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Developing Physical Education Program Based on Contractual Learning to Enhance Physical Fitness and Mental Health in Medical University Students

Jiao Runyi[1] and Pattarapon Mahakhan[2]
[1]Faculty of Sports Science and Technology, Bangkokthonburi University, Thailand
[1]E-mail: 195278892@qq.com, ORCID ID: https://orcid.org/0009-0004-4505-2864
[2]E-mail: paulsport@gmail.com, ORCID ID: https://orcid.org/0009-0008-1355-8894
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Abstract
Background and Aims: The research on contract teaching mode is a reflection on the distribution of learning responsibilities between teachers and students in physical education classroom teaching. Give full play to the students' subjective position in learning, stimulate students' subjective initiative, and encourage students to participate in teaching. The objective of this study is to develop a physical education program based on contractual learning to enhance the physical health and mental health of students at the University of Chinese Medicine (GZUCM).
Methodology: Among 1500 college males and females aged between 18-19 years old students in the second year of the public physical education course at Guangzhou University of Chinese Medicine, a sample size of 30 subjects was determined by GPOWER calculations to carry out a teaching experiment. Using the Delphi questionnaire to formulate the content of the physical education curriculum, signing a contract with students to execute the training plan, starting an 8-week experimental implementation, testing students' physical health before the experiment and after every 2 weeks of training, and testing their mental health before and after the experiment, collating and analyzing the results by software package use the one-way repeated-measures ANOVA for analyze the results, and deriving the effects of the physical education curriculum on the change factors of physical health and mental health of college students.
Conclusion: the curriculum developed by the contractual learning method can improve the physical health as well as the mental health of college students. The contractual learning approach to physical education is practical and effective and can be promoted and used.
Keywords: Contractual Learning Method; Physical Health; Mental Health

Introduction

As the high-quality talents of the country in the new era, university students shoulder the important responsibility of promoting the construction of a strong sports country. With the increasingly fierce competition in society (Yin, 2007), the demand of society for excellent university students with all-round development is becoming more and more urgent. However, it should not be overlooked that under the environment of fierce competition and employment pressure, the physical health level of university students has generally declined, and the mental health problems of university students have become increasingly prominent. In this context, it is necessary to re-examine the way of physical education teaching in universities and universities. At present, most university and universities still adhere to a single teaching process, which may weaken students' initiative and motivation to participate in physical exercise. A long-term unchanging pattern will not only affect students' interest in physical exercise but also exacerbate the problems of interpersonal relationships, anxiety, and other psychological disorders (Liu, 2009).

Critical thinking, emotional intelligence, and practical skills are improved through experiential and holistic learning, which benefits mental health and physical fitness (U-Shenyang, 2024; Rasri et al., 2024). Proven methods such as Reggio Emilia and Montessori show how well they develop practical problem-solving skills. Furthermore, MOOCs guarantee effective information delivery, encouraging participation and adaptability (Potiwan & Chinnavongsa, 2025). By fusing digital learning resources, emotional development, and experiential activities, incorporating these methods into education promotes active lifestyles, improved mental health, and lifetime well-being.

Health does not only mean freedom from physical illness but also the pursuit of an overall state of physical, mental, and social perfection. This state covers not only physical health but also psychological balance and social adaptability. However, in the field of medical specialties, students face special challenges, and the learning tasks and practical courses in medical schools are relatively heavy, resulting in relatively high psychological pressure on medical students, even more than that of university students in other specialties. This high-pressure learning environment may lead medical students to neglect the importance of physical exercise (Gao, 2023). Lack of exercise can affect

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physical fitness levels, decrease physical fitness, increase body weight, and may increase the risk of developing chronic diseases. Meanwhile, some studies have shown that the percentage of medical students with poor mental health reaches 38.5%.

Therefore, the study of how to improve the physical health and mental health of university students has become a brand-new direction for the reform of physical education teaching in universities and universities. In the traditional physical education teaching mode, the physical education teacher plays a leading role in the classroom, what kind of knowledge is taught, what kind of style is used in classroom teaching, and how to deepen the teaching of important and difficult points depends entirely on the teacher's understanding of the teaching materials. Students passively catch up with the teacher's thinking, and repeat the teacher's teaching content, students in the subjective level of the learning activities do not have a sense of ownership. What students learn in the classroom and what kind of learning effect they achieve depends entirely on the level of the teacher. The research on contract teaching mode is a reflection on the distribution of learning responsibilities between teachers and students in physical education classroom teaching. Give full play to the students' subjective position in learning, stimulate students' subjective initiative, and encourage students to participate in teaching. Classroom teaching should also move from simple instructional repetition to reflection-based lessons.

In this study, the contractual learning method was adopted and combined with the National Physical Fitness Standard for Students to construct a (mainly goal-training oriented) physical education program applicable to medical university students. We clarified the core connotation and characteristics of the contractual learning method and gained comprehensive insights into the current status and value of its application in the field of university students' physical fitness and mental health. Through these aspects, we were able to accurately identify the potential problems of the university students and provide them with assistance, thus maintaining their good physical and psychological condition, and improving their quality of life and sense of well-being is of great significance.

