

Article**A Study of PBL Teaching Model in College Badminton Courses by Using Design of Experiment****Yu-Sheng Lin ¹, Jen-Jen Yang ², Ting-I Lee ³, and Chun-Yu Chien ^{4,*}**

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Abstract: The purpose of this study is to explore the differences in sports attitudes after problem-based learning (PBL) teaching model intervening in college badminton courses. The students were divided into experiment group, with 66 students adopted the PBL teaching method, and the control group, with 67 students adopted the direct instruction. Badminton skill perceived scale (teaching effectiveness) and athletic attitude scale were using as research tools. The data was analyzed by descriptive statistics, independent sample t test, and paired sample t test. The results show that in the experiment group students improved their serving skills in badminton better than the control group students. Students who took badminton courses have significant difference in the affective dimension. PBL teaching method used in badminton courses effectively improve students' learning sports skills and students enjoyed the fun of the exercise process that is positively beneficial to self-growth and exercise habits.

Keywords: problem-based learning, exercise attitude, exercises participation behavior, quasi-experimental research

1. Introduction

College physical education courses have a substantial impact on students' developing lifelong exercise habits, and the goal of the courses is to develop students' lifelong exercise habits (Huang, 2017). Badminton is one of the favorite sports courses for college students since badminton duo Wang Chi-Lin and Lee Yang won the nation's first Olympic gold medal and Tai Tuz-Ying also won the women's singles silver medal in Olympic, which set the record in badminton history in Taiwan and have a craze for badminton. Therefore, how the physical education teachers can effectively guide and promote students to develop regular and continuous participation in physical activities, generate enthusiasm and interest in sports and help to develop the habit of lifelong exercise as a part of life is important.

In physical education courses, integrating different teaching situations and methods would arouse students' interests and motivate them to learn. In the past, traditional teaching was teacher-centered and emphasizing on skill-oriented teaching methods. Problem-based Learning (PBL) was proposed by Howard Barrows who reformed teaching method in the medical school in McMaster University (Barrows & Barrows, 1998). In the teaching process, the learners are the center and the practical problems are asked to trigger discussions among the learners. The teacher decides the teaching goals and guides the problem; the grouping method is used to cultivate learners' thinking, discussion, criticism, and solve the practical problems which would effectively improve the motivation and ability of learners to learn independently (Edens, 2000). The teaching method centers on "practical problems" and "learners" that allow learners to encounter problems in the industry and students are encouraged to conduct group discussions and analyze and solve case problems (Evenson, Hmelo, & Evenson, 2000).

Hmelo-Silver (2004) pointed out that PBL is a teaching strategy in which students learn through problem solving, and there are no correct answers. Therefore, the PBL learning process can be roughly divided into three stages: facing the problem, learning independently, and problem return (Wiers, et al., 2002). The PBL teaching method is to promote independent and cooperative

learning. Teachers play the role of facilitators, allowing students to be in an authentic situation, and then discuss reason and judge from the questioning situation to improve the problem-solving process. It can guide students to learn from problems, and achieve knowledge construction and application by exploring problems (Hsu, 2013). The problem-oriented teaching process is to collect relevant data and integrate others' opinions through interaction with peers and to explore and solve problems in real situations through discussion and practice. This teaching strategy includes goal setting, critique thinking and cooperative learning (Cheng & Chang, 2006; Wang et al. 2010). Therefore, PBL can help students to establish and develop their learning attitude and also cultivate students' teamwork and learning ability. In the badminton course of this study, the student-centered teaching mode is adopted. Identifying problems and encouraging students to conduct group discussions, active learning, critical thinking, and problem-solving ability.

Physical education at school is a part of the development of modern multi-sports concept, and it is also the most basic and the key part of learning. How to effectively plan for students to continuously participate in sports and drive their inner psychological motivation can effectively improve their behaviors for sports participation. Because attitude is mainly used to explain people's action intention, not the behavior itself, it is transformed into the basis of action through the inspection of individual perception (Wu, 2008). In addition, the attitude is the actual experience obtained by the individual, and it is also the behavioral tendency of the individual, not the behavior itself, and the learning theory emphasizes on the past behavioral experience that affects behavioral attitudes (Yang & Ku, 2004; Huang & Lu, 2012).

