks, with three lessons per week. Tests were conducted during the third lesson of each week, resulting in twelve tests (E1.1-12) over the 12 weeks. Following the completion of the 12-week instructional period, a final test (E2) was administered.

The average score for the experimental group's routine tests over the 12 weeks (E1) was 0.78, compared to the control group's average score of 0.75. This indicates that the experimental group's E1 average score was 0.03 points higher than that of the control group. Furthermore, the experimental group's average score on the final test (E2) was 0.80, while the control group's average was 0.75, showing that the experimental group's E2 average score exceeded that of the control group by 0.05 points. These results suggest that the new Teaching Program adopted by the experimental group was more effective than the traditional Teaching Program used by the control group.

Comparison of Mental Health Using HSCL-25:

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Table 6 The comparison of mental health indicators between the experimental and control groups pretest and posttest.

Variable	Group	Mean± SD		t	p
		Pretest	Posttest		
HSCL-25	**Experimental**	33.33±3.65	25.50±0.63	11.58*	0.00
	Control	32.50±3.59	30.83±3.00	1.95	0.06
	t	0.89	-9.54*		
	p	0.38	0.00		

* $p<0.05$

1) Comparison of Mental Health Between the Experimental Group and the Control Group Before the Experiment

Table 11 showed that before the experiment, a comparison of mental health between the experimental and control groups, using an independent sample t-test, found no significant differences ($p>0.05$). This indicates that the mental health levels of students in both the experimental and control groups were comparable, allowing the experiment to proceed.

2) Comparison of Mental Health in the Experimental Group Before and After the Experiment

From Table 11, it was evident that a comparison of mental health in the experimental group before and after the experiment, conducted using a paired sample t-test, revealed a very significant difference ($t=11.58$, $p=0.00$, $p<0.05$). The average value before the experiment was significantly higher than the average value after the experiment in the experimental group, indicating that the new teaching methods adopted by the experimental group had a very significant positive effect on improving students' mental health levels.

3) Comparison of Mental Health in the Control Group Before and After the Experiment

From Table 6, it is clear that in the comparison of mental health before and after the experiment in the control group, a paired sample t-test indicated no significant difference in the level of mental health before and after the experiment ($t=1.95$, $p=0.06$, $p>0.05$). This suggests that the traditional physical education Teaching Program used by the control group did not significantly improve the students' mental health levels.

Comparison of Mental Health Between the Experimental and Control Groups After the Experiment

From Table 11, following the experiment, a comparison of the mental health levels between the experimental group and the control group through an independent samples t-test showed a very significant difference ($t=-9.54$, $p=0.00$, $p<0.05$). This indicates that the new teaching method adopted by the experimental group has a highly significant effect on improving students' mental health levels.

Functional Movement Screen (FMS) Analysis:

The Functional Movement Screen (FMS) is an evaluative tool designed to identify the most significant areas of movement deficits by observing the quality of completion of 7 specific movements, scoring participants, and determining where limitations or asymmetries in capabilities exist. The outcomes of this assessment are then used to implement a series of targeted corrective exercises to swiftly enhance movement quality, reduce injury risk, and ultimately improve athletic performance. The scoring system uses a scale of 0, 1, 2, and 3, with a total possible score of 21 and a baseline score of 14. Participants scoring below 14 are considered to be at risk of injury during physical training. A score of 0 is given if the pain is experienced during any test movement, 1 if the participant is unable to complete the movement or maintain the starting posture, 2 if the movement is completed with compensatory actions but of low quality, and 3 if the participant completes the movement correctly and with high quality.

If pain occurs during any of the screening movements, regardless of the quality of the movement, that specific movement is scored as 0. This underscores the significance of pain, indicating that even if it does not severely affect the quality of movement completion at the moment, the presence of pain suggests an impact on movement control. However, for caution, movements associated with pain are scored as 0.

Table 7 The comparison of FMS indicators between the experimental and control groups pretest and posttest.

Variable	Group	Mean± SD	t	p

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		Pretest	Posttest		
FMS	Experimental	15.00±0.79	18.23±1.04	-13.57*	0.00
	Control	15.17±1.02	15.60±0.72	-1.90	0.06
	t	-0.71	11.38*		
	p	0.48	0.00		

* p<0.05

1) Pre-experiment comparison of Functional Movement Screen (FMS) between the experimental group and the control group

As indicated in Table 12 above, before the experiment, there was a comparison of Functional Movement Screen (FMS) scores between the experimental group and the control group. An independent samples t-test revealed no significant difference in FMS test scores between the two groups (t=-0.71, p=0.48, p>0.05), indicating that the levels of the two groups were comparable, thereby validating the feasibility of proceeding with the experiment.