Objectives

1. To construct a scientific and effective physical education curriculum based on the contractual learning method.
2. To compare the changes in physical fitness and mental health level of university students by the physical education curriculum of contractual learning method.

Literature Review

1. Contractual learning method

Contracts were first used in ancient times as an activity of human production and trade. As an ancient system, people have never stopped recognizing and exploring it. From ancient times to the present contract has four different meanings: the first is a self-agreement, that is to say, to agree with oneself and oneself, without the intervention of others, commonly known as a kind of psychological implication. The second is a written agreement, which has legal significance and is protected by law; the third is a socio-political contract, and the fourth is a philosophical contract. Contracts exist in many forms, but in the end, people can use them in the two areas of law and life.

Contract Learning (CL) is an educational method that emphasizes a clear contract or contract between the learner and the teacher that specifies the learning objectives, the content of the learning, the method of learning, and the method of assessment. This method aims to stimulate learners' initiative, autonomy, and self-management so that they can participate in decision-making in the educational process, formulate learning plans, and achieve predetermined learning objectives.

1.1 Origin of the Contractual Learning Method

The idea of contractual learning can be traced back to 1922 when the American scholar Parkhurst put forward the idea of "contracting in education" (contracting in education) on the distribution of responsibilities between educators and scholars. In the 1860s, the U.S. education sector emerged from "individualization of instruction" (individualization of instruction) experiments and research. Malcolm S. Knowles, a renowned scholar and practitioner in the field of adult education, combined independent study, individualized instruction, self-directed learning, and lifelong learning into a new theoretical framework. In his book "The Adult Learner: A Neglected Species", he introduced the core concept of contractual learning. In just over a decade, the Contractual Learning Approach has been widely used in the United States, Australia, Canada, and other countries in adult learning, in-house employee training, and the professional development of social workers, and has been recognized as a good method of teaching and learning that effectively meets the specific learning

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needs, preferences, experiences, and pace of learning of adults. Adult education guru Knowles. (1975) was the first to advocate and promote the use of contractual learning in the United States. He defines contractual learning as contractual learning is the negotiation and signing of a learning contract between the learner and the educator, which is a means of helping the learner to organize and implement his/her learning activities according to the learner's differences. Contractual learning can be effectively adapted to the specific circumstances of different students and can be tailored to their needs. Knowles. (1986) believes that the key players in self-directed learning are the learner and the facilitator and that the learning contract is one of the most suitable tools for the development of self-directed skills. This contract defines the goals of the student's learning, how the goals are to be achieved when the learning activity is to take place, and the criteria by which the learning activity is to be evaluated. In the same year, Berte NA. (1975). argued that contractual learning should be a written commitment between the student and the instructor to reward or credit the student for a specific amount of work. The definition he gave is close to the current contractual learning approach. Educators such as Tompkins et al. (1988) emphasized the contractual learning approach as having an interrelationship between the three dimensions of self-determination, the learner, and the learning goals, and they viewed contractual learning as uninterrupted and continuous. Through continuous negotiation between the teacher and the students, the learning goals are reached together.

1.2 Characteristics of the Contractual Learning Method

Through the cognition of the contractual learning method, we understand that the contractual learning method is a kind of spiritual contract dependent on students, which requires learners to participate autonomously, actively, and honestly. As adults, university students usually have a certain degree of self-control and harbor curiosity about new things, which is compatible with the psychological needs of university-level students. Compared with the traditional teaching mode, the contractual learning method has significant differences in the inner nature and also has several advantages and features.

1.2.1 Contractual nature of learning tasks

"The contractual learning method has the characteristics of a business contract, which requires students to make a clear commitment to themselves, their teachers, and their classmates in the learning process (Alatanbagun, 2014). Integrity is regarded as an important value in society and is vital to the development and progress of the whole society. However, university students are the reserve of social talents and the backbone of the society they are about to enter. Therefore, it is particularly important to strengthen the cultivation of university students' awareness of keeping promises in the learning process. Learning through the contract can help students develop a sense of reverence for their commitments in both thought and action so that they can more effectively practice their commitments and implement them by the learning objectives and plans set out in the contract, to complete their learning tasks within a predetermined period. This helps to enhance students' self-literacy and develop good behavioral habits and strong willpower qualities.

1.2.2 Learning objectives should be set differently for each student

In the learning process, there are differences in each student's experience background, learning level, comprehension ability, and personality traits. It is based on these individual differences that the Contractual Learning Approach aims to provide students with a targeted and individualized approach to education. Individualized learning compacts are developed to take into account students' learning characteristics while following curriculum standards. When developing learning compacts, it is important to adhere to the principle of realism and ensure that the learning targets set are realistic and achievable. Such a practice will help avoid the problem of not being able to accomplish the learning objectives due to unreasonable learning objectives. At the same time, teachers can also provide students with targeted assessment and guidance based on their learning objectives. The contractual learning method emphasizes individual differences and implements personalized teaching. The learning contract is formulated according to the actual situation of each student, highlighting the unique traits and needs of individual students.