Tsai and Hsu (2006) pointed out that the intensity of attitude is an important factor to behavior. To enhance attitude, it is an attitude formed after an individual's thinking based on direct, past experience or one's own closely and direct feelings, and it can promote the consistency of attitude and behavior. Athletic attitude is individuals' perceptions, affective, and action intentions toward continuous participation in sports (Gau & Kim, 2011). Therefore, athletic attitude is an individual's perception tendency toward physical activity and beliefs and behavioral perception tendency, and it also has a persistent preference for a certain exercise (Gau & Kim, 2011; Yang et al., 2013). According to the American College of Sports Medicine, if simply providing sports-related knowledge cannot effectively improve sports behavior; to change individual behavioral concepts should through strategic planning and through learning to development of exercise habits (Riebe, 2017). Therefore, getting a good experience in sports or in courses would improve the continuous and regular exercise behavior and the establishment of athletic attitude.

In the past, PBL teaching mode is applied to physical education, and it is found that students have a significant impact on learning skills, learning attitude, critical thinking, and problem-solving ability (Liao & Huang, 2009; Chen & Tseng, 2017; Liu & Chen, 2018). In addition, athletic attitude is important basis for judging whether an individual can continue follow-up. Individuals can be developed the concept of sports and health and exercise practice, which will develop and maintain good physical fitness (Liao & Shiu, 2020). Therefore, how to use effective sports teaching strategies to enable students to judge, think, construct and utilize valuable knowledge by them, so that students can arouse their interest in learning in the classroom, improve sports skills and establish correct sports concepts, and then cultivate regular sports. This study is based on PBL to explore whether the 8-week PBL intervention badminton course has an impact on students' athletic attitude.

Based on the statement above, the purposes of this study are as follows:

- (1) Compare the difference between PBL teaching mode and direct teaching mode.
- (2) Explore the difference of students' attitude towards sports between PBL teaching mode and direct teaching mode.

2. Materials and Methods

2.1 Research objects

The students from two badminton courses in Chaoyang University of Technology were the research subjects and were divided into experiment group and control group. Experiment group, with 66 students, adopted the PBL teaching method; the control group, with 67 students, adopted the direct instruction. The teaching courses lasted for eight weeks.

2.2 Research tools

The research questionnaire is divided into two parts: the first part is badminton skill perceived scale, which refers to the students have the ability to control the power and the skills of hitting the badminton, and the ability to hit the badminton to the target setting area. It is scored on a five-point scale, ranging from completely uncontrollable to almost controllable (set the target area) to give 1 to 5 points respectively. The second part is "athletic attitude" that refers to inner feeling and evaluations by students after participating in badminton courses. In turn, it affects the behavioral intentions, beliefs, and behavior tendency of subsequent participation in sports. It refers to Yang, Ni, and Shi (2013) based on Hovland and Rosenberg (1960) who proposed three elements, perception (students' knowledge and ideas about badminton), affection (feelings about badminton and social values), and behavioral (the

influence of students on badminton behavior and motivation), and modify some semantics of the language to develop a athletic attitude scale for this study. Likert five-point scale is used in this study. The Cronbach's α coefficients were 0.72, 0.73, and 0.85, and the overall reliability was 0.83, indicating that the athletic attitude of this study has good reliability. The pre-and post-test data were analyzed by SPSS 18.0. The data was analyzed by descriptive statistics, independent sample t test, and paired sample t test. The significance level was $\alpha=0.05$.

2.3 Research steps

In order to understand the influence of PBL teaching mode on college badminton courses, the following experimental steps are proposed:

1. In the first week of the experimental study, the experimental group and the control group were respectively to do “the badminton skills perceive scale” and the athletic attitude pre-test questionnaire, and the PBL teaching method description was implement in the experimental group.

2. In the second week of the experimental study, the researchers conducted the course teaching from the basic grip, batting posture, and the description of the serving action and landing point, and then implemented the first serving test. From the third week to the sixth week, the experimental group was supplemented with the PBL teaching experiment method, and the control group was taught by the original teaching method.

3. In the seventh week of the experimental study, the second serving test between the experimental group and the control group was conducted.

4. In the eighth week of the experimental study, a general evaluation and review of the course was conducted, and the badminton skill self-consciousness scale and a sports attitude post-test questionnaire were conducted.

3. Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

3.1. Analysis of the badminton skill perceive scale

From the pre- and post tests that show the students found that the experimental group had a significant difference in conscious serving skills ($t=4.452, p<0.05$), while the control group had no significant difference ($t=1.255, p>0.05$). It means that the students in the experimental group have a higher degree of confidence in the control of serving skills and power after having the PBL teaching method. Through the active learning strategies, students discuss critical thinking issues together has a substantial impact on enhancing personal self-confidence (Nelson & Crow, 2014; Al-Madi, 2018). Therefore, PBL teaching mode can effectively arouse students' learning motivation, which enhances self-worth and self-confidence.

