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Experimental Study on Aerobics Teaching Model Based on Cognitive Flexibility Theory

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Abstract

Based on the theory of cognitive flexibility, a new model of aerobic teaching is designed and compared with the traditional teaching model. The experimental results show that the constructed new aerobics teaching mode based on cognitive flexible theory can greatly improve students' aerobic technology and basic physical quality, strengthen their self-confidence, stimulate their learning motivation, and have a comparatively advantages in improving learning effect and knowledge reproduction level compared with the traditional teaching model.

Keywords: Cognitive flexibility theory; Aerobics; Teaching model

Introduction

Aerobics, as a new popular physical education curriculum of china, is not only a kind of performance art embodied a variety of human movement modelling, but also represents complex internal psychology which embodies learner's information decoding and processing, such as movement, and internal motivation's decoding and processing. At present, most of the physical education workers are still using the traditional methods in aerobics teaching, such as demonstration and explanation, which pay less attention to motivate students' internal motivation and cultivate their learning ability. Teacher take a dominant position in the teaching process, and most students are in passive learning state, only following teacher's demonstration blindfold. Hence, learning effect is inefficient. Aerobics teaching is a complicated process, so the teaching model and the strategy chose must be special. Therefore, how to construct a targeted aerobics teaching model which is observable and operational is an urgent problem to be solved.

In the 1990s, cognitive flexibility theory was advocated by Professor Rand J. Sprio from American University of Illinois, and it was widely accepted and development. Professor Rand J. Sprio believes that cognitive flexibility refers to a kind of knowledge system which is reconstructed by a variety of ways, aims to respond to the situation that may change at any time and in any situation, and makes a relatively appropriate response. It has the function of mental representation, which not only repairs of Gestalt, but also processes a set of schema, and has the function of knowledge representation, which is the multi-dimensional representation beyond single model [1]. Therefore, the academic circle named cognitive flexibility theory, as "cognitive theory of elasticity ". It origins in constructivism, and is its new branch. After carefully examining multi-complicated situation and ill-structured field, cognitive flexibility theory apply more than one viewpoint to analysis the transfer of the concept form one field to another, or study different concepts with the same viewpoint, so deduce new insights, reveal the nature of complex and ill-structured learning fields [2]. When people has difficulty in understanding the complex and changeable concept, they could use specific example to demonstrate, which can make this concept valuable, so the concept and the constitution of this case has the features of "criss-crossing", Since professor J. Sprio Rand proposed the theory of cognitive flexibility, many scholars have applied it to theoretical teaching research, and have achieved a lot of results. However, its application in physical education teaching is limited, and in aerobics teaching mode is very rare. Therefore, it is important to construct a new Aerobics Teaching model based on cognitive flexibility theory, which has important practical significance to improve students' ability to improve their fitness, enhance their self-confidence and stimulate their learning motivation.

This research based on cognitive flexibility theory will analyse and decompose the complex and comprehensive teaching case of the aerobics class, construct a new aerobic teaching model and apply this new model in aerobic teaching finally. To explore the teaching model of aerobics under the guidance of cognitive flexibility theory, we hope it can provide not only practical example for the continuous improvement and development of aerobic teaching, but also a useful reference for the majority of sports educators in the process of improving the application of this theory in physical education teaching.

Research Objects and Methods

Research objects

Students from 2012 aerobics elective class 1 (45 students), classes 2 (47 students) Sanming University in China were chose to take part in this experiment. They have no aerobic foundation, and no significant differences in physical fitness.

Research methods

We mainly applied the method of teaching experiment, choosing aerobic elective class 1 (45 students) as control class, taught by traditional teaching model; and choosing aerobic elective class 2 (47 students) as experimental class, taught by the new aerobic teaching model designed according to cognitive flexibility theory. Before and after the experiment, these two groups were investigated by questionnaire, and then the data and the results of the experiment were analysed by SPSS19.0 and EXCEL2007 (Figure 1).