In summary, the contractual learning method, as a new teaching mode, can meet the psychological needs of university students, cultivate students' independent learning ability, self-management ability, and integrity quality, and then improve the quality of education. The application of this method in physical education teaching is feasible, although it may face some unavoidable factors in the implementation process.

1.3 Content of Contractual Learning Method

In the Journal of Economic Education Special Report, it is mentioned that the contract signed between teachers and students or between students and students is the learning contract, which is

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signed between an individual and an individual or between an individual and a group. In his opinion, the signing of the contract consists of nine parts: firstly, the formulation of the learning plan, learning objectives, learning content, and the supervision of learning, and also the evaluation of the learning effect, and finally the assessment of the learning effect of the content and standards are also part of the contract, and of course, the beginning time and the end time of the contract are also included in the contract. After the completion of the contract, students need to fulfill the content of the contract, the teacher should provide students with all kinds of help, and timely communication with the students and then modify and improve the contract.

1.3.1 Learning Plan Development

In the contractual learning method, the development of the learning plan is an important part of the overall learning process. In this component, there is intensive collaboration between students and teachers aimed at ensuring that learning activities are organized while meeting individual learning needs. Students and teachers discuss the development of a learning plan to clarify the weekly schedule of learning and activities. This process is based on positive interactions between students and teachers and a deep understanding of course objectives and student learning styles. The development of a program of study begins with students and teachers clarifying the major goals within each learning cycle. Students can share their academic interests, learning goals, and personal schedules so that they can work with the instructor to develop a specific schedule. In the study plan, specific learning activities are identified for each week, and how time will be allocated for research, discussion, and practice. This helps to ensure that learning tasks are organized and reduces uncertainty in the learning process. In addition, the development of a study plan involves how to allocate time appropriately to meet the needs of different subjects and learning tasks. More time can be scheduled for subjects that require more in-depth study.

In summary, the development of study plans is of great importance in the contractual learning method. Through collaboration between students and teachers, learning plans can better meet the learning needs of individual students, making learning activities more focused and organized. Such customized learning plans help to improve students' learning efficiency and academic achievement while developing independent learning and time management skills.

1.3.2 Setting of Learning Objectives

In the Contractual Learning Approach, learning goal setting is a key step in guiding students to achieve clear academic goals. After an in-depth exchange with teachers, students can clarify the specific goals for each learning cycle and thus carry out learning activities in a more focused manner. This personalized learning goal-setting helps to increase students' motivation and sense of achievement. Learning goal-setting involves active collaboration between students and teachers. By communicating with teachers, students can share their academic interests, strengths, and challenges. Based on this information, teachers can set specific, achievable learning goals for each student. These goals may include understanding a particular concept, mastering a skill, or solving a particular problem. With clear learning goals, students are more motivated to engage in learning because they have a clearer idea of the outcomes they want to achieve. Learning goal setting also helps students plan their learning process more effectively. When students know what they want to achieve, they can be more focused on choosing appropriate learning resources and methods. They can focus on learning content that is relevant to their goals and avoid wasting time and energy on irrelevant areas. This kind of learning target setting also helps to improve students' learning efficiency, enabling them to make progress more quickly. In addition, clear learning objectives provide teachers with an effective basis for assessment. Teachers can assess students' performance and progress in the learning process based on the goals they set. This kind of goal-oriented assessment helps students understand their weaknesses and strengths so that they can adjust their learning strategies in a more targeted way.

1.3.3 Design of Learning Content

In the Contractual Learning Approach, the design of learning content is a key component in ensuring that students can acquire the required knowledge and skills in a focused manner in each learning cycle. Students and teachers work together to identify the content to be covered in each learning cycle and to ensure that this content is closely linked to the learning objectives, leading to an efficient learning process. The design of learning content requires thorough communication and consultation between students and teachers in the development of the course program. Students can express their academic interests, subject preferences, and learning needs, while teachers carefully select appropriate course materials, topics, or themes based on curriculum standards and student feedback. This collaborative approach ensures that the content selected closely matches the learning objectives, making the learning process more relevant and motivating for students. The design of

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learning content can also stimulate students' interest and initiative in learning. When students are involved in the selection and design of course content, they are more likely to feel in the driver's seat of their learning. This initiative motivates them to explore, think, and master knowledge more actively. In addition, the design of learning content helps to develop students' self-directed learning skills, enabling them to continue to delve deeper into content of interest outside the course.

At the end of the learning cycle, students and teachers assess the learning outcomes together. This process not only helps to check whether students have achieved the set learning targets but also helps them to recognize the progress they have made in the learning process. Students can compare their actual performance with the learning targets they initially set and analyze the gaps and reasons. This helps to develop students' self-awareness and self-evaluation skills so that they can better understand their learning status and needs. At the same time, the assessment of learning outcomes provides teachers with valuable information. By understanding students' learning outcomes and difficulties, teachers can better adjust their teaching strategies to suit students' needs. Teachers can gain reflections on teaching methods and contents from students' feedback, to continuously optimize teaching plans and improve teaching effectiveness. The assessment of learning outcomes also guides future learning. Based on assessment, students and teachers can work together to set learning goals and plans for the next learning cycle. Students can adjust the setting of learning objectives according to their performance and feedback, and plan their learning routes more precisely. Teachers, on the other hand, can target better guidance and support according to students' needs and progress.