3.2 Analysis of differences in badminton serve skills

From the test of homogeneity, it shows that there is no significant difference in the skills of the first serving test in the experimental group and the control group ($t=0.198, p>0.05$), which Indicates that the two groups of experimental subjects are homogeneous, and follow-up teaching experimental research can be carried out.

According to the paired sample t test, there were significant differences between the experimental group and the control group in the scores in pre- and post the serving skills ($t=-5.219, -4.782, p<0.05$). Judging from the average score, the score in the experimental group in serving skill ($62.444 > 52.529$) was 9.905 points, which was higher than the students in the control group ($51.968 > 60.613$), which had 8.645 points. It indicates that the effect of PBL teaching method on serving skills is higher than the direct teaching method, shown in Figure 1 and Figure 2.

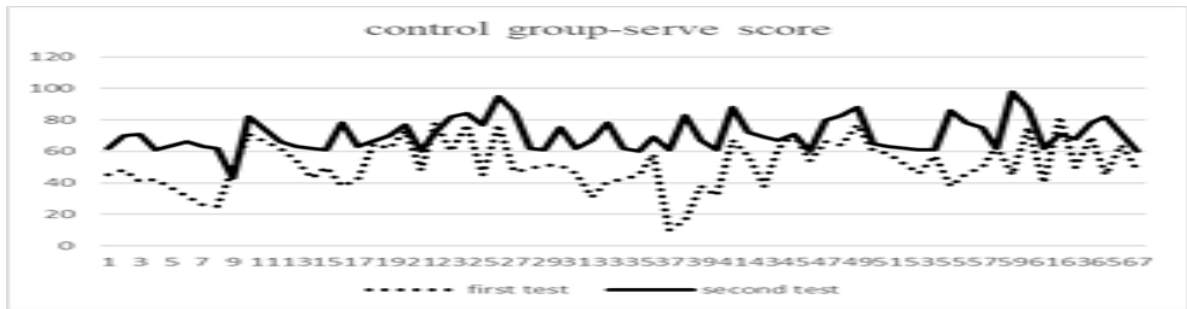


Fig. 1. Experimental group - comparison of pre- and post serving

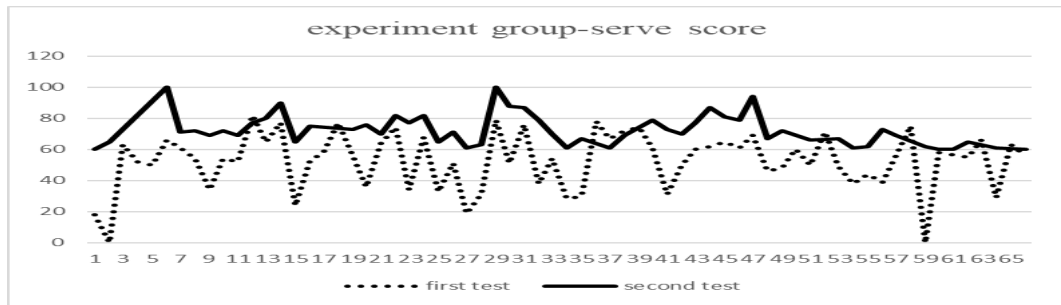


Fig. 2. Control group - comparison of pre- and post serving

According to Son (2020), the learning attitude and critical thinking ability of the experimental group increased significantly compared with the control group. It is proved that students in the experimental group can effectively improve their learning effectiveness through group discussion and cooperative learning.

3.3 Analysis of the differences between PBL teaching and direct teaching methods in athletic attitude

Before and after PBL teaching and direct teaching methods, it was found that the affective dimension of athletic attitude are significant differences ($t=-3.680, -2.030, p<0.05$), which Indicates that students think that taking badminton courses can not only enjoy the fun of sports, but also feel the stimulation during the competitions, which is helpful to increase the development of exercise habits. The experimental group also has significant differences in the behavioral dimension ($t=-2.814, p<0.05$), which indicates that students who had the PBL teaching method have a higher desire to improve their athletic knowledge, which supports them to continue participating in sports, as shown in Table I. Almulla (2020) pointed out that through the PBL teaching method, a variety of viewpoints can be received, and their participation can be improved through knowledge sharing and group discussion.