2) Comparison of Functional Movement Screen (FMS) Scores Before and After the Experiment in the Experimental Group

As evident from Table 12, a comparison of Functional Movement Screen (FMS) scores before and after the experiment within the experimental group was conducted. A paired samples t-test indicated a highly significant difference in FMS scores before and after the test within the experimental group (t=-13.574, p=0.000, p<0.05). This demonstrates that the experimental group's adoption of a new program significantly improved the quality of movement.

3) Comparison of Functional Movement Screen (FMS) Scores Before and After the Experiment in the Control Group

As indicated in Table 12 above, a comparison of the Functional Movement Screen (FMS) before and after the experiment in the control group, using paired sample t-tests, revealed no significant difference (t=-1.90, p=0.06, p>0.05). This suggests that the traditional physical education Teaching Program adopted by the control group did not improve movement quality as effectively as the new Teaching Program.

4) Post-experiment comparison of Functional Movement Screen (FMS) between Experimental and Control Groups

From the table above 7, a comparison of the Functional Movement Screen (FMS) between the two groups after the experiment, conducted through an independent samples t-test, revealed a highly significant difference (t=11.38, p=0.00, p<0.05). The experimental group's post-experiment mean score (18.23) was significantly higher than that of the control group (15.60), indicating that the adoption of the new Teaching Program effectively improved students' movement quality.

Analysis of Teacher and Student Satisfaction with the Teaching Program:

To collect the opinions and satisfaction of PE teachers and students in the experimental group on PE and health comprehensive teaching, and to deeply understand the effectiveness difference between the comprehensive teaching method and the traditional PE teaching scheme in practical application, the effectiveness of the comprehensive teaching scheme was tested. The researchers assessed teacher and student satisfaction with instructional content, methods, learning environments, and curriculum outcomes to assess the effectiveness of instructional programs and, based on feedback, further refine instructional strategies to better meet the needs of students. The following is the analysis of teachers' and students' satisfaction with the teaching program after the experiment:

Researchers used a satisfaction survey questionnaire covering multiple dimensions, including teaching content, methods, course participation, facilities and equipment, classroom environment, physical and health improvement, psychological health promotion, and overall satisfaction. Each indicator was

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scored out of 5, with a total of 50 valid questionnaires collected from the experimental group of teachers and students.

Table 8 Statistics of Teacher and Student Satisfaction Questionnaires

No.	Items	Sample	$\bar{X}$	SD	Level
1	Aligns with student interests	50	4.66	0.52	A
2	Appropriate difficulty	50	4.42	0.76	B
3	Teaching methods	50	4.64	0.53	A
4	Student participation	50	4.60	0.64	A
5	Facilities and equipment	50	4.50	0.65	A
6	Classroom environment	50	4.56	0.58	A
7	Physical and health level	50	4.54	0.65	A
8	Psychological relaxation and stress relief	50	4.56	0.71	A
9	Overall satisfaction	50	4.58	0.58	A

Evaluation criteria:
4.51-5.00 Strongly High Satisfaction for grade A
3.51-4.50 High Satisfaction for grade B
2.51-3.50 Moderate Satisfaction for Grade C
1.51-2.50 Low Satisfaction for Grade D
1.00-1.50 Very Low Satisfaction for Grade E
Analysis results:

Alignment with Student Interests: The average score is 4.66 with a standard deviation of 0.52, rated as A. This indicates that the majority of students believe the teaching content highly aligns with their interests, with a concentrated distribution of data suggesting a generally high level of satisfaction.

Appropriate Difficulty: The average score is 4.42 with a standard deviation of 0.76, rated as B. This is the lowest-rated item among all, indicating a significant divergence in students' perceptions of course difficulty.

Teaching Methods: The average score is 4.64 with a standard deviation of 0.53, rated as A. Students are generally satisfied with the teaching methods employed, as indicated by the high data concentration and uniformly positive evaluations.

Student Participation: The average score is 4.60 with a standard deviation of 0.64, rated as A. High scores reflect active student engagement and high levels of interaction within the course.

Facilities and Equipment: The average score is 4.50 with a standard deviation of 0.65, rated as A. This demonstrates a general satisfaction with the teaching facilities and equipment.

