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Enhancing learning achievement and students' satisfaction among the first year students of Zhoukou Normal University through problem-based learning

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ABSTRACT
The purposes of this research were to 1) compare learning achievements on Fundamentals of Information Technology course of the first year students at Zhoukou Normal University, China before and after using problem-based learning, 2) study learning achievements with an expectation of passing with the criteria 70 percent, and 3) study the student's satisfaction towards problem-based learning organization. The samples were 66 students of the first year from Zhoukou Normal University and network engineering university which selected through cluster random sampling. The research instruments were: 1) the lesson plan 2) PBL pretest and posttest form, and 3) the satisfaction questionnaire. Data were analyzed by mean, standard deviation, and t-test. The findings revealed that: 1) post-learning of students was higher than their pre-learning with statistical significance at the level .05. 2) The learning achievement of students was 89 percent that higher than the standard criteria of 70 percent with statistical significance at the level .05. 3) The students' satisfaction after learning was at a highest level.

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1. INTRODUCTION

In 2016, the Ministry of education of the people's Republic of China pointed out in the "Guiding Opinions of the Ministry of Education on Deepening Education and Teaching Reform in Colleges and Universities Affiliated to the Central Departments": in terms of the relationship between teaching and learning, we should establish the idea that students are the main body of teaching activities, and pay more attention to the cultivation of students' autonomous learning ability and innovative spirit; It is proposed that the reform of teaching is to change the teaching approach, let students become the main body of the classroom, fully mobilize the enthusiasm of students, improve their innovative consciousness, change the traditional teaching approach, reform the teaching approach, and widely carry out heuristic, discussion and participation teaching. Let the students' study actively to improve their autonomous learning ability and academic performance (Ministry of Education of the People's Republic of China, 2016).

In 2019, the Ministry of Education issued the "Opinions on Deepening the Reform of Undergraduate Education and Teaching and Comprehensively Improving the Quality of Talent Training", which clearly pointed out: to enhance the academic challenge, strengthen the quality requirements of talent training program, teaching process and teaching assessment, scientifically and reasonably set the total amount of credits and the number of courses, increase students' learning time, and improve their autonomous learning ability, Guide students to read

more, think deeply, ask questions and practice frequently (Ministry of Education of the People's Republic of China, 2019).

In August 2020, Zhoukou Normal University issued the "2020 Undergraduate Talent Training Program", which requires the graduates of network engineering major (Article 12) to have the awareness of autonomous learning and lifelong learning, and the ability to constantly learn and adapt to the rapid development of network technology. Credit requirements: students must complete 171 credits required by the professional talent training program and be allowed to graduate, which is a clear requirement for the academic performance of network engineering students (Zhoukou Normal University, 2020).

Zhoukou Normal University network engineering major is an undergraduate specialty set up by the school in 2007. As a network engineering major established by local colleges and Universities under the provincial level, it is a "Comprehensive Reform Pilot of Henan Province" and "Pilot Project Education Professional Certification Pilot". Talent training mode: "students as the main body, supported by school enterprise cooperation, international cooperation and production, learning and research cooperation, guided by advanced engineering education ideas, and with the cultivation of engineering application ability and innovation spirit as the core, the theory teaching, independent learning and practical teaching are integrated and promoted, and knowledge, ability and quality are comprehensively coordinated and developed".

The theoretical significance of this study is to determine the relationship between problem-based learning and students' learning achievement and students' satisfaction, that is, students' learning process under the guidance of problem-based learning. It has a positive driving relationship with students' learning achievement and students' satisfaction (Zhou et.al., 2019). In view of the above reasons, problem-based learning is a new teaching method in computer basic course. Whether PBL can also become a powerful tool in the teaching field of computer specialty is worth studying. (Zhou et.al., 2015) The basic course of information technology is developed with the learning method of problem-based learning teaching approach, to improve the learning effect of professional basic courses for undergraduates majoring in network engineering. This is also the process of opening new ideas for the exploration and research of information technology teaching. In addition, the results of this study will provide valuable enlightenment to the research of problem-based learning in the whole curriculum teaching.

2. RESEARCH OBJECTIVE

(1) To compare learning achievements on Fundamentals of Information Technology course of the first year students at Zhoukou Normal University before and after using problem-based learning.

(2) To study learning achievements on Fundamentals of Information Technology course of the first year students at Zhoukou Normal University before and after using problem-based learning with an expectation of passing with the criteria 70 percent.

(3) To study the student's satisfaction towards problem-based learning organization.