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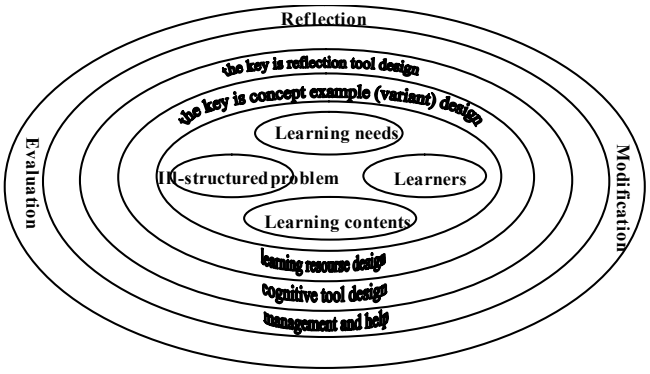

Figure 1: The new aerobic teaching model based on the cognitive flexible theory.

Theoretical supports

In the process of constructing the new teaching model based on cognitive flexible theory, some scholars took the ill-structured problem as the main line, set from two centres-the one is concept example (variant) design, so called learning resource design; the other is reflective tool design, that is, cognitive tool design [1] and analyse learning task as learning needs, learners and learning content.

Figure 1 shows the theoretical teaching model. The scholars carry on the teaching model on "three centres" gradually, which are "learning resource design", "cognitive tool design", and "management and help". These three centres work together to serve the learning task, and solve relative ill-structured problem, which have positive results to the learning needs, learners, and learning content, but also have some the limitations on its theoretical teaching research [3] (Figure 2).

The reconstructed aerobics teaching model

On the basis of the above mentioned three centres teaching model of cognitive flexibility theory, combined with actual situation of the technical skills of aerobics, the author constructed a new aerobic teaching model (Figure 2), and carried on the practical teaching according to this figure.

The experimental procedures of aerobic teaching model

Based on the new aerobic teaching model, experimental class carried on the experiment strictly. its experimental steps are as follow: make clear task and goal in two aspects, that is teaching and learning → create some easily appeared problems as the main part (create a number of technical issues and problems which are easily appeared in aerobic teaching, and guide students to find the ill- structured problem during their learning). → Learning recourse design (demonstrate specific and selected aerobic cases through multimedia). → cognitive tool design (reproduce wrong movement and demonstrate right movement through multimedia, and guide students to reflect through cognitive tool) → Management and help (teachers, under the guidance of cognitive flexibility theory in specific learning environment, make clear learning task, organize learning activities, and provide help and guidance when students are using learning resources and cognitive tools → establish task driven inquiry model (the students use research method of group discussion to solve ill-structured problem. In the discussion, the students have to create and design the specific situation, design a real task, and propose task driven problem. Moreover, they also have to analyse the problems existing in the teaching process, and explore ways and means to solve these problems.) → reflection, evaluation, modification and random access learning (after students operate autonomously and learn interactively in hypertext learn environment, they can learn aerobic movement in different aspects from different angle, which can make the teaching process more "scientific", and make the students can grasp the right technological movements.) → Return to teaching tasks and objectives (this is aimed for further evaluation, reflection and revision).