Classroom Environment: The average score is 4.56 with a standard deviation of 0.58, rated as A. High scores indicate that students perceive the classroom environment as supportive of learning and conducive to sports activities, being both comfortable and facilitative.

Physical and Health Education: The average score is 4.54 with a standard deviation of 0.65, rated as A. This reflects students' satisfaction with the physical and health education aspects.

Psychological Relaxation and Stress Relief: The average score is 4.56 with a standard deviation of 0.71, rated as A. Despite a relatively high standard deviation, indicating varied experiences, the overall satisfaction remains high.

Overall Satisfaction: The average score is 4.58 with a standard deviation of 0.58, rated as A. Overall, the teachers and students have expressed a high level of satisfaction of 91.24% with the integrated sports and health education program.

In summary, the questionnaire reveals high student satisfaction across various aspects of the integrated sports and health education program, particularly in terms of teaching methods, student

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participation, and classroom environment. Despite a lower rating in course difficulty, all other aspects received an A rating, demonstrating high recognition of the teaching content and environment.

Summary

This study conducted an experimental investigation of a physical education and health-integrated teaching program on fifth-grade primary students to explore its impact on students' physical and mental health as well as their level of athletic skills. The research findings indicate:

Impact of the Integrated Teaching Program on Students' Physical and Mental Health: The experiment demonstrated that the experimental group, which employed the physical education and health integrated teaching program, showed significant improvements in physical health indicators (such as BMI, lung capacity) and mental health indicators (such as the enthusiasm for autonomous learning and scores on psychological assessments). Particularly in promoting mental health, students exhibited higher levels of enthusiasm and participation, reflecting the effectiveness of the integrated teaching program in fostering comprehensive health development among students.

Enhancement of Students' Participation in Physical Activities Through the Integrated Teaching Program: Through questionnaire surveys, teaching satisfaction assessments, and comparative analyses before and after the experiment, the experimental group exhibited a significant increase in participation in physical activities. This was evident in the notable improvement in students' performance in skill learning, one-minute rope jumping, and one-minute sit-ups. This indicates that the physical education and health-integrated teaching program effectively sparked students' interest in physical activities, thereby enhancing their participation level.

Improvement of Students' Athletic Skill Levels by the Integrated Teaching Program: The experimental results also revealed that the experimental group significantly outperformed the control group in athletic achievements, such as the 50 m sprint, sit-and-reach, and one-minute sit-ups. This suggests that the integrated teaching program not only elevated the students' physical health levels but also effectively enhanced their athletic skills.

In summary, through the analysis and discussion of the experimental data, this study validated the significant impact of the physical education and health-integrated teaching program on the physical and mental health of fifth-grade primary students. It effectively increased students' participation in physical activities and their level of athletic skills. These findings provide a scientific basis and methodological guidance for subsequent physical education practices.

Conclusion

The results of the experiment showed that:

Physical education and health integration teaching programs could improve the physical health of primary school students.

Physical education and health integration teaching programs could improve the mental health of primary school students.

Physical education and health integration teaching programs may promote the motivation of primary school pupils to participate in physical activities.

Physical education and health-integrated teaching programs may improve the level of physical skills of primary school pupils.

The results of the teacher-student satisfaction survey show that teachers and students are very satisfied with the effectiveness of the integrated teaching program for physical education and health.

Discussion

Summary of results: After the experiment of the integrated teaching program of physical education and health, the students in the experimental group significantly improved their physical fitness level, mental health level, FMS level, and teaching satisfaction compared with the control group, which showed that the new teaching program in the experimental group had a significant effect in improving the physical and mental health of primary school students.

Discuss the results

Similarities with Previous Research:

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The findings of this study align with existing literature (Hao & Zeng, 2009; Centers for Disease Control and Prevention, USA, 2010) that the effective integration of physical education and health education significantly improves students' physical and mental health levels.

The integrated physical education and health instruction program significantly enhances primary students' physical and mental health and sports skills, consistent with previous research findings. For example, Slingerland's (2011) research indicates that physical activities can enhance adolescents' sports participation and positively impact their physical and mental health, aligning with this study's findings on sports participation and health improvement.

Moreover, Li's (2019)) research emphasizes the importance of integrated physical education and health instruction in enhancing students' health awareness and practical abilities. His findings show that a teaching model combining physical activities with health education effectively improves students' health knowledge and life skills, similar to this study's conclusion that integrated instruction programs can promote comprehensive development in students' physical and mental health.