2. Physical Fitness

Physical fitness testing is a method of understanding an individual's physical condition and associated health risks and potential problems by measuring and assessing the body's physiology, function, and health status. Physical fitness testing aims to provide objective data and information to help individuals, healthcare professionals, health educators, etc. to understand their physical health status so that appropriate health management and promotion programs can be developed.

Specifics of the National Student Physical Fitness Test in China

1. The National Physical Fitness Standard for Students (hereinafter referred to as the Standard) is a basic guiding document for the work of national school education and a basic standard for the quality of education; it is an important basis for evaluating the comprehensive quality of students, assessing the work of schools and measuring the development of education in various regions; it is the specific implementation of the National Physical Exercise Standard in schools, and it applies to the full-time ordinary elementary school, junior high schools, ordinary senior high schools, secondary vocational schools, and ordinary schools of higher education.

2. The revision of the Standard adheres to health first and implements the Outline of the National Medium- and Long-Term Education Reform and Development Plan (2010-2020), the Circular of the General Office of the State Council Transmitting Several Opinions of the Ministry of Education and Other Departments on Further Strengthening the Work of Physical Education in Schools (Guo Ban Fa 〔2012〕 No. 53), and the Notice of the Ministry of Education on the Issuance of the Three Documents on the Measures for Monitoring and Evaluating Students' Physical Health (Teaching, Physical Education and Arts, etc). Notice the Issuance of Three Documents of the Ministry of Education on the Measures for Monitoring and Evaluating Students' Physical Fitness and Health (No. 3 of Teaching Physical Education and Arts [2014]), focusing on improving the credibility, validity, and differentiation of the application of the Standard, focusing on strengthening its functions of education and motivation, feedback and adjustment, and guiding exercise, and focusing on improving the supporting capacity of its education monitoring and performance evaluation.

3. Mental Health

Testing and assessment of mental health often use a systematic approach to assess an individual's mental health status, emotional state, and psychological functioning. It aims to understand the emotional, cognitive, and behavioral status of an individual to help identify potential mental health problems and develop appropriate intervention and support plans that can be self-assessed using appropriate tools and questionnaires.

3.1 The current situation of mental health of university students in China's university and universities

With the development and change of society and the change of living environment, people's way of life has changed a lot. Social competition is becoming more and more intense, and the emergence of the social transition period has an impact effect on people's psychology. People's mental health has changed and has affected the mental health development of university students in various ways. Some researchers believe that the mental health level of university students in this era has been

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improving year by year, and the overall health condition is optimistic. Xin et al. (2012) conducted a cross-sectional historical meta-analysis of mental health self-assessment scales spanning 25 years. The results showed that the mean values of various factors affecting mental health status showed a decreasing trend. Over these 25 years, the mental health problems exposed by university students have shown a trend of decreasing year by year, and the overall mental health of university students has improved. The improvement in the mental health development of university students is mainly reflected in the second year of university and above students, among which the mental health status of students from key universities, students of urban origin, and male students improved more quickly. Zhang and Xiao (2015) used a questionnaire to assess the mental health of 3,826 university freshmen who enrolled in the university. The results found that ethnic minority students had lower levels of anxiety, and only children, science and engineering university students, and female students had better mental health. Overall, the mental health status of university freshmen is better. Ma (2019) analyzed the mental health data of nearly 20,000 freshmen students in the class of 2018. The results found that their psychological characteristics are mainly characterized by optimism, the pursuit of innovation, self-awareness, and awareness of rights, but interpersonal problems are more difficult to solve. From the perspective of their psychological condition, the psychological problems of the "00" generation are at a lower age, but they are easy to talk, easy to communicate, easy to intervene, and vulnerable. Some scholars also believe that contemporary university students have a high level of psychological depression and anxiety, and students are prone to show poor psychological conditions in examinations, learning, and life and interpersonal interactions, and the overall mental health level of students is poor. In addition, Zhang (2018) analyzed the mental health survey data of 64143 freshmen from three undergraduate universities and universities in Fujian Province from 2005 to 2016. The results showed that the overall mental health status of freshmen in these three undergraduate universities showed a fluctuating trend, and there was a decline in the fluctuation. Certain factor scores such as social withdrawal, anxiety, compulsion, and dependence showed a linear growth trend with the change of generations. Wang & Wang, (2018)utilized the symptom self-assessment scale to assess 2157 university students from Longnan University of Technology. The results showed that teacher-training university students, rural university students, and female university students had more serious problems than non-teacher-training university students, urban university students, and male university students, respectively, with a detection rate of 8%, and the psychological problems of university students were more obvious. Song et al. (2016) conducted a study on 800 post-90s students at Nanhua University. The results found that their mental health problems were mainly manifested in compulsion, depression, anxiety, paranoia, and interpersonal relationships, and the survey values of these problems were higher than the values of the National Youth Psychological Survey. Liu (2019) conducted a survey and research on the mental health status of university students in 2015-2018 and found that the mental health status of university students is good overall, but the level of mental health is decreasing year by year. There are differences in the mental health level of university students in different grades and genders, and the psychological problems are mainly concentrated in personality, interpersonal communication, and obsessive-compulsive psychology.

