

Effect of ecological teaching on a university course

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ABSTRACT: Urban planning majors in China and problems related to them are aired and discussed in this article. Ecological teaching concepts are introduced as a possible method by which to handle teaching problems. An experiment to analyse the effect of ecological teaching was performed on a basketball course that is intended to motivate and encourage urban planning students. Novel evaluation indices and a BP (back propagation) neural network evaluation method were used to analyse the experiment's results. Four evaluation indices indicated that students taught using ecological teaching methods were better than those taught by traditional methods. The integration of ecological curriculum teaching concepts into teaching improves the enthusiasm of students and enhances the overall teaching quality.

INTRODUCTION

Urban planning majors provide training in the discipline's knowledge base and technological innovation [1]. These programmes lay foundations for developing engineering talent that can be divided into three phases.

Phase one is the development of specific abilities. This focuses on training to solve single problems under controlled conditions. Students focus on applying theoretical knowledge to solving real-life problems. They become familiar with technology and develop a scientific interest.

Phase two is inter-disciplinary training. This requires the promotion of learning to meet personal needs, through the urban planning majors. This phase combines teaching and research through independent inquiry.

Phase three involves innovative training. The mission of higher education is *cultivating senior specialised talent with innovative and practical ability and developing a science and technology culture*. The cultivation of innovative talent in urban planning majors embraces the strategy of building a creative country [1].

The urban planning majors have two problems regarding the cultivation of talent, viz. the channels providing training are all similar, and there is limited promotion of the discipline; practical and innovation abilities should be further strengthened.

Researchers have conducted studies into solving these problems. They analysed the current teaching situation in colleges and proposed, for example, establishing classes based on conflict management. They also analysed the concepts, characteristics, theoretical bases and implementation of teaching in urban planning majors. They summarised the experiences and existing problems, and proposed reforming the teaching, including the updated hardware support, as well as introducing a co-operative mode of teaching, and updated management and evaluation systems [2]. Most researchers focused on just one aspect of the entire cultivation mechanism for their independent research; a comprehensive research plan has not been formulated.

ECOLOGICAL MODE OF TEACHING

The ecological teaching concept is a novel theory in the field of education and has been studied extensively by scholars [3]. Ecological teaching explains teaching problems using ecological principles and promotes ecological teaching practices [4]. Therefore, ecological teaching is not only a teaching strategy, but also a teaching concept. Ecological teaching is systematic, comprehensive, harmonious and balanced; it embodies and applies ecological concepts [5]. Ecological teaching connotes:

- Natural harmony: ecological teaching advocates a respect for individual character, with the aim of cultivating harmonious and wholesome students.
- Teaching integrity: in ecological teaching the teaching goals, content and elements are linked together to form an integrated whole.
- Self-organisation: the ecological mode of teaching gradually becomes well-organised through student individual self-development, as well as by interaction and feedback.
- Openness: openness in information exchange within the system.
- Richness: the richness of ecological teaching derives from diverse teaching content and respect for student personalities.
- Process compliance: ecological teaching involves compliance and adaptable development. Development may involve *doing nothing* if that is natural for the student, or *naturally developing* in line with the nature of the student [5][6].

Ecological teaching regards the whole teaching process as an ecosystem affected by many factors in the teaching process. Ecological teaching has been applied extensively, from kindergarten to university. However, its main focus has been on liberal arts teaching and less on engineering. This study explored the application of ecological teaching to urban planning courses at universities, which have a sports component.

APPLICATION OF ECOLOGICAL TEACHING TO SPORTS TEACHING

An experiment was performed to determine the effect of ecological teaching at university. The experiment involved a control group taught by the traditional method and an experimental group taught using the ecological teaching method.

Subjects

Seventy two students (37 male and 35 female) were selected randomly from six physics classes in the 2013 academic year. The students were from a major university. The subjects were divided into an experimental group (36 students from classes 1 to 3) and a control group (36 students from classes 4 to 6). The experimental group was taught using ecological teaching, whereas the control group was taught using traditional teaching.

Experiment's Schedule

The experimental teaching was conducted for one term, from September to December 2013. Ecological teaching time for each semester was 32 hours, which included 8 hours of theoretical study and 24 hours of outdoor practice. The period was equivalent to that of the traditional teaching mode.

Teaching Methodology

The study applied to the basketball class, which includes physics as applied to basketball. The traditional teaching mode is divided into two parts: theoretical teaching (mainly conducted in the classroom) and practical teaching (mainly conducted outdoors).