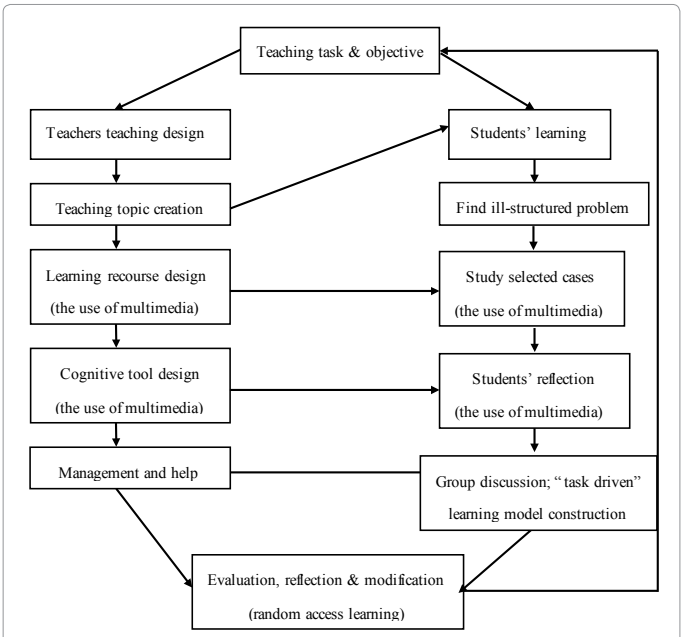

Figure 2: The structure of aerobic teaching model.

The class time is 32 hours for both groups. The syllabus, teaching progress, and teachers for them are all the same. Under the same teaching content, control class used the traditional teaching model, and experimental class used cognitive flexible theory to carry on the teaching. For both classes, the teaching method was not explained in advance, and all the contents were completed in classroom, and exercises and tasks which are the same were arranged after class. In the experiment, mutual communications between two classes were forbidden to make sure the equalization of the experiment condition and the consistency of students' energy input. After 32 hours 16 weeks' experiment, in order to ensure the fairness and accuracy of scoring, the scores which were given by the evaluation group composed of 4 aerobics teachers, were input into EXCEL and SPSS19.0 software to carry on the analysis in the last.

Results and Discussion

Comparison of students' average results of aerobic technology and its analysis

Table 1 indicates the average result of experimental class was 85.25 and control class was 72.63. The result of experimental class were significantly higher than that of control class, and the difference has statistically significant ($P < 0.01$). In addition, after the statistics of variance value, we can see the technology result of experimental class is more stable compared to control class, and their overall level is comparatively higher. Hence, the new aerobic teaching model based on cognitive flexibility theory plays an active role in improving students' aerobics technical performance. The main reason is that: on the one hand,

Group	n	Technical evaluation results $(\overline{X} \pm S)$
Experimental class	47	85.25 ± 5.28
Control class	45	72.63 ± 6.83
T		3.645
P		<0.01*
$\overline{X}$ is average value; S is standard variance*		

Table 1: Comparison of students' average results of aerobic technology*.

the complex and hard to handled ill-structured problem are carefully constructed according to the teaching task and goal in experimental class. Through the use of multimedia, which presents a selection of cases, teachers guide students to reflect, reproduce complex and easy to make mistakes, which forms a targeted psychological representation to students; on the other hand, the new aerobic teaching model applies multimedia and hypertext interaction technology, which makes aerobic movements teaching not a separate and isolated teaching model, but a highly related teaching process, which make the students in experimental class can learn and grasp the aerobic technology more fully and comprehensively.

Comparison of aerobics basic quality results and its analysis

Aerobic basic quality was tested through three observation points, which are basic posture, musical sense, and coordination [4]. Table 2 shows that the results of basic posture and music sense of experimental class were significantly higher than those of control class and have significant difference ($P < 0.05$); physical coordination has also been greatly improved in experimental class and have a very significant difference ($P < 0.01$). These indicate that the new aerobic teaching model based on cognitive flexibility theory have a comparatively advantage in improving students basic quality. After teachers' conscious topic creation, students in experimental class found a lot of ill-structured problems in complex process of learning, especially the problem of rhythm of music, basic posture, the coordination of the movement, and so on. The students in experimental class can excuse these errors from the heart. And then through comparing the selected cases and its reflection, the basic aerobic quality can be effectively improved. These solve the problem appeared in improving the basic aerobic quality and avoid the blindness in learning [5]. Therefore, the improvement of basic aerobic quality is obvious compared with traditional sports teaching method in control class.

