

# Research on the Application of Wearable Devices in University Physical Education Classes

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**Abstract:** Basketball, currently one of the most widely practiced sports in higher education institutions, has a dedicated club course specifically designed for basketball instruction, which has always been a popular elective class among students. Traditional public physical education courses with a focus on basketball instruction, despite having a strong mass foundation, encounter numerous challenges in actual teaching, such as high student-to-teacher ratios, insufficient facilities, and the inability to effectively track teaching outcomes. In this innovative reform of the basketball club course, wearable devices and AI technology are employed to effectively address the challenges of public physical education courses. Through subsequent data tracking, it has been observed that this approach significantly enhances classroom organizational efficiency and, consequently, elevates the overall teaching quality.

**Keywords:** Basketball Club; Public Physical Education Courses; AI; Wearable Devices.

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## 1. Course Introduction

The Basketball Club aims at teaching basketball-related knowledge and skills. It typically covers basketball history, rules, techniques, and tactics, as well as methods for game practice and self-training. At Shenzhen University, this course is mainly offered to undergraduate students in the 1st and 2nd grades.

The basketball course not only helps students understand the basic knowledge and skills of basketball but also contributes to improving their physical fitness, coordination, teamwork, and self-motivation. Additionally, the course helps students master game strategies and techniques, enhancing the attractiveness and participation in games like Shenzhen University's "President's Cup" basketball tournament, which is the most anticipated event on campus.

In summary, the Basketball Club provides a highly popular course that helps students understand and master the basic knowledge and skills of basketball, while also enhancing their physical and psychological qualities [1].

## 2. Current Status and Problem Analysis of the Course

Some issues exist in the current public basketball courses in universities [2]:

### 2.1. Limitations in Teaching Content

Due to most physical education teachers having a background in sports, and lacking systematic and scientific teaching experience, class time is often spent solely on technical training, neglecting theoretical explanations and tactical exercises. Limited teaching time and facilities prevent teachers from fully assessing each student's skill level, hindering targeted improvement.

### 2.2. Insufficient Teaching Methods

Traditional one-on-ten or fewer teaching methods in professional team training require teachers to correct technical movements one-on-one in class. Post-class assignments are challenging to monitor effectively, leading to

uncertainties in practice quality. Demonstrations by teachers during class may not ensure students recall the standard demonstrations afterward, and some teachers' demonstration actions may not align with current advanced techniques.

### 2.3. Lack of Equipment and Facility Conditions

Insufficient facilities and equipment are challenges in current university public physical education basketball courses. Basketball requires suitable facilities and equipment, but current university basketball facilities often fail to meet student demands. This results in situations where 10-15 students share a single basket during practice, limiting practice opportunities. Guiding 50 students in a 600-square-meter basketball court for dribbling practice, with each student receiving 30 seconds of guidance, consumes the entire 30-minute class, illustrating the time and workload required for teaching a single technical movement.

### 2.4. Lack of Personalized Training and Evaluation System

Due to high student-teacher ratios [3], teachers cannot create personalized training plans for each student. This results in students without prior basketball experience receiving unfair evaluations within the course assessment system. Even if they make more significant progress and diligently study the course, they may not compete with students who have undergone basketball training since childhood under a single technical evaluation system. This may lead to students with weaker foundations losing interest and enthusiasm for learning, while students with strong foundations may lose motivation for further improvement. Additionally, some students may not excel in technical movements but positively impact the team in areas such as team atmosphere, leadership, and tactical planning. Therefore, the assessment in this regard seems incomplete.

In conclusion, to improve the teaching effectiveness of the Basketball Club course, enhance student interest, and address issues in teaching modes, content, equipment, and evaluation methods, reforms must be comprehensive and multi-dimensional.