By contrast, the ecological teaching mode is divided into theoretical teaching, which is conducted by topic through discussion and questions; free discussion in which students raise questions that students discuss and draw conclusions with the teacher as a guide; and outdoor sports, where students pursue their own ideas or work on projects assigned by the teacher. Outdoor sports are performed by collaborations of a small number of students and take the form of a group competition.

Teaching Content

Basketball requires immense practice and theoretical guidance. Most students find the course difficult, when taught in the traditional way. Thus, the teaching content of the course should be improved. The ecological teaching mode is based on the original course syllabus, but with enriched course content to stimulate the students' interest and make the course easier to understand.

Evaluation Methods

Marks are used to evaluate students in the traditional teaching mode, which makes students focus on grades instead of actual learning. For the ecological mode of teaching, innovative evaluation indices and methods were adopted.

Evaluation indices should measure students' development and quality given the nature of the course. The following evaluation indices were used:

Index 1: Theoretical knowledge

This index is measured by an examination out of 100 and tests student understanding of theory. Students only achieve good grades if they fully understand and can flexibly use the knowledge obtained from the course. Theoretical knowledge has six evaluation sub-indices: introduction to basketball; techniques, tactics and principles of basketball; code of arbitrage; basketball rules; prevention and treatment of common injuries; and classic examples.

Index 2: Practical, co-operative and communications abilities

This index provides insight into a student's ability to use knowledge to solve practical problems, i.e. analysis, training, tactics co-operation and refereeing. This is marked out of 100.

Index 3: Independent thinking

Free discussion in ecological teaching gauges the independent thinking ability of students. This is marked out of 100. Experts score students according to their performance during free discussion. However, this assessment is not mandatory.

Index 4: Team spirit

This index is assessed through student performances in a series of university or organisational competitions. This is also marked out of 100.

Participants did not know the course evaluation methods prior to the end of the course to ensure the accuracy of the evaluation process. The multiple-indicators were used to assess the teaching quality using a BP (back propagation) neural network. This uses the maximum entropy error criterion evaluation method by which to evaluate each student.

RESULTS AND ANALYSIS

At the end of the course, each student was evaluated using the four indices and the BP neural network evaluation. Table 1 and Figure 1 present the overall results.

Table 1: Overall results.

Groups	Index 1	Index 2	Index 3 (Participation*)	Index 4 (Participation*)	Total Score
Control group	67	61	35 (42%)	54 (14%)	47
Experimental group	79	71	60 (56%)	58 (42%)	68

$\lambda_{max} = 5.0683$ C.I = 0.0171 C.R = 0.0153 < 0.1

*The percentage of the group that was tested on this index

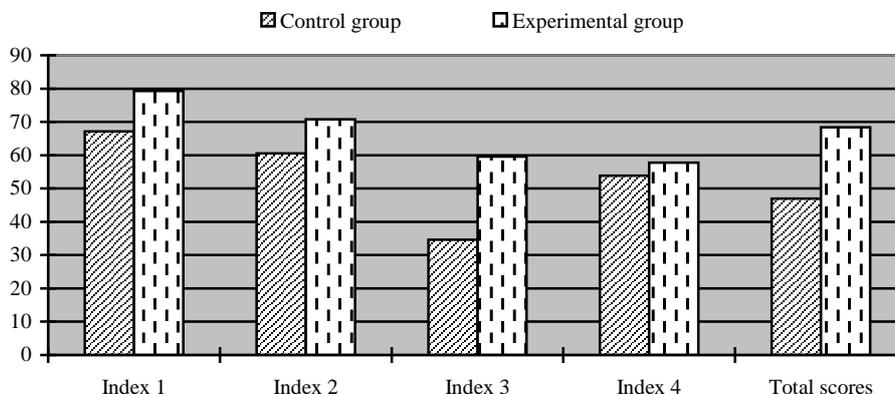


Figure 1: Bar graph of overall results.

Table 1 shows that overall, the experimental group was better than the control group. The experimental group average total score, which is a summary across all indices, was 21 points higher than the control group.

For Index 3 (independent thinking), in which students participate voluntarily, the participation of the experimental group was higher than that of the control group. Across the indices the effect of the ecological teaching method was better than that of the traditional teaching method.

The specific analysis is as follows:

Index 1: Theoretical knowledge

The control group found the examination difficult because teachers focus on teaching basic knowledge without covering the use of the knowledge.