In summary, the above studies affect the specific conclusions of the study to a certain extent due to the differences in the research object, research content, and research method. The differences in conclusions may be caused by different research times, different research subjects, or different measurement tools. However, from the above analysis, it can be seen that the psychological health status of university students has both optimistic and pessimistic sides. The psychological barriers arising from university students' academic, interpersonal, and social adaptability still cannot be ignored and still need to be intervened.

Conceptual Framework

The research title “Developing Physical Education Program Based on Contractual Learning to Enhance Physical Fitness and Mental Health in Medical University Students” was designed as follows.

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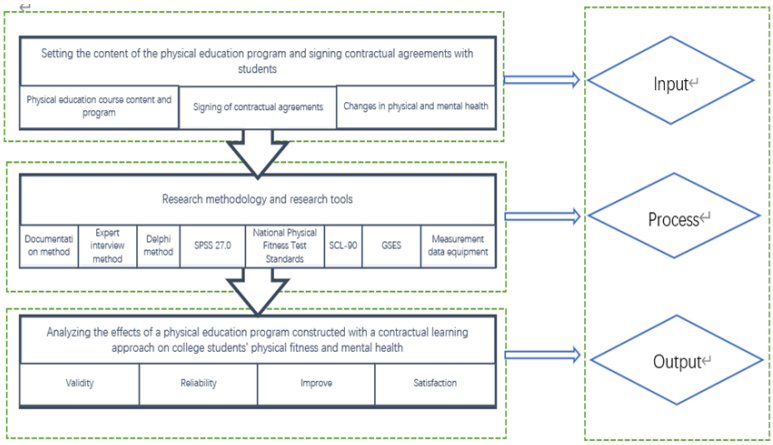

Figure 1 Conceptual Framework

Methodology

Population

The target population is university students in the second year of public physical education elective university at Guangzhou University of Chinese Medicine, 40 classes with 1200 students in total.

Sample size

Through G*POWER calculation, the sample size of 30 people meets, so randomly selected Guangzhou University of Chinese Medicine 2022-2023 University of Public Sports elective course of the University of the second year of university students, a class of 30 people as the experimental subjects to carry out teaching experiments.

Research tools

1. Main testing tools
   1) Psychometric scales.
   2) Height and weight tester
   3) Lung capacity tester
   4) Seated forward bending tester
   5) Standing long jump tester
   6) 50 meters running tester
   7) Sit-up tester
   8) Middle-distance running tester
   9) Self-Efficacy Scale and Symptomatic Self-Rating Scale
2. Contractual commitment to learning
3. Comprehensive test manual/forms and test equipment

Data analysis

1. Descriptive statistical analysis: before analyzing, descriptive statistics were first performed, including calculating the mean, median, standard deviation, minimum, and maximum values for each period. This provides an initial understanding of the basic characteristics of the data.

2. Analysis of Variance (ANOVA): Test results from multiple periods are analyzed for significant differences between these periods to determine if there is a statistically significant difference. Repeated measures ANOVA can be used to statistically analyze data for the same factor at three or more different periods.

Research Process

Step 1: Review the literature, explain what the principles of the contractual learning method are and what kind of concept it is, and analyze the current situation of physical health and mental health of college students in medical schools.

Step 2: Send invitations to five experts, including domestic physical fitness coaches, fitness-level athletes, and teachers, using face-to-face interviews, telephone interviews, and e-mail interviews, to use the Delphi method and open-ended questions to guide the construction of physical education course content for the contractual learning method.

Step 3: Based on the experts' opinions, the content of the physical education curriculum was developed (preliminary version)

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Step 4: Once again, using the Delphi method, 17 national experts who are very experienced in physical education teaching, health education, and medical management, respectively, were invited to further refine, improve, and validate the initially designed curriculum content.

Step 5: Development of a refined contractual learning approach-based content and program.

Step 6: To test the credibility of the developed content and program, five experts were invited to conduct IOC (Index of Content Validity) analyses of the content, from the fields of education, sports science, curriculum design, psychology, and practical teaching. Reliability analysis: an 8-week pre-experiment was conducted with 2 sessions per week, and a satisfaction questionnaire, 'Satisfaction Questionnaire for Physical Education Classes Based on Contractual Learning Approach' was designed to test the questionnaire using the internal consistency reliability of the scale. At the end of the pre-experiment, the questionnaire was distributed to the pre-experiment subjects for the satisfaction survey, and Cronbach's α was calculated.

Step 7: The final version will be negotiated with the university students to study together and clarify the requirements.

Step 8: Sign the goal agreement with the university students for the successful completion of the goal.

Step 9: Start the formal experiment implementation for 8 weeks the students' physical health and mental health will be tested before the experiment with the result of t0, and the results will be tested every 2 weeks apart with the results of t1, t2, t3, t4 respectively until the completion of the test in 8 weeks.

