

# Research on the Promotion of College Students' Physical Literacy Based on the Flipped Classroom

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**Abstract:** In order to explore the role of the "flipped classroom" teaching mode in college physical education in the formation and promotion of college students' physical literacy, this study used research methods such as the questionnaire survey method, testing method, and quantitative statistical method to conduct in-depth analysis and research on the acquired data. The research results indicate that: The "flipped classroom" teaching mode is conducive to the improvement of college students' core physical literacy and the formation of a healthy lifestyle. The "flipped classroom" physical education teaching mode is a new way to improve students' core physical literacy; there is a new regression relationship between the total score of college students' core physical literacy and various dimensional indicators. The two dimensions of "daily behavior" and "knowledge and understanding" of college students in the experimental group have a greater impact on the improvement of their core physical literacy, but more efforts still need to be made to improve the "physical ability" dimension of college students; the main factors affecting the improvement of college students' core physical literacy in the process of curriculum reform are the two factors of "evaluation tools" and "teachers".

**Keywords:** Flipped Classroom; Teaching Mode; Physical Literacy;

## 1. Introduction

The "flipped classroom", also known as the inverted classroom, is a product of the information-based society. Educational technology serves as an important support for the implementation of the "flipped classroom". The traditional teaching process consists of two stages: knowledge transmission and knowledge

internalization. Knowledge transmission is accomplished through teachers' in-class lectures, while knowledge internalization requires students to complete through homework, exercises, or practice after class. When this form is reversed, with knowledge transmission being completed outside the class through video playback and knowledge internalization being achieved in class with the help of teachers and classmates, the "flipped classroom" comes into being.

The "flipped classroom" originated in the United States. In 2007, chemistry teachers Jonathan Bergmann and Aaron Sams from Woodland Park High School in the Rocky Mountains of Colorado began recording PowerPoint presentations and lecture voices and uploaded the videos to the Internet to help absent students make up for missed lessons. Later, these two teachers asked students to watch teaching videos at home, complete their homework in class, and provided explanations to students who encountered difficulties in their studies. This teaching mode has been widely welcomed by students.

In the current "Internet +" era, the "flipped classroom" teaching model, with the help of cloud service technology, is showing a rapid development trend. Research in the past decade shows that theoretical research on the "flipped classroom" in the field of sports has grown rapidly, but empirical research is extremely scarce. Especially in the context of the current thematic education, how to introduce the "flipped classroom" into physical education teaching that includes ideological and political content of the curriculum, and what the effect will be after the introduction, all need to be further explored and verified through teaching practice.

This study selects sample undergraduate students from the sophomore and junior years of our university as the research subjects. The aim is to explore the feasibility and specific

implementation plans of the "flipped classroom" teaching model in college physical education courses, enhance undergraduates' enthusiasm and learning outcomes in college physical education courses, promote the formation of undergraduates' core physical literacy, and simultaneously improve the teaching proficiency and classroom control ability of teachers from various teaching and research groups of college physical education courses.

## 2. Research Objects and Methods

### 2.1. Research Subjects

A randomly selected experimental class of college students participating in the "flipped classroom" teaching model for physical education curriculum reform was used as the observation group (596 males and 802 females), while students from other classes were used as the control group (605 males and 792 females) to analyze and study the improvement of physical education core literacy among second and third year students in our university. There was no significant difference between the two groups of students in various indicators such as age, height, weight, and sports literacy before the experiment ( $P > 0.05$ ).

### 2.2. Research Methods

#### 2.2.1. Questionnaire survey method

The college student sports core literacy evaluation system adopted by our research group is mainly developed based on the Canadian Assessment Physical Literacy (CAPL) system, which is also one of the widely used evaluation tools in the international community. It consists of three methods: on-site testing, questionnaire survey, and follow-up testing, mainly covering four dimensions. The highest score for the daily behavior part is 32 points, the physical ability part is 5.2-32 points, the knowledge and understanding part is -0.63-18 points, the motivation and confidence part is -1.5-18 points, and the total score is between 3.07-100 points. The evaluation results can be divided into four levels from low to high, The higher the score, the higher the level of sports core literacy. The questionnaire survey mainly covers four dimensions (daily behavior, motivation and confidence, knowledge and understanding, and influencing factors), with a retest reliability coefficient of 0.92. The "Sports Core Literacy Survey Questionnaire" was distributed and

collected by professionals on the spot. A total of 2795 questionnaires were distributed and 2781 were collected, excluding 13 invalid questionnaires. A total of 2763 valid questionnaires were collected, with an effective recovery rate of 98.86%.