Li (2016) proposed that physical education teaching integrated with health education elements could better promote students' mastery and application of health knowledge, especially in cultivating good sports attitudes, which is consistent with this study's findings in improving students' sports skill levels and participation.

Zhang's (2017) research further emphasizes the role of health education in physical education, suggesting that implementing health education through physical education effectively enhances students' health management abilities and quality of life, aligning with this study's viewpoint that integrated physical education and health instruction programs have a significant positive impact on promoting primary students' physical and mental health.

Smith & Thomas (2018) demonstrated that regular participation in physical activities significantly enhances children's and adolescents' physical health and psychological well-being. This is consistent with this study's preliminary findings that physical activities indeed promote students' physical and mental health in various aspects.

Differences from Previous Research

While this study and many previous studies agree on the positive effects of integrated physical education and health instruction programs on primary students' physical and mental health and sports skills, this study presents new perspectives and unique contributions in several areas:

Application of follow-up assessments: Compared to previous studies, such as those by Li (2016) and Zhang (2017), which mainly used cross-sectional research designs, this study employed a 12-week experimental design with long-term follow-up assessments to explore the sustained impact of integrated physical education and health instruction on students' physical and mental health. This design provides important insights into the durability of the effects of integrated instruction programs.

Comprehensive assessment of physical and mental health indicators: This study used a multidimensional assessment system, including physical health indicators, mental health status, and sports skill levels. While Slingerland's (2011) research explored the impact of physical activities on adolescents' physical and mental health, focusing mainly on changes in sports participation, this study provided richer data support for understanding the comprehensive benefits of integrated instruction through a comprehensive assessment.

Development and implementation of specific instruction programs: Unlike previous studies, such as those by Li (2019) and Smith & Thomas (2018), which focused more on theoretical analysis of integrated teaching and the enhancement of students' health awareness, this study explored the specific effects of integrated physical education and health instruction programs. By applying the instruction program in practice, this study provides practical references and guidance for future educational practices.

In-depth exploration of teachers' roles and student participation: Compared to previous research, this study delved deeper into teachers' roles in integrated teaching and how to effectively enhance student participation. By analyzing how teachers can stimulate students' interest and participation through strategies and methods, this study offers targeted recommendations to optimize the teaching process and improve teaching outcomes.

By comparing relevant research domestically and internationally, this study further confirms the empirical effects of integrated instruction programs in enhancing students' physical health, mental health, and social skills, providing new theoretical and practical foundations for future teaching reforms and research in related fields.

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Recommendation

This study presents new perspectives and unique contributions compared to previous research in methodology, assessment systems, teaching implementation, and teacher-student interaction, providing significant supplements to the theory and practice of integrated physical education and health instruction. Through empirical analysis, this study validates the positive impact of integrated instruction programs on the development of primary students' physical and mental health, offering valuable references and guidance for future research and practice in related fields. Because the implementation of the Integrated Physical Education and Health Teaching Program has significantly improved the physical and mental health of students, it is recommended that the education sector should further promote the teaching program to benefit more students. More experiments can be tried in different districts and grades to verify its general applicability.

Suggestions for applying research results

1) This study shows that the integrated teaching program of sports and health is effective, and it is recommended that the government should promote this research results.

2) Provide the training and knowledge and practice distribution for teachers in in-service training.

Suggestions for future research

1) Explore the comparative effects of different teaching methods:

Future research could further explore and compare the impacts of different integrated physical education and health instruction methods (such as project-based learning, scenario simulation, team collaboration, etc.) on students' physical and mental health to find the most effective teaching strategies.

2) Study long-term impacts and their sustainability:

Considering that this study mainly focused on short-term teaching effects, future research should emphasize the long-term effects of integrated physical education and health instruction programs on students' physical and mental health and their sustainability, for example, through follow-up studies, assessing students' physical and mental health status months or years later.

3) Examine the role of family and community participation:

Further, research the role and impact of family and community in integrated physical education and health education. Explore how to effectively integrate family and community resources into school education to form an educational ecosystem that supports the comprehensive development of students' physical and mental health across society.

4) Cross-cultural studies:

In the context of globalization, conduct cross-cultural studies to compare the design, implementation, and outcomes of integrated physical education and health instruction programs in different countries and regions, gaining broader educational insights and inspirations.

Through the implementation of the above suggestions and the exploration of future research directions, it is hoped to more comprehensively promote students' physical and mental health development, providing richer experiences and evidence for the theory and practice of integrated physical education and health education.

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