By contrast, the experimental group rated the examination as of moderate difficulty. Students in the experimental group focused on basic knowledge during the daily lecture, but also had teacher-guided discussions among themselves. Table 2 and Figure 2 present the results for Index 1 (theoretical knowledge).

Table 2: Results for the sub-indices of Index 1 (theoretical knowledge).

Group	Basketball - introduction	Basketball - techniques tactics, principles	Code of arbitrage	Basketball rules	Prevention and treatment of common injuries	Classic examples	Average score
Control group	76	65	63	70	61	68	67
Experimental group	85	77	73	83	81	77	79
<i>p</i> *	0.0072	0.0086	0.0056	0.0041	0.0093	0.0072	0.0086

**p* < 0.01 indicates that the experimental group is significantly better than the control group

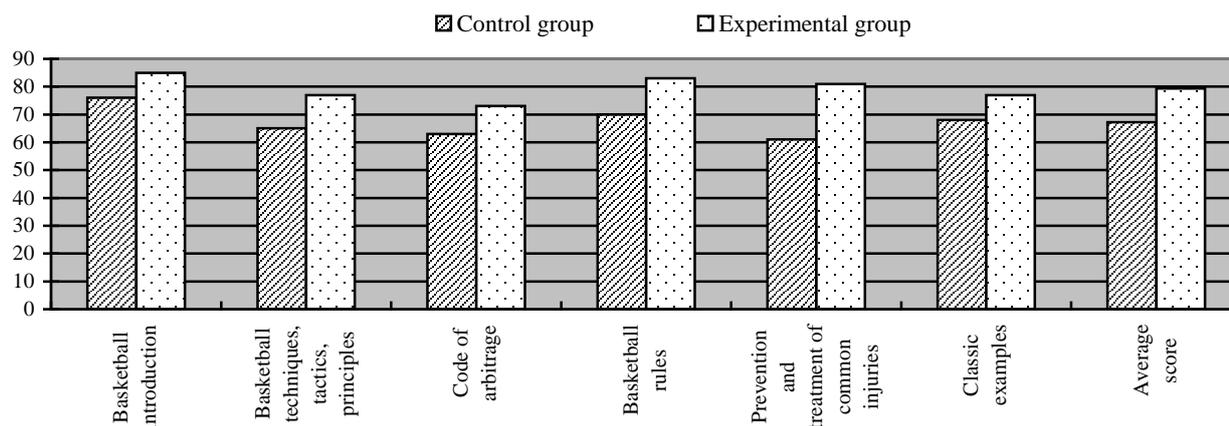


Figure 2: Results for Index 1 (theoretical knowledge).

Index 2: Practical, co-operative and communications abilities

Teachers guided students in the experimental group to actively consider possible problems during outdoor teaching and their solution. Teachers co-operated with students on solving problems and enhancing practical and co-operative communications capability.

By contrast, in the control group, teachers closely directed students, so that when problems occurred, few students knew how to resolve the matter. The average score of the experimental group is better than that of the control group for theoretical analysis, especially for strategy co-operation, which requires high flexible operation ability. Table 3 and Figure 3 present the results for Index 2.

Table 3: Results for Index 2 (Practical, co-operative and communications abilities).

Groups	Analysis	Training	Tactics co-operation	Refereeing	Average score
Control group	71	53	55	63	61
Experimental group	75	67	68	73	71
<i>p</i> *	0.0072	0.0065	0.0078	0.0086	0.0052