#### 2.2.2. Testing method

The physical ability part of the college student sports core literacy evaluation system is mainly tested at the college student physique testing center, using the Jianmin GMCS-IV series national physique monitoring instrument produced by Beijing Xindong Huateng Sports Equipment Co., Ltd. to measure relevant indicators, including 10x4 meter round-trip running, obstacle running, grip strength, plate support, body mass index, waist circumference, and sitting forward bending. The tracking test of the "average daily steps taken within seven days" in the daily behavior section was conducted using the "Sports World APP Campus Edition" software on the mobile client.

#### 2.2.3. Mathematical Statistics

All statistical data in the article were analyzed using IBM SPSS Statistics 22 statistical software. The measurement data were represented by mean, standard deviation, mean standard error, etc. The independent sample t-test and multiple independent sample K-W test were used for inter group comparison of the measurement data. The difference was statistically significant when  $P < 0.05$ .

## 3. Research Results and Analysis

### 3.1. Organization and Implementation of the "Flipped Classroom" Teaching Model in College Physical Education

#### 3.1.1. Organizational Plan Design of "Flipped Classroom" in University Physical Education Curriculum

The implementation stage of "flipped classroom" consists of pre class, during class, and after class, with online communication between teachers and students running through the entire teaching process. Before class, the teacher releases relevant teaching resources to the online teaching platform based on the course objectives and content, and supervises students to carry out pre class learning through online guidance, online testing, and online homework release; During class, the teacher provides explanations based on students' pre class mastery, or organizes students to discuss problems,

showcase learning outcomes, and engage in various learning practices, thereby achieving the goal of deepening learning outcomes; After class, teachers reflect on the problems in teaching and improve the next step of teaching. Students reflect on their learning process, further consolidate their learning achievements, and exchange feedback with physical education teachers on the problems in learning.

### 3.1.2. Teaching Design of "Flipped Classroom" in Physical Education Curriculum

The "flipped classroom" changes the roles of teachers and students in traditional teaching through the inverted arrangement of knowledge transmission and internalization, and reprogrammes the use of classroom time, achieving innovation in traditional teaching models. In the "flipped classroom", information technology and activity learning create a collaborative learning environment for learners, which helps to enhance a new learning culture. To achieve effective teaching results in a flipped classroom, it is necessary to first provide a practical instructional design model, integrate various teaching resources in the learning process, and provide services for learners' autonomous learning before class and collaborative learning in class. The teaching design of "flipped classroom" in college physical education includes the following content:

#### 3.1.2.1. Selection of Teaching Content for the "Flipped Classroom" Part of College Physical Education

This project aims to explore the feasibility and plan of implementing "flipped classroom" in university courses, and promote the formation of sports literacy among college students. In order to facilitate the comparison of teaching effectiveness, only a portion of the content was selected for exploratory attempts.

#### 3.1.2.2. Selection of Teaching Objects and Teaching Organization Arrangement for "Flipped Classroom" in College Physical Education

At present, the teaching programs of university physical education courses offered by our school mainly include Tai Chi, Changquan, badminton, basketball, football, volleyball, fitness exercises, yoga, Tai Chi Kung Fu fans, darts, etc. The first grade is taught in natural classes, while the second grade is taught in elective classes. In order to ensure the effectiveness of the class, the number of students in each teaching class ranges from 35 to 40. Therefore, during the

implementation of this project, the selection of class size was tested using teaching classes. On the one hand, the teaching effect can be compared with other parallel teaching classes, and at the same time, problem feedback will be more fully grasped. Students can be divided into 5-6 groups, and each group will learn around the unit content. Classroom teaching usually lasts for 90 minutes per class. Students can use 70 minutes to complete the "questions" arranged by the teacher, while teachers use 20 minutes to lecture and comment on difficult knowledge points. During the process of classroom discussions and problem-solving among students, teachers can use 5-10 minutes to discuss and guide students in each learning group, enhancing the interaction between teachers, students, and students.