3. METHOD

3.1 Participants

The research population of this study was 399 students (5 classrooms) majoring in network engineering in Zhoukou Normal University, Henan Province, China. The sample of this study were 66 students (1 classroom), from Zhoukou Normal University and network engineering university which selected through cluster random sampling.

3.2 Research Instruments

Research instruments consisted of the lesson plan, problem-based learning pretest and posttest form, and the satisfaction questionnaire. Data were analyzed by mean, standard deviation, and t-test.

3.3 Data Collection

The following are the stages of data collection. The development methods of research tools are as follows:

3.3.1. The samples are given the pretest by measuring learning achievements with constructed instruments. The PBL test consists of 30 items of multiple-choice questions, each of which has four alternatives with one correct answer. The problem-based learning test items consisted of four types of cognitive domain: 1) knowledge, 2) comprehension, 3) application, and 4) analysis.

3.3.2. The samples are taught by using the problem-based learning, students' learning process includes three main stages: 1. Define problem in this stage, students define problems; 2. PBL task. In this stage, students analyze problems, determine further learning needs, guide themselves, collect additional information, review what they have learned, put forward solutions and solve problems together; 3. Evaluation. At this stage, teachers and students jointly evaluate the impact of problem-based learning process on students' autonomous learning ability and academic performance.

3.3.3. After finishing the instruction, the samples receive the posttest by using the same instrument which are used in the pretest.

3.3.4. Using the method of questionnaire, this research investigates the students' satisfaction with the sample: the questionnaire of problem-based learning teaching purpose of fundamentals of information technology course.

3.4 Data Analysis

In this study, data analyze according to the research objectives.

3.4.1 Compare the learning achievements before and after receiving the problem-based learning by using t-test for dependent sample.

3.4.2 Compare the learning achievement with the determined criteria set at 70 percent by using t-test for one sample.

3.4.3 Study the student's satisfaction on the problem-based learning by using arithmetic mean and standard deviation.

To analyze the problem-based learning pre-test and post-test, we tested 66 non sample students in Zhoukou Normal University, determined the difficulty index (P) of the problem-based learning pre-test and post-test, and analyzed the difficulty of the scores. The results show that the problem-based learning test difficulty index is between 0.25 and 0.35. For the calculation of the problem-based learning test reliability, Kuder Richardson's KR-20 formula was applied. The reliability of the PBL test was 0.81. The contents validity of the problem-based learning test was examined by three experts and had the IOC of 0.67-1.00. The contents validity of the lesson plan was examined by three experts and had the IOC of 0.67-1.00. The contents validity of the satisfaction form was also examined by three experts and possessed the IOC of 0.67-1.00. The statistics, mean and standard deviation, were employed to analyze the form to find the samples' levels of satisfaction towards problem-based learning organization.

4. RESULT

4.1 Learning achievement before and afterlearning organization

The table above indicates that the learning achievements of students after received the Problem-Based Learning Approach was significantly higher than before learning at the level .05 (Table 1).

Table 1 Comparing learning achievements before and after

Test	n	score	$\bar{x}$	S.D.	t	df	sig
Before	66	30	17.21	2.02	37.37	65	.00
After	66	30	26.62	1.97			

4.2 Learning achievement with the determined 70% of criteria

Table 2 indicates that the learning achievement of students was 89 percent that higher than the standard criteria of 70 percent with statistical significance at the level .05.

Table 2 The results of compare learning achievement with the determined criteria set at 70 percent

Test	n	score	$\bar{x}$	criteria	S.D.	t	sig
Learning achievement	66	30	26.62	70	2.00	23.23	.00

4.3 Student's satisfaction towards problem-based learning

The level of satisfaction is fluctuated and ranges high and highest levels, but it is mostly highest level. The item can be shown in Table 3.

Table 3 Student's satisfaction towards problem-based learning

Items	$\bar{x}$	S.D.	Levels of satisfaction
The formal difference between problem-based learning teaching approach and traditional teaching approach	5.00	0.00	Highest
Classroom atmosphere activity	5.00	0.00	Highest
Students fully express their views	5.00	0.00	Highest
Improve students' ability to solve problems	4.00	0.61	Highest
Improvement of students' learning enthusiasm	5.00	0.00	Highest
Improvement of students' innovative thinking ability	4.55	0.50	Highest
Classroom atmosphere created by problem-based learning teaching approach	4.05	0.64	Highest
Students' mastery of classroom knowledge of fundamentals of information technology course	5.00	0.00	Highest
Improve students' academic performance	5.00	0.00	Highest

The change of teachers' role in the classroom	4.50	0.66	Highest
Mutual help from team members	5.00	0.00	Highest
Group cooperation mode can better promote the mastery of personal classroom knowledge	5.00	0.00	Highest
Teaching effect of problem-based learning teaching approach in fundamentals of information technology course	4.55	0.79	Highest
Total	4.74	0.25	Highest

Table 3 indicates that the student's satisfaction towards problem-based learning organization after learning was ranked at the highest level ($\bar{x}$ = 4.74, S.D. = 0.25).