**p* < 0.01 indicates that the experimental group is significantly better than the control group

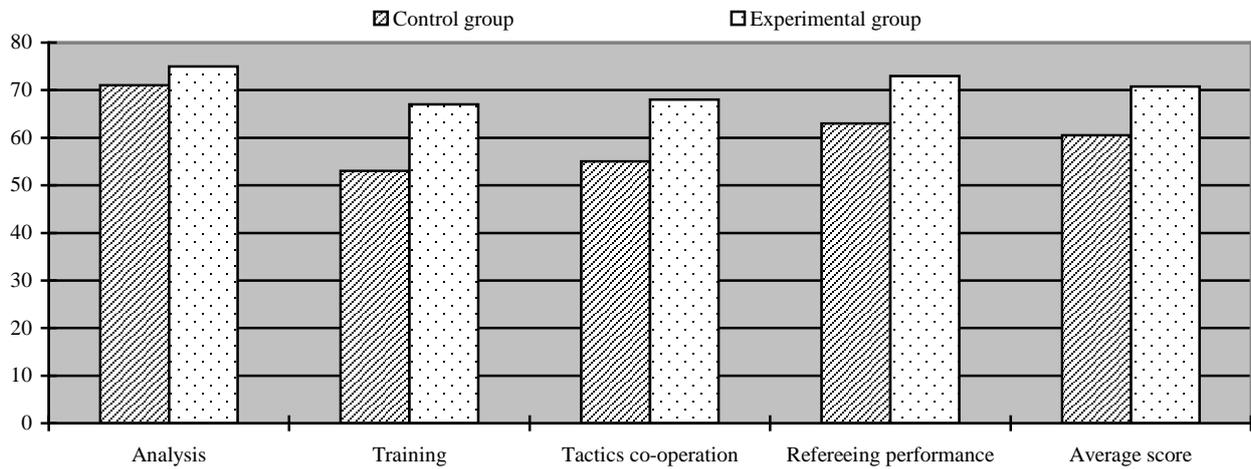


Figure 3: Bar chart results for Index 2 (practical, co-operative and communications abilities).

Index 3: Independent thinking

The control group attempted to finish tasks as quickly as possible without the raising or solving of problems. By contrast, the experimental group was interested in studying, discussing and solving problems independently. Table 4 and Figure 4 present the results for Index 3 and Index 4.

Index 4: Team spirit

The control group was poor at participating in competitions. By contrast, the experimental group exhibited a willingness to participate in competitions regardless of personal abilities. Table 4 and Figure 4 present the results for Index 3 and Index 4.

Table 4: Results for Index 3 (independent thinking) and Index 4 (team spirit).

	Index 3 (independent thinking)		Index 4 (team spirit)	
	Control group	Experimental group	Control group	Experimental group
Number of participants	15	19	5	15
Participation*	42%	56%	14%	42%
Average score	67	79	35	60

*The percentage of the group that was tested on this index

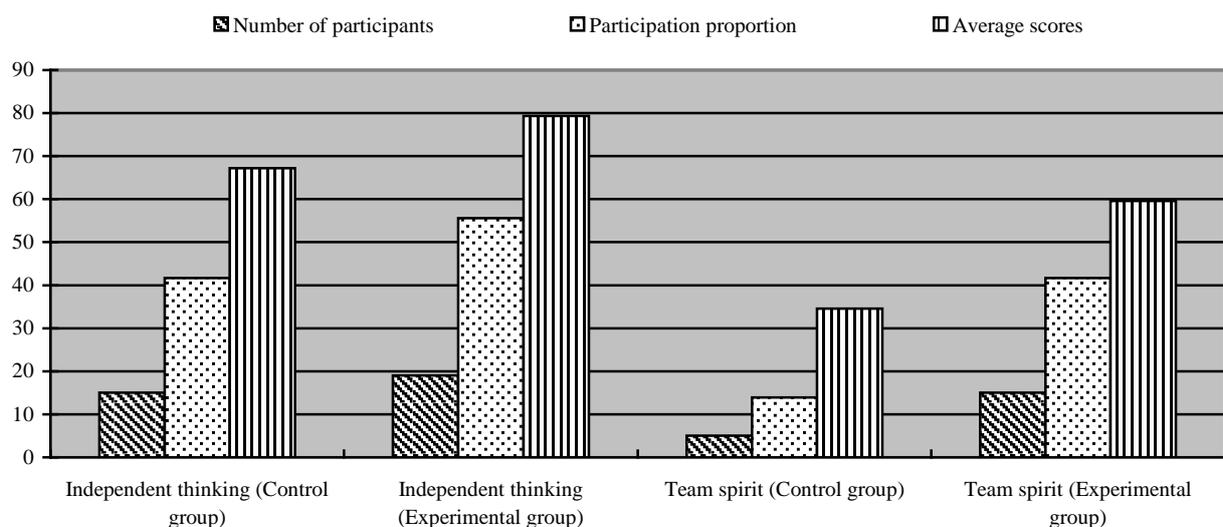


Figure 4: Results for Index 3 (independent thinking) and Index 4 (team spirit).

CONCLUSIONS

The ecological teaching model has broken free from the traditional mode of teaching. It encourages students to not only focus on examination results, but also on communication, co-operation and independent thinking. Thus, students have a

more rounded educational experience. Ecological teaching emphasises the ecology of the teaching process. Teaching elements are developed taking account of this ecology by addressing the actual learning environment. Consequently, students take pleasure in studying, which can perhaps extend to lifetime-learning. The ecological teaching model creates a comfortable environment for students in which to learn actively.

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