#### 3.1.2.3. Production of classroom videos

University physical education courses are available in renowned universities such as Wuhan University, Huazhong University of Science and Technology, and Xi'an University of Architecture and Technology, with abundant online video resources. Reasonably utilize online resources and create a small portion of "micro lesson" videos to explore students' learning outcomes and reactions.

#### 3.1.2.4. Evaluation of student learning effectiveness

The purpose of this research project is to improve students' learning outcomes and promote the formation of core sports literacy. Therefore, how to fairly and reasonably evaluate students' learning outcomes is a very important issue. This project can evaluate students' learning effectiveness in three aspects: comparing the learning effectiveness of parallel chapters. The content system of ball games is very similar, and the learning effect can be compared; Martial arts, aerobics, yoga, etc. also have similar attributes and adopt relatively close learning effectiveness standards; The learning outcomes between parallel classes can be compared. Through the exam results, one can basically understand the learning effectiveness between parallel classes; Comparison of learning outcomes with students of different grades in the same major. In order to improve teaching effectiveness, the number of teachers who teach various majors in the physical education research group of different projects in our school is basically fixed. The same teacher has been teaching the same major for many years, and the

students' state and learning effectiveness can also be compared vertically.

### 3.2. The Impact of the "Flipped Classroom" Teaching Mode on the Core Sports Literacy of College Students

After a year of reform experiments, except for physical ability indicators, the average values of various indicators of sports core literacy in the experimental group are higher than those in the control group, and there is a very significant difference ( $p < 0.01$ ), indicating that the implementation of the "flipped classroom"

teaching model is very conducive to the improvement of sports core literacy among college students.

From Table 1, it can be seen that the linear regression equation that can be established between the total score of college students' sports core literacy ( $y$ ) and various dimensional indicators is:  
 $y = 14.02 + 1.01x_1 + 0.68x_2 + 1.07x_3 + 0.43x_4$ , where  $x_1$  represents daily behavior,  $x_2$  represents physical ability,  $x_3$  represents motivation and confidence, and  $x_4$  represents knowledge and understanding.

**Table 1. Statistical Table a of Linear Regression Coefficients for the Total Score and Scores of Sports Core Literacy of College Students in All Dimensions**

model	Non standardized coefficient		Standard coefficient	t	Sig.
	B	Standard Error	Beta		
(Constant)	14.017	0.541		25.931	0.000
Daily behavior	1.007	0.015	0.536	68.660	0.000
Physical ability	0.678	0.014	0.372	48.141	0.000
Knowledge and Understanding	1.070	0.024	0.418	43.978	0.000
Motivation and Confidence	0.425	0.033	0.120	12.709	0.000

a. Dependent variable: total score

The established linear regression equation suggests that after a year of teaching reform in the "flipped classroom" model, the scores in the dimensions of "daily behavior" and "knowledge and understanding" have a significant impact on the improvement of college students' core sports literacy level; The statistical results in Table 2 also show that the experimental group of college students scored significantly higher than the control group in the dimensions of "daily behavior" and "knowledge and understanding" ( $p < 0.01$ ). Due to the fact that the "daily behavior" dimension in the sports core literacy evaluation system mainly includes "average daily steps taken within 7 days", "weekly time spent facing electronic screens", and "weekly frequency of participating in medium to high intensity sports", it indicates that after a year of "flipped classroom" university physical education curriculum reform, the experimental group of college students has improved their more scientific and healthy lifestyle, Transfer more of my spare time from electronic screens to fitness activities and engage in more moderate to high intensity exercise; The improvement in the scores of the "knowledge and understanding" dimension among the control group of college students reflects their deeper understanding of sports culture and sports values, indicating that the measures taken in this curriculum reform to

incorporate red education and socialist core values into sports ethics and spiritual education are correct. It suggests that the "flipped classroom" teaching mode of physical education curriculum reform is conducive to the implementation of the fundamental task of "cultivating morality and cultivating people", It is a new way to promote the improvement of students' core sports literacy.