### 3. Teaching Innovation Philosophy and Implementation

To address the issues in university public physical education basketball teaching, the course innovates and reforms in the following aspects [4]:

#### 3.1. Introducing Wearable Devices and AI Applications to Improve Classroom Efficiency

The wearable device used in this class is the "Action Recognition and Training System Based on Multimodal Motion Big Data" developed by Associate Professor Zhou Yu from the Computer Science Department of Shenzhen University. The system operates through the following steps:

1) Collecting and analyzing technical movements such as shooting

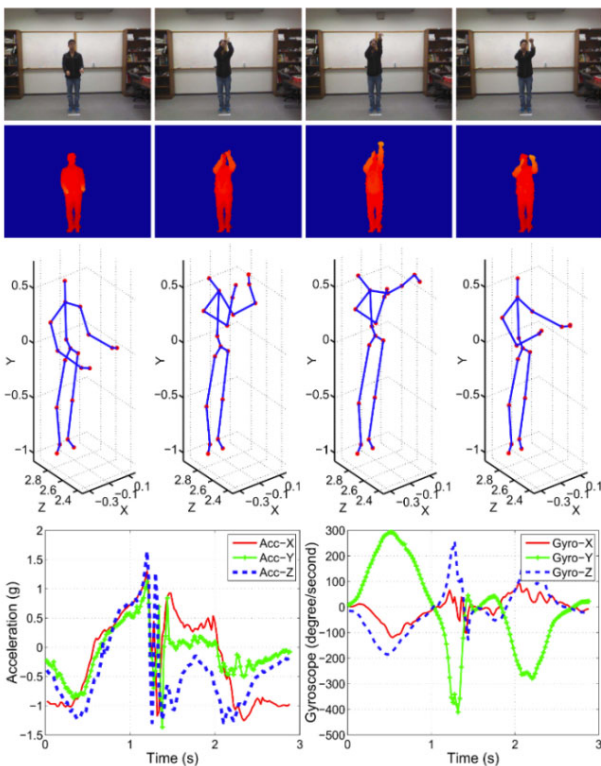


Figure 1. Collecting big data on student shooting movements and analysis

2) Researching advanced algorithms for technical movement recognition

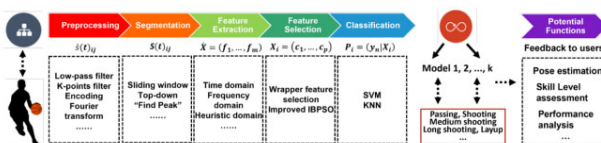


Figure 2. Calculating data

3) Displaying the application's front end and back end.



Figure 3. Intelligent AI Coach frontend platform

The device addresses the issue of high student-teacher ratios in basketball clubs. For courses requiring standardized movements like shooting, dribbling, and passing, the system uses data collected from the best domestic athletes through tools such as gyroscopes and accelerometers to establish correct movement models. During teaching, setting training requirements such as the number of repetitions and success rates allows for more effective monitoring of student training quality. This enables students with standardized movements to quickly move on to the next level of practice, while identifying students with yet-to-be-standardized movements, allowing for focused technical explanations. The teaching course revolves around the work of the AI intelligent coach, as outlined below:

1) Before learning a new technical movement, the teacher plays a video of the standard movement in the class group, guiding students to consider the key points and difficulties of the technical movement and explaining why this movement model has become the current technical mainstream. The teacher also analyzes the application scenarios of the technical movement in actual competitions.

2) Students enter the offline classroom for learning, wear wearable devices for the first round of data collection, observe the success rate of each student's movements, record each student's initial technical success rate, and then engage in deconstruction exercises for technical movements. Using the teaching method of summarizing points before and after, the teacher elaborates on and solidifies each movement detail. Subsequently, guidance is provided again through the AI intelligent coach of wearable devices, allowing the teacher to monitor each student's training progress in the background.

3) Afterward, the teacher instructs students who have mastered movements quickly to practice at a higher level, while providing targeted guidance and explanations to students with lower success rates.

4) Finally, observe at the end of the course or during review sessions how much each student has improved in the success rate of their initial technical movement exercises, with the improvement rate being a crucial evaluation criterion.

5) After class, teachers can continue to require students to upload their movement videos to the system's backend for further review and correction, further consolidating the standardization of movements.

#### 3.2. Enhancing Course Relevance, Transforming Students from Passive Participants to Active Guides

By combining with established events such as the "New Student Cup" and "President's Cup," significant tactical

training with practical significance, such as 2-3 zone defense and full-court pressure in a 2-2-1 formation, is integrated into the curriculum. This allows students to gain tangible benefits from the practical application, thereby boosting their enthusiasm for learning in the course.

In the 2022 President's Cup final, teams from the School of Telecommunications and the School of Economics, both of which had students enrolled in the course, repeatedly used defensive tactics such as 1-3-1 zone defense and 2-2-1 full-court zone defense, as well as offensive tactics like "horn" and "zipper". All of these were part of the course's teaching content.