Step 10: Selection of appropriate research instrument and collection of data.

Step 11: test and analyze the factors of changes in physical fitness and mental health of college students by physical education courses, and assess and analyze the actual performance of the research subjects in this paper.

Results

Analysis of differences in standardized total scores at different test times as follows:

Table 1 Analysis of Differences in Standardized Total Scores over Time

Test	n	Mean value	Standard deviation	Standard Error	Minimum value	Extreme value	F	p
Pre-training test	30	78.26	8.560	1.563	57	94		
First test (2 weeks)	30	77.90	8.222	1.501	54	93		
Second test (4 weeks)	30	79.67	8.304	1.516	60	95	3.167	.016
Third test (6 weeks)	30	81.35	7.377	1.347	63	96		
Fourth test (8 weeks)	30	84.14	6.769	1.236	66	97		

*. The significance level of difference in means is 0.05.

As can be seen from Table 1 was found that there was a significant difference between the standardized total scores of the different periods ($p < 0.05$).

The first test: showed a slight decrease in the mean value compared to the pre-training test, indicating that in the first test, the subjects' mean scores decreased and the range of scores was similar to the pre-training test.

The second test: showed an improvement over the first test, indicating that the training may be starting to have a positive impact. It also reflects the fact that some subjects may have had greater fluctuations in their scores on the test. The range of scores has widened, indicating that some subjects have improved significantly.

The third test: Mean (81.35): Significantly improved, indicating that the overall performance of the subjects improved significantly as the training continued. Shows increased concentration of scores. The minimum value improved, indicating that the lowest-scoring subjects also improved.

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The fourth test: Maximum reached, showing a continued increase in the effectiveness of the training. Scores were more concentrated, ranges were further reduced, volatility was reduced, and performance was more consistent.

Overall, these data provide strong support for the effectiveness of training, suggesting that subject performance can be significantly improved with appropriate training methods and time. This is an important reference value for the design and implementation of similar educational or training programs.

Comparative analysis of standardized total scores on physical fitness tests at different time points

Table 2 Comparative analysis of standardized total scores on physical fitness tests at different time points

	Period	Difference in Means	Standard Error	p	95% confidence interval	
					lower	upper
Pre-training test	First test (2 weeks)	.352	2.033	.863	-3.67	4.37
	Second test (4 weeks)	-1.412	2.033	.489	-5.43	2.61
	Third test (6 weeks)	-3.092	2.033	.131	-7.11	.93
	Fourth test (8 weeks)	-5.888*	2.033	.004	-9.91	-1.87
First test (2 weeks)	Pre-training test	-.352	2.033	.863	-4.37	3.67
	Second test (4 weeks)	-1.763	2.033	.387	-5.78	2.26
	Third test (6 weeks)	-3.443	2.033	.093	-7.46	.58
	Fourth test (8 weeks)	-6.240*	2.033	.003	-10.26	-2.22
Second test (4 weeks)	Pre-training test	1.412	2.033	.489	-2.61	5.43
	First test (2 weeks)	1.763	2.033	.387	-2.26	5.78
	Third test (6 weeks)	-1.680	2.033	.410	-5.70	2.34
	Fourth test (8 weeks)	-4.477*	2.033	.029	-8.50	-.46
Third test (6 weeks)	Pre-training test	3.092	2.033	.131	-.93	7.11
	First test (2 weeks)	3.443	2.033	.093	-.58	7.46
	Second test (4 weeks)	1.680	2.033	.410	-2.34	5.70
	Fourth test (8 weeks)	-2.797	2.033	.171	-6.82	1.22
Fourth test (8 weeks)	Pre-training test	5.888*	2.033	.004	1.87	9.91
	First test (2 weeks)	6.240*	2.033	.003	2.22	10.26
	Second test (4 weeks)	4.477*	2.033	.029	.46	8.50

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	Period	Difference in Means	Standard Error	p	95% confidence interval	
					lower	upper
	Third test (6 weeks)	2.797	2.033	.171	-1.22	6.82

*The significance level of difference in means is 0.05.

From Table 2 can be found that the first time compared to the other phases: the change between the first and the second test is not significant. The change between the first and second tests was not significant, and it may take more time for the training to affect fitness levels. The change between the first and third tests is beginning to show but is not significant and may indicate that the participants are beginning to adapt to the training. A significant difference between the first and fourth tests indicates that the training produced a noticeable effect.

Comparisons between other phases: The change between the first and second tests was not significant, possibly due to insufficient training intensity or time. The change between the first test and the third test is on the edge of significance, and the effect of training is beginning to be seen. Significant difference between the first test and the fourth test, indicating a significant improvement in fitness as a result of training.

Comparison of the final stage: the greatest significance between the first test and the first test, as the second performance has slipped and is in the adaptation stage, and a significant change exists between the second test, indicating that it is in an ascending stage due to the increasing intensity of training.