In response to the current lack of sports literacy among college students, Chen Xiaohong and Zhu Ergang's research suggests strengthening education by constructing a system of sports curriculum evaluation and sports skills curriculum content, safeguarding students' sports rights, and practicing socialist core values. The reason for the significant improvement in the scores of the "knowledge and understanding" dimension among the experimental group of college students may be related to the implementation of the "regular health behavior reporting system" management plan in this curriculum reform. The statistical results of this study show that 82.6% of the experimental group of college students choose "weekly lectures by renowned teachers, experts, and celebrities" as their best way to understand sports culture. The research by Zhang Jianhui and Zhong Bingshu also pointed out that sports stars play a constructive role in shaping the

unique cultural spirit of sports events and showcasing their unique cultural connotations. The significant improvement in the scores of the "daily behavior" dimension among the experimental group of college students may be related to the implementation of the "sports APP system" teaching model in the "flipped classroom" university physical education curriculum reform. The statistical results of this study also show that 95.6% of college students in the experimental group who used sports app software for exercise were able to complete 45 2km runs per semester, while the average of college students in the control group completing 2km runs per semester was only 4.8.

Therefore, for the reform of physical education courses, only by taking the continuous improvement of college students' physical health as the fundamental goal, successfully transforming the concept of physical education

courses from subject-centered to student-centered, and constructing a teaching content system conducive to the improvement of core physical literacy as well as a scientific core physical literacy detection and evaluation system, can the level of college students' core physical literacy be steadily enhanced.

### 3.3 Analysis of Factors Influencing the Improvement of College Students' Core Sports Literacy under the "Flipped Classroom" Mode

In order to promote the high-quality development of college physical education teaching reform and further enhance the level of college students' sports core literacy, this study used principal component analysis to conduct factor analysis on the relevant factors that may affect the improvement of college students' sports core literacy.

**Table 2. Explanation of Total Variance**

variable	Initial eigenvalue			Extract the sum of squares of the load			Sum of squares of rotational load		
	Total	variance percentage	cumulative%	Total	variance percentage	cumulative%	Total	variance percentage	cumulative%
1	3.887	24.291	24.291	3.887	24.291	24.291	2.829	17.683	17.683
2	2.533	15.833	40.124	2.533	15.833	40.124	2.272	14.199	31.883
3	2.124	13.276	53.399	2.124	13.276	53.399	2.184	13.648	45.531
4	1.896	11.848	65.247	1.896	11.848	65.247	2.110	13.189	58.720
5	1.357	8.479	73.726	1.357	8.479	73.726	2.058	12.864	71.584
6	1.239	7.741	81.467	1.239	7.741	81.467	1.581	9.883	81.467
7	.629	3.933	85.400						
8	.609	3.809	89.209						
9	.403	2.521	91.729						
10	.393	2.456	94.186						
11	.316	1.977	96.163						
12	.208	1.298	97.461						
13	.151	.943	98.404						
14	.118	.735	99.139						
15	.076	.478	99.617						
16	.061	.383	100.000						

Extraction method: Principal component analysis

**Table 3. Rotated Component Matrix**

option	1	2	3	4	5	6
physical quality	.325	.196	-.098	.480	-.081	-.633
Cultural level	.519	.457	-.207	-.181	.109	.332
The quality of literacy evaluation software	.833	.180	.066	.047	.089	-.136
Content of literacy evaluation	.732	.095	-.295	.109	-.439	.116
Family support and recognition level	.282	.119	.109	.205	.161	.830
Opportunities to participate in various competitions	-.163	.235	.271	.697	-.085	.356
Lectures on Sports Culture and Knowledge	.053	-.034	-.209	.799	.162	.069
Number of sports events held	.201	-.138	.242	.770	.147	-.214
Literacy evaluation mechanism	.868	.045	-.017	.083	.041	.116
Importance level of leadership	.028	.119	.937	.111	-.017	.111
Financial support efforts	-.119	-.099	.953	-.026	-.051	.011

Sports halls	.051	.031	-.159	.179	.781	.377
Sports equipment	.495	.405	.163	.136	.662	.031
Teaching Curriculum Setting	.073	.911	-.054	.010	-.017	-.030
Teacher's Guidance Ability	.204	.923	.101	.025	-.052	.049
employment pressure	-.112	-.146	-.032	.033	.838	-.035

Extraction method: Principal component analysis. Rotation method: Kaiser standardized maximum variance method.