### 3.3. Strengthening Moral Education, Infusing Moral Education into Basketball Teaching

The characteristics of basketball, such as teamwork, on-court competition, completing tasks within specified time limits, and requiring deliberate practice, make it an important tool for cultivating students' teamwork, confidence, and self-discipline, among other excellent qualities [5]. Therefore, the teaching process of public physical education courses should also design corresponding teaching environments. For example, when teaching the "free throw" technique, the following course design is implemented: Three students A, B, and C are divided into a group. When A practices free throws, a requirement is set for A's shooting accuracy. If A hits only one out of two free throws, all members of A's group, including A, B, and C, must perform a suicide run. After the run, they continue practicing, repeating the process until A completes two consecutive free throws. This teaching environment design increases the psychological pressure on player A. If a free throw is missed, not only does A have to perform a suicide run, but teammates also have to perform the run. As for students B and C, guidance is provided to emphasize that in team sports, a teammate's missed free throw has a detrimental effect. Therefore, during training, they should cooperate with teammates to create a training environment that better simulates real-game scenarios.

### 3.4. Multi-dimensional Evaluation System, Comprehensive Assessment of Students' Classroom Learning Achievements

The teaching goals and assessment indicators of the basketball club course should be clear, specific, and operationally feasible to evaluate students' learning outcomes and teachers' teaching effectiveness. Specific assessment indicators include:

#### 1) Technical Indicators

Assessing students' technical movements through traditional methods such as shooting, dribbling, and layups. This assessment directly evaluates students' technical proficiency.

#### 2) Progress Index

Comparing students' initial technical movement success rates with their success rates after teacher explanations and practice produces a progress index. This effectively enhances the interest and motivation of students with weak foundations while avoiding intentionally lowering the initial technical movement success rate by students with strong foundations. The assessment focuses on the completion degree of movements, excluding specific indicators such as shooting accuracy and dribbling layup speed.

#### 3) Team Index

Through peer evaluation, selecting favorite teammates and assessing students' improvement in team exercises, including team awareness, cooperation, and communication skills.

## 4. Teaching Innovation Achievements

Through comparison with the control group, this teaching innovation has achieved significant results. Student participation has increased, and their interest and skills have noticeably improved. These achievements are reflected not only in data but also in the personal growth and future development of students.

### 4.1. Comparative Teaching Achievements

Table 1. Comparison of Teaching Achievements

Class	Teaching Method	Attendance Rate	Exam Pass Rate	Student Satisfaction	Selected for School Team
Experimental Group	Innovative	96%	80%	Top 30%	3
Control Group	Traditional	85%	75%	Top 80%	3

During the teaching reform process, one class was selected for the experimental and control groups each semester from 2021 to 2023, and the data were finally compiled. The experimental group showed a significantly higher attendance rate, indicating stronger learning interest and enthusiasm. The exam success rate also improved in the experimental group, although not as much as the attendance rate. This is because skill improvement in basketball is challenging within a short semester, requiring higher teaching efficiency to achieve better results. The improvement in student satisfaction also indicates a better teaching relationship between students and teachers, progressing together in a collaborative teaching environment. As for the number of students selected for the university team, the results were tied. This indicates that significantly improving basketball skills in a short period is a challenging task, and to cultivate well-rounded students in morality, intelligence, physical fitness, and aesthetics, consideration may need to extend to a timeframe of 5 to 10 years.

### 4.2. Transfer of Teaching Achievements

After the initial success of the basketball club teaching reform with wearable devices and AI assistance, the technical team has expanded data collection to other sports such as volleyball, skipping, and swimming. Shortly, this teaching model can also be transferred to daily teaching work in these sports, which similarly face challenges such as high student-teacher ratios, limited facilities, and a shortage of excellent coaches [6].

## 5. Conclusion and Outlook

Through our practice, we have demonstrated that traditional basketball classrooms need the infusion of technological power, which can significantly save time and space in both dimensions. However, our work has just begun, and we look forward to further deepening this innovative teaching philosophy and applying it to more courses. After

one to two years of systematic summarization and refinement of supporting teaching content, and enhancing system performance, we aim to promote overall improvement in the quality and efficiency of physical education classrooms in Chinese primary, secondary, and tertiary institutions.

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