Analysis of differences between the sexes in the various programs

Table 3 Analysis of Differences by Sex on Various Items

	Gender	n	Mean	Standard deviation	t	p
Height	Male	15	174.02	6.07	17.03	.000
	Female	15	159.89	3.84		
Body weight	Male	15	62.39	7.66	3.93	.000
	Female	15	56.42	10.69		
Lung capacity	Male	15	4570.88	588.48	14.39	.000
	Female	15	3380.66	407.99		
Fifty-meter	Male	15	6.78	0.30	-16.52	.000
	Female	15	8.63	0.92		
800/1000-meter run	Male	15	3.60	0.31	-4.92	.000
	Female	15	3.94	0.50		
Seated Bending Forward	Male	15	15.29	6.48	-3.48	.000
	Female	15	18.77	5.711		
Standing long jump	Male	15	250.96	17.37	20.78	.000
	Female	15	184.20	21.72		
One-minute sit-up pull-up or	Male	15	8.04	5.05	-32.61	.000
	Female	15	41.23	7.22		
Total Standard Score	Male	15	80.25	7.07	-0.02	.984
	Female	15	80.28	9.06		

*The significance level of difference in means is 0.05.

Table 3 shows that after the independent sample t-test, it was found that there were significant differences between genders in height, weight, lung capacity, 50-meter run, long-distance run, seated

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forward bending, standing long jump, and pull-ups/sit-ups ($p < 0.01$), and there were no significant differences between genders in the standardized total score ($p > 0.05$).

Analysis of gender differences in each item: Height: males (174.029cm) were significantly higher than females (159.894cm). This indicates that the difference in height by sex is highly significant. Weight: Male (62.393kg) was higher than female (56.424kg). This shows that the difference in weight by sex is highly significant.

Lung capacity: Male (4570.88ml) was higher than female (3380.667ml). It means that there is a significant difference in lung capacity between genders. 50-meter run: males (6.780s) were faster than females (8.63507s). This indicates that males performed significantly better than females in the 50-meter run. 800/1000 run: males (4.00493 minutes) were faster than females (4.30429 minutes). This indicates that there is a significant difference between the sexes in long-distance running performance.

Seated Bend Forward: Females (18.77cm) were better than males (15.29cm). This shows that females performed significantly better than males in sitting forward bend.

Vertical jump: Male (250.96 cm) is much better than female (184.20 cm). This indicates that males performed significantly better than females in standing long jump. Total Standardized Score: The difference between males (80.25) and females (80.28) is minimal.

These results may reflect physiological differences and differences in physical characteristics between the sexes. Meanwhile, despite significant differences in performance in most of the events, the standardized total scores showed no significant difference in overall performance between men and women. This suggests that despite gender differences in specific events, overall quality or fitness levels may not show a significant gender bias. These findings have important implications for the development of more targeted training programs that can be developed differently based on gender characteristics to better enhance overall fitness levels.

Comparative analysis of college students' general self-efficacy before and after exercise

Table 4 Paired Samples Test for Self-Efficacy

	Pairwise difference in value					t	df	p
	Mean	Standard Deviation	Standard Error Mean	Difference 95% confidence interval				
				lower	upper			
Self-efficacy pre-test score - Post-test	-11.43	6.64	1.21	-13.91	-8.95	-9.42	29	0.01*

* The significance level of difference in means is 0.05.

From Table 4 can be found that the paired samples test, self-efficacy pre-test score - post-test score = -11.43, the mean difference of -11.43 indicates that the exercise intervention resulted in a significant increase in the self-efficacy scores of the students. T-value of -9.42 indicates that there is a significant difference between the pre-test and post-test scores. P-values less than 0.05 indicate that the results are statistically significant. Self-efficacy assesses an individual's confidence and ability to perform a specific task or cope with a specific situation.

Based on the results of the paired samples test, we can conclude that the students' self-efficacy scores increased significantly through the eight weeks of exercise training, indicating that the exercise intervention had a positive impact on improving the students' self-efficacy and coping skills. This provides evidence that implementing regular exercise intervention among students is an effective way to enhance self-efficacy. The results of the study showed that exercise training significantly increased their self-efficacy. Based on these findings, we suggest that schools and educational institutions should emphasize and promote exercise interventions to help students cope with psychological stress and enhance their self-efficacy to support their overall development.

Table 5 Comparison of pre-test and post-test scores of SCL-90 scale factors after exercise training

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	Pairwise difference in value					t	df	p
	Mean	Standard Deviation	Standard Error Mean	Difference 95% confidence interval				
				lower	upper			
Forced pre-test score-post-test score	0.60	0.63	0.11	.36	0.84	5.20	29	.000
Paranoia pre-test score - post-test score	0.72	0.58	0.10	.50	0.94	6.71	29	.000
Scary pre-test scores - post-test scores	0.69	0.59	0.10	.47	0.91	6.40	29	.000
Hostility Pretest Score - Posttest Score	0.61	0.68	0.12	.35	0.86	4.91	29	.000
Psychoticism Pretest Score - Posttest Score	0.69	0.55	0.10	.48	0.90	6.81	29	.000
Anxiety pre-test score - Post-test score	1.36	1.08	0.19	.95	1.77	6.85	29	.000
Depression pre-test score - Post-test score	0.70	0.61	0.11	.47	.93	6.31	29	.000
Sleep and Diet Pre-test Score - Post-test Score	0.69	0.59	0.10	.47	.91	6.40	29	.000
Interpersonal Relationships Pre-test Score - Post-test Score	0.72	0.63	0.11	0.48	0.96	6.22	29	.000
Somatization Pretest Score - Posttest Score	0.51	0.56	0.10	0.29	0.72	4.93	29	.000

* The significance level of difference in means is 0.05.