From Table 2, it can be seen that the variance contribution rate of the six factors extracted when the feature value is 1 is 81.5%, indicating that they can reflect most of the information of the influencing factors, and the selected six factors are also more suitable. From the rotated factor load matrix results in table 3, it can be seen that the first factor that affects the improvement of college students' core physical education literacy in the process of the "flipped classroom" teaching mode reform mainly includes several factors such as "the quality of literacy evaluation software", "literacy evaluation content", and "literacy evaluation mechanism". We can name it the "evaluation tool" factor; The second factor includes two influencing factors: "teaching curriculum design" and "teacher's guidance ability", which we can name as the "teacher" factor; The third factor can be named as the 'level of leadership importance' factor; The fourth factor is named as the "transmission channels of sports culture" factor, and the fifth factor is named as the "venue equipment" factor; The sixth factor is named the "family" factor.

The reason why college students believe that the "evaluation tool" factor is the most important factor affecting their improvement of sports core literacy may be related to the practical effectiveness of the new evaluation mechanism and evaluation tools adopted in the "flipped classroom" curriculum reform, because 91.3% of college students believe that the practicality and accuracy of the Sports World APP software will have a significant impact on their sports performance; In addition, it may also be related to insufficient promotion of the use of evaluation software. The use of electronic pedometers as a measurement method for physical activity levels has become extremely common in the field of physical activity research. The accuracy and reliability of this method in measuring children and adolescents have been fully certified, and teachers have the responsibility and obligation to eliminate students' concerns in this regard.

In the process of educational reform, the

"teacher" factor has become the second major factor affecting the improvement of college students' core physical education literacy. This suggests that in the process of carrying out the "flipped classroom" physical education teaching reform, we should not only set up scientific and reasonable teaching content, but also use various ways to improve the professional level of physical education teachers and fully play the guiding role of frontline teachers. Liu Haiyan's research also believes that the main reasons for students' abnormal sports behavior indicators and cognitive problems are the emphasis on skill teaching and the excessive emphasis on exam content and sports teaching safety accidents in physical education curriculum; In addition, from the following influencing factors, it can also be seen that "the level of leadership attention", "the transmission channels of sports culture", the richness of "venue equipment", and the support from "families" all have a significant impact on the improvement of college students' core sports literacy. The current promotion of the core sports literacy of contemporary college students requires close collaboration and joint efforts from various forces such as families, schools, and society. Zhang Desheng et al. also pointed out that strengthening the interaction between the media, sports departments, and education departments, and carrying out various forms of family sports, school sports, and community sports, is one of the core measures to comprehensively promote citizens' sports literacy.

#### 4. Conclusion and Suggestions

The "flipped classroom" teaching mode is conducive to the improvement of college students' core sports literacy and healthy lifestyle. The "flipped classroom" sports teaching mode is a new way to enhance students' core sports literacy.

In the process of physical education curriculum reform based on the "flipped classroom" teaching model, there is a new regression relationship between the total score of college

students' physical core literacy and various dimensions of indicators. The "daily behavior" and "knowledge and understanding" dimensions of the experimental group of college students have a significant impact on the improvement of their physical core literacy, but the improvement of the "physical ability" dimension of college students still needs to be strengthened.

During the implementation process of the "flipped classroom" physical education teaching model, the factors that affect the improvement of college students' core sports literacy can be summarized into six main influencing factors, with "evaluation tools" and "teachers" having the greatest impact.

It is recommended that universities pay close attention to the improvement of college students' physical abilities during the implementation of the "flipped classroom" teaching model.

While implementing the fundamental task of "cultivating morality and cultivating talents", they should also pay more attention to the reform effect of "promoting students' physical fitness".

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