Comparison of aerobic learning motivation and its analysis

Learning motivation refers to a kind of driven which can stimulate and maintain people are learning behavior, and make their mind to go for a certain academic goal. It is the internal cause for students to carry on their learning activities, to improve their learning interest and enhance learning effect [6]. Before and after this experiment; experimental class and control class were questioned (Table 3). The results show: the students in experimental class and control class had no significant difference before experiment ($P > 0.05$), and the average learning motivation in experimental class (74.75) was slightly lower than that of control group (75.0). After 16 weeks of experiment, the learning motivation in experimental class was significantly improved, compared with control class, after applying the new model based on cognitive flexible theory. There appear a significant difference ($P < 0.01$), which indicates the new model has positive effect in improving students' motivation to learn aerobics. Meanwhile, control class applied with the traditional teaching methods such as "spoon feeding", "teaching method". Students under these methods only imitate aerobic

Group	n	Basic posture $(\overline{X} \pm S)$	Musical sense $(\overline{X} \pm S)$	Coordination $(\overline{X} \pm S)$
Experimental class	47	82.31 ± 4.86	79.50 ± 4.53	87.37 ± 2.26
Control class	45	78.50 ± 5.73	75.25 ± 4.89	79.12 ± 1.64
T		2.832	3.191	8.147
P		<0.05*	<0.05*	<0.01*
$\overline{X}$ is average value; S is standard variance*				

Table 2: Comparison of aerobics basic quality*.

Group	n	Before experiment $(\overline{X} \pm S)$	After experiment $(\overline{X} \pm S)$
Experimental class	47	74.75 ± 5.59	85.62 ± 3.73
Control class	45	75.00 ± 5.47	78.12 ± 1.96
T		-0.357	5.451
P		>0.05	<0.01*
$\overline{X}$ is average value; S is standard variance*			

Table 3: Comparison of aerobic learning motivation*.

technology movement, and lack of in-depth understanding to complex technical movement. In this traditional teaching model, when students suffered complex and had to handle technology movements, they just turned to teachers and got limited information. However, students in experimental class were teaching to understand the ill-structured problem first, and to form a "cross type" feedback through the ways of multimedia, mutual learning, group discussion, and so on, which made the students can fully apply their energy to solve complex problem of technical movements, obtain a positive «mental representation», and finally improve learning motivation significantly.

Comparison of learning self-confidence and its analysis

Self-confidence is a kind of psychological characteristics that reflect the individual consider himself has the confidence to carry out, and can successfully complete the object. It is a positive characteristic and psychological status which can effectively express self-value, self-respect, and self-understanding [7]; self-confidence directly affect individual's learning, competition, employment, achievements and other psychological status and following actions [8]. Through investigating both classes, experimental class and control class have no significant difference before experiment ($P>0.05$) (Table 4). After the experiment, the confidence of experimental class has been improved obviously compared to control class ($P < 0.01$). This reflects that the teaching model based on the cognitive flexibility theory has a positive role in improving their confidence. Under the guidance of the new teaching model, the students in experimental class had to face the ill-structured problem while learning the complex technology movements. Then they applied the way of reflection, group discussion, and drove by "task driven" model, which can not only solve confusion during their learning, but also change their psychological status to a positive direction. When the students in experimental class felt "sense of achievement" and "sense of success" continuously [9] their self-confidence would be improved which is the main reason why the self-confidence in experimental class is higher than control class after the experiment.

Comparison of self-evaluation of learning effect and its analysis

Table 5 shows students of both classes have different points of view of self-evaluation. The self-evaluations was classified into four grades, that is "good", "fine", "general" and "poor". Students from both classes have a very significant difference in the "good", "general" and "poor" grades, but the difference in "fine" is not obvious. In experimental group, a majority of students evaluated "good" in the learning effect,

Group	n	Before experiment ($\overline{X} \pm S$)	After experiment ($\overline{X} \pm S$)
Experimental class	47	63.50 ± 3.82	79.37 ± 6.41
Control class	45	64.98 ± 2.67	71.87 ± 7.43
T		-0.917	5.45
P		>0.05	<0.01*
$\overline{X}$ is average value; S is standard variance*			

Table 4: Comparison of self-confidence*.