Table 1 Summary of paired sample t-test of PBL teaching and direct teaching methods in athletic attitude

Dimensions	Groups	Numbers	Averages	SD	t value
Perception	Pre-test of experimental group	66	4.188	0.473	-1.654
	Post-test of experimental group		4.303	0.415	
Affective	Pre-test of experimental group	66	4.021	0.560	-3.680*
	Post-test of experimental group		4.339	0.481	
Behavioral	Pre-test of experimental group	66	3.752	0.678	-2.814*
	Post-test of control group		4.061	0.484	
Perception	Pre-test of control group	67	4.054	0.521	-1.449
	Post-test of control group		4.197	0.600	
Affective	Pre-test of control group	67	3.937	0.568	-2.030*
	Post-test of control group		4.128	0.655	
Behavioral	Pre-test of control group	67	3.785	0.621	-.859
	Post-test of control group		3.878	0.661	

3.4 Analysis of difference between PBL teaching and direct teaching methods after the experiment course

After an eight-week experimental course, there were significant differences between the experimental group and the control group in the factors of conscious serving skills and athletic attitudes ($t=3.052, 2.121, p<0.05$); but no perceived and behavioral factors were found. There are no significant differences, as shown in Table II; it means that through the PBL teaching method, students have a higher degree of feeling about improving their conscious serving skills, and the degree of satisfaction with badminton is stronger. Ramírez et al. (2017) proposed in the application of PBL teaching in physical education courses shows that through the experience of PBL teaching mode, it can stimulate the desire for knowledge and the ability to solve problems, and it has a positive effect on improving students' sense of self-worth.

Table 2 Summary of independent sample t-test after PBL teaching and direct teaching method after the experimental course

Dimensions	Groups	Numbers	Average	SD	t value
Perceived	Experiment group	66	3.909	0.575	3.052*
	Control group	67	3.597	0.605	
Perception	Experiment group	66	4.303	0.415	1.185
	Control group	67	4.197	0.600	
Affective	Experiment group	66	4.339	0.481	2.121*
	Control group	67	4.128	0.655	
Behavioral	Experiment group	66	4.061	0.484	1.825
	Control group	67	3.878	0.661	

* $p < 0.05$

4. Conclusions and suggestions

4.1 Conclusions

After the PBL teaching method, the experimental group has differences of serving skills pre- and posts the tests, and the serving score was higher than the control group. It shows that the PBL teaching method can stimulate students' motivation and interests in learning. In addition, it can enhance individual self-confidence and have better learning results and through cooperative learning and independent thinking among groups, and to formulate problem-solving strategies.

Different teaching modes have differences in the affective dimension of athletic attitudes and significant differences in the perception and behavioral dimensions. It shows PBL teaching method in badminton courses can enhance self-worth and enhance self-growth, and pay more attention to the fun and joy of competitions brought by sports.

4.2 Suggestions

The results of this study show that the PBL teaching mode is effective in students' learning. It is suggested that schools should adopt the cooperative learning teaching mode in athletic courses. Through peer communication and discussion, mutual friendship can be promoted, and an active and a happy learning environment can be created, which can enhance students' learning motivation and improve learning effectiveness. In addition, there are significant differences in perceived athletic skills among the experimental groups, which shows that through PBL teaching, students have a sense of achievement in active learning and problem solving and improve personal self-confidence and develop regular exercise behaviors have positive benefits.

This study only selects students from Chaoyang University of Technology in Taiwan as the research objects. It is suggested that other non-ball sports courses (such as weight training, yoga) can extend the research to compare their differences and understand the impact of PBL courses on students' learning outcomes in the future.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “conceptualization, Yu-Sheng Lin and Jen-Jen Yang; methodology, Yu-Sheng Lin; software, Yu-Sheng Lin and Ting-I Lee; validation, Yu-Sheng Lin and Ting-I Lee; formal analysis, Yu-Sheng Lin; investigation, Jen-Jen Yang and Chun-Yu Chien; resources, Chun-Yu Chien; data curation, Yu-Sheng Lin and Ting-I Lee; writing—original draft preparation, Yu-Sheng Lin and Chun-Yu Chien; writing—review and editing, Chun-Yu Chien; visualization, Ting-I Lee.; supervision, Yu-Sheng Lin” Authorship must be limited to those who have contributed substantially to the work reported.

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