From Table 5 can be found that exercise can have a significant positive impact on the mental health of university students. Exercise can significantly reduce the scores of the factors in the SCL-90 symptom self-assessment scale, including paranoia, terror, hostility, psychoticism, anxiety, depression, interpersonal relationships, somatization, and obsessive-compulsive symptoms, and it also significantly improves sleep and eating problems, which is reflected in the reduction of the students' somatic symptoms and the improvement of their physical health. Students' trust in others increased and suspicion and hostility decreased, students' ability to cope with fearful situations increased and fearful and avoidant behaviors decreased, students' anger and aggressive behaviors decreased, students' psychotic symptoms decreased and socialization improved, students' anxiety was significantly reduced, students' depression decreased and their emotional state improved, and students' had reduced discomfort in social situations and improved interpersonal skills, and students had reduced obsessive-compulsive symptoms. Students' sleep and eating problems were alleviated.

Summary

The data of 5 physical fitness tests of 30 experimental subjects, in the training test results on the first stage time, lasted 2 weeks, the performance improvement was small, the second stage lasted 4 weeks, the performance improvement is greater than the first stage, the third stage lasted 6 weeks, the performance improvement is more obvious, the fourth stage lasted 8 weeks, the performance improvement is significant, which is very significant in the speed, explosive strength and cardiorespiratory endurance is very significant, such as the 50-meter project, standing long jump, 800

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meters / 1000 meters run to improve significantly, the number of excellent, good results have increased significantly, the number of failures decreased significantly.

Discussion

In this study, students engaged in self-setting goals within the framework of a contract and gradually achieved these goals under the guidance of their teachers, and in the process, they experienced a sense of autonomy and control. This sense of autonomy not only enhanced their motivation but also enabled them to demonstrate greater perseverance and endurance in the face of challenges. In addition, the sense of achievement that students gained from reaching their contractual goals further enhanced their sense of competence, and this positive psychological experience contributed to their overall psychological well-being. Established research supports this idea. For example, Ryan and Deci (2000) showed that when individuals feel a sense of self-determination and control, they are more likely to remain highly engaged and motivated in long-term tasks. The contractual approach to learning successfully applies this theory to physical education by emphasizing student autonomy and individual goals and was validated in this study.

Teacher feedback and support in contractual learning served as important environmental factors that positively influenced students' behavioral choices and level of engagement. For example, when students encountered difficulties during training, teachers' encouragement and guidance helped them overcome these challenges and enhanced their confidence and perseverance. This positive learning environment not only helped students achieve better physical performance but also had a positive impact on their psychological well-being. Bandura's (1997) study showed that self-efficacy is a significant predictor of behavioral change and psychological well-being. By enhancing students' self-efficacy, the contractual learning method not only improved their physical performance but also their psychological state, validating the applicability of the social cognitive theory in the field of education.

This study also found that the contractual learning method performed well in addressing gender differences. While there were no significant differences in overall progress between male and female students, differences in performance on specific items demonstrated the flexibility and adaptability of the contractual learning method. For example, male students made significant progress in the strength program, while female students performed more prominently in agility and flexibility. This finding is consistent with gender role theory. Traditionally, males are more inclined to participate in strength sports, while females have an advantage in flexibility and coordination. Therefore, the contractual learning method effectively utilizes these innate strengths by providing differentiated training content for students of different genders, enabling each student to progress in their strengths.

Overall, combining the findings of self-determination theory and social cognitive theory, this study validates the effectiveness and feasibility of the contractual learning approach in improving the physical and mental health of college students. By meeting students' needs for autonomy, enhancing their self-efficacy, and providing personalized training content to address gender differences, the contractual learning approach not only promotes students' physical fitness but also positively impacts their mental health. In the future, as this method is promoted and applied in more educational contexts, the contractual learning method is expected to become an effective educational tool to support students' holistic development.

Recommendations

Recommendation for applying the research result

Promote Contractual Learning Methods

As an innovative teaching model, the promotion of the Contractual Learning Approach requires systematic training and support. It is recommended that education departments and school administrators start with teacher training to systematically promote this method so that educators can fully understand its theoretical basis and practical operation process.

Recommendation for future study

1. Extending the duration of intervention

It is recommended that schools extend the intervention period of the Contractual Learning Approach to the whole school year or longer, to assess its effectiveness more comprehensively. Long-term observation and assessment can reveal the changes in students at different developmental stages and understand the continuity and potential long-term impact of the training effect.

2. Strengthening home-school co-operation

Family education is an integral part of a student's growth process. Schools are advised to communicate with parents regularly to share the concepts and implementation methods of the

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"Contract Learning Approach". Parents are advised to draw up a family exercise program and participate in sports activities together with their children to enhance family cohesion and interaction.

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