Group	n	Good	Fine	General	Poor
Experimental class	47	70.21%	25.53%	4.26%	0
Control class	45	11.11%	26.67%	53.33%	8.89%

Table 5: Comparison of self-evaluation of learning effect.

a minority evaluated "general", and nobody evaluated "poor" [10]. Through the comprehensive analysis of the data in Table 5, the learning effect of experimental class is basically concentrated in "good" and "fine" level, while control class was concentrated in "fine" and "general" level. Hence, students' degree of approval to this new teaching model is higher. Learning effect is students' learning experiment in their learning. The students in experimental class have a pleasant experience in their learning topic and learning environment that teachers created. They will excited when they breakthrough of the "ill-structure" problem. Therefore, the classroom atmosphere is active, and students' inner thinking ability is activated, which makes students experience the fun of aerobics [11]. This is the direct reason why the self-evaluation of experimental class is higher than control class.

Comparison of level of knowledge representation and its analysis

After 16 week teaching experiment, the level of knowledge representation was tested in both classes. The test was carried out by demonstrating a group of new aerobic technical movements, and then asking students in two classes to represent the movements immediately [12]. The test was evaluated by 4 teachers simultaneously. The results are shown in Table 6. Obviously, knowledge representation level in experimental class were significantly higher than that of control class, and has a very significant difference ($P < 0.01$), forgetting rate in experimental class was lower than that of the control class. The result further illustrates the new teaching model based on cognitive flexibility theory can make students further consolidate their learning, strengthen their technology movement. The learning steps in experimental class are as follow: study the selected cases---students' reflection---group discussion---teacher's management and help---students' evaluation, reflection and modification. The teaching model is combined with multimedia, which also achieves representation and feedback. This new aerobic teaching model based on cognitive flexibility theory not only makes the students remember the technical movements, but also lets students have formed a solid image in their mind and muscle to some complex technical movements. With the enhancement of brain's ability to analyses technical movements and muscle's ability to remember movements, students in experimental class can make full use of the learned knowledge to solve the new problems that have been encountered during the late period of the study. The "self-learning" ability and "muscle memory ability" of students in experimental class is obviously better than control class [13].

Conclusions

The new aerobic teaching model based on cognitive flexibility theory can greatly improve students' aerobic technology and basic quality, and make them grasp their technology better.

The new aerobic teaching model can improve the students' self-confidence, learning motivation and other internal factors, so students no longer mechanically imitate teachers and transfer from passive learning to active learning.

Group	n	$\overline{X} \pm S$	Knowledge representation level training $\overline{X1} - \overline{X2}$	Forgetting rate(100 ± X%)
Experimental class	47	87.45 ± 5.57	15.83	12.55
Control class	45	71.62 ± 4.45		28.38
P			<0.01*	
$\overline{X1}$ stands for Knowledge representation level in Experimental class, and $\overline{X2}$ stands for Knowledge representation level in Control class. Therefore, after the Knowledge Representation Level Training, the results in experimental group are improved, which can be show in $(\overline{X1} - \overline{X2})$*.				

Table 6: Comparison of the level of knowledge representation*.

The new aerobic teaching model not only make students pay great attention to the external presentation of technical movements, but also make them strengthen their internal psychological learning and information processing initiatively, which erase "simplified" phenomenon in the aerobic teaching process, and great improve learning effect and the level of knowledge reproduction.

The new aerobic teaching model suggested collecting ill-structured problem and it has a crucial role to the model. However, the collected cases are not rich enough. Hence it recommends schools to set up teaching union to collect typical ill actions in aerobic teaching process to form a teaching resources library and improve the complement of teaching resources. In addition, the application of cognitive flexibility theory in sports teaching research is not deep enough; its practice in other courses and project operation is also limited. Therefore, it is recommended that the deeply and systematic research can be carried out in physical teaching to explore its significance.

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