5. DISCUSSION

This paper studies the application of problem-based learning approach in the classroom of computer specialty in Zhoukou Normal University. By introducing problem-based learning approach into the classroom of "information technology foundation" of computer specialty course, this paper solves some existing problems, improves the teaching effect, and provides a certain reference for the future teaching reform. In the research process, students actively use their brains to think, search learning information and learning resources through various channels, analyze and screen, explore independently, and actively practice solving problems; in practice, students can skillfully apply the basic theories and basic concepts learned to the production of works; group cooperation also improves the ability of team cooperation. As scholars have said, the purpose of problem-based learning is to make students better participate in the classroom and become the main body of the classroom. By improving students' participation in the classroom, it can improve students' sense of achievement in the classroom, and then cultivate students' interest in learning (Pan, 2020).

Problem-based learning approach has achieved good results in this teaching practice. On the one hand, it is due to the nature of problem-based learning approach itself, on the other hand, it is also related to students' characteristics, teachers' style, harmony of class atmosphere, teaching objectives, class arrangement, etc. Therefore, when problem-based learning approach is applied to other majors and other courses, these factors should be fully considered (Ali, 2019; Wijnia et.al., 2019). This is also merging with the views of scholars: PBL is not a simple teaching method. PBL is a complex teaching method that needs to mobilize all elements of teaching. In the process of using it, it will glow with different brilliance according to different teachers, students, and teaching contents. (Liu, 2018).

The student's satisfaction towards problem-based learning after learning was ranked at the highest level ($\bar{x}$ = 4.74, S.D. = 0.25), and the samples' satisfaction with the formal difference between PBL teaching approach and traditional teaching approach, classroom atmosphere activity, students fully express their views, improvement of students' learning enthusiasm, students' mastery of classroom knowledge of fundamentals of information technology course, improve students' academic performance, mutual help from team members, and group cooperation mode can better promote the mastery of personal classroom knowledge were also found at highest level ($\bar{x}$ = 5.00, S.D. = 0.00). This is similar to the research results of the researcher who said that the samples were satisfied with the local innovation because it covered the needed contents, and was convenient to use (Garnjost & Lawter, 2019; Sonam & Pema, 2021).

Problem based learning was not designed to help instructors provide as much information to students. It was developed to help students improve problem solving skills and their involvement in real experiences in the form of simulations, and become student-focused learning. The problem-based learning model is more challenging because learning begins with a real problem encountered in work (Fidan & Tuncel, 2019; Pardimin et.al., 2019). Problem based learning could improve the ability of problem solving while learning outcomes indicate that students use their tacit knowledge for problem solving (Chamidy et.al., 2020).

6. CONCLUSION

For the problem, creating a situation is its fundamental condition. Teachers combine the actual situation of teaching content and objectives to create relevant learning situations of interest to students, so that they are willing to explore. For the curriculum, students are the main body, give full play to students' subjective initiative, make students diligent in thinking and willing to cooperate, enable them to actively connect thinking and knowledge, and improve their application ability, to improve students' ability to understand and deal with problems.

Group cooperation, creative design of works, group members actively discuss, learn from each other, cooperate to complete the work display, which plays a positive role in promoting students' academic performance. In the process of problem-based learning approach, teachers should pay attention to the problems of students in cooperative learning and solve them in time; Teachers should fully grasp the learning situation,

correctly guide students and deal with the relationship between teachers and students. Therefore, in problem-based learning teaching practice, students, teachers, and teaching environment should be fully considered to better improve students' academic performance and students' satisfaction.

7. RECOMMENDATION

Teachers should timely guide students to the problems encountered in the discussion process. After teaching, teachers should evaluate the whole process and give targeted guidance to the problems in the process. In the process of group discussion and achievement display, teachers should also encourage students to ask questions boldly, and let students dare to make their own suggestions in the whole teaching process. Therefore, we need to explore a set of problem-based learning approach that is more in line with the computer courses in colleges and universities in the application of this mode in combination with the characteristics of school students and the conditions of software and hardware facilities of the school itself.

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