STUDY OF PROBLEM-BASED LEARNING APPROACH FOR ENHANCING LEARNING ACHIEVEMENT AND STUDENTS' SATISFACTION AMONG THE FIRST YEAR STUDENTS ON FUNDAMENTALS OF INFORMATION TECHNOLOGY COURSE, ZHOUKOU NORMAL UNIVERSITY

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**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF EDUCATION
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UNDER THE ROYAL PATRONAGE PATHUM THANI
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การศึกษารูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐานเพื่อพัฒนาผลสัมฤทธิ์ทางการเรียนและ
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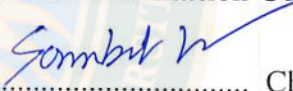
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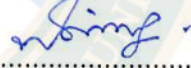
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บทคัดย่อ

การวิจัยนี้เป็นการวิจัยกึ่งทดลอง มีวัตถุประสงค์เพื่อ 1) เปรียบเทียบผลสัมฤทธิ์ทางการเรียนของนักศึกษาชั้นปีที่ 1 รายวิชาพื้นฐานเทคโนโลยีสารสนเทศ Zhoukou Normal University ก่อนและหลังจากการเรียนด้วยรูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐาน 2) เปรียบเทียบผลสัมฤทธิ์ทางการเรียนของนักศึกษาชั้นปีที่ 1 รายวิชาพื้นฐานเทคโนโลยีสารสนเทศ Zhoukou Normal University หลังจากการเรียนด้วยรูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐานที่เทียบกับเกณฑ์ 70% และ 3) ศึกษาความพึงพอใจของนักศึกษาที่เรียนด้วยรูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐาน กลุ่มตัวอย่างที่ใช้ ได้แก่ นักศึกษาจีน ชั้นปีที่ 1 สาขาวิศวกรรมเครือข่าย จาก Zhoukou Normal University ประเทศสาธารณรัฐประชาชนจีน จำนวน 66 คน ที่ได้มาโดยการสุ่มแบบแบ่งกลุ่ม เครื่องมือที่ใช้ในการวิจัยได้แก่ 1) แผนการจัดการเรียนรู้ 2) แบบทดสอบวัดผลสัมฤทธิ์ทางการเรียน และ 3) แบบสอบถามความพึงพอใจ วิเคราะห์ข้อมูลโดยใช้ค่าเฉลี่ย ค่าเบี่ยงเบนมาตรฐาน และการทดสอบค่าที

ผลการวิจัยพบว่า 1) หลังจากเรียนด้วยรูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐาน นักศึกษามีผลสัมฤทธิ์ทางการเรียนหลังเรียนสูงกว่าก่อนเรียนอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 2) ผลสัมฤทธิ์ทางการเรียนของนักศึกษาร้อยละ 89 สูงกว่าเกณฑ์ 70% อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 และ 3) นักศึกษามีความพึงพอใจต่อการเรียนด้วยรูปแบบนี้อยู่ในระดับระดับมากที่สุด

องค์ความรู้ที่ได้จากการวิจัยในครั้งนี้ คือ 1) ได้ขั้นตอนการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญที่ช่วยส่งเสริมพัฒนาความคิดขั้นสูง ความคิดริเริ่ม ความคิดแก้ปัญหา โดยมีการเชื่อมโยงความรู้ ความคิด เพื่อพัฒนาทักษะความสามารถในทางปฏิบัติ และการแก้ปัญหาที่เผชิญได้ 2) รูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐาน นักศึกษาจะได้รับการพัฒนาทั้งทางด้านวิชาการ ความรู้ ทักษะ คุณลักษณะ และความสามารถในการปฏิบัติ ด้วยกิจกรรมกลุ่มความร่วมมือ การออกแบบสร้างสรรค์ และการอภิปรายกลุ่ม ซึ่งกิจกรรมเหล่านี้จะเป็นสิ่งที่ช่วยส่งเสริมทางด้านวิชาการต่อไป

คำสำคัญ : รูปแบบการจัดการเรียนรู้ที่เน้นปัญหาเป็นฐาน ผลสัมฤทธิ์ทางการเรียน ความพึงพอใจของนักศึกษา

ABSTRACT

The current study was quasi-experimental research aiming to; 1) compare the learning achievements before and after implementing the Problem-Based Learning (PBL) Approach to the first-year students studying Fundamentals of Information Technology course from Zhoukou Normal University, 2) compare the learning achievements before and after implementing the Problem-Based Learning approach to the same group of students based on 70% criterion reference, and 3) explore the students' satisfaction towards the Problem-Based Learning approach. The research sample was 66 first-year Chinese students at the College of Network Engineering, Zhoukou Normal University, Republic of China. They were selected employing the cluster random sampling. The research instruments were, 1) lesson plans 2) an achievement test, and 3) a satisfaction questionnaire. The data were analyzed using mean, standard deviation, and t-test.

The research findings were revealed that: 1) After implementing PBL, students' learning achievement was higher with significance at the level .05. 2) The students' learning achievement was 89 percent that was higher than 70% criterion reference with statistical significance at the level .05. Additionally, 3) the students' satisfaction after implementing PBL was at the highest level.

The explicit knowledge gained from the research were as followed: 1) Learning processes that emphasize on learners, enhance higher thinking skill and problem-solving skills, help develop practical skills when encountering real-life problems. In addition, 2) Students can be developed academic performance and practical ability. The students can be effectively improved those skills through group cooperation, creative design of works and group discussion. There are positive roles in promoting students' academic performance.

Keywords: Problem-Based Learning Approach, Learning Achievement, Students' Satisfaction

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CHAPTER 1
INTRODUCTION

1.1 Introduction (Background of the study and statement of the problems)

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. (JG [2016] No.2 document, 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 learning achievements, Guide students to read more, think deeply, ask questions and practice frequently. (JG [2019] No. 6 document, 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 Undergraduate Talent Training Program, 2020)

Zhoukou Normal University network engineering major is a 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."

At present, the network engineering students use large class teaching, with an average of 80 students in each class. There are 399 students in the network engineering major (four grades + one grade from junior college to undergraduate). The current teaching approach is mainly traditional teaching approach, which does not reflect the student-centered teaching theory. Students' learning ability is difficult to develop, and students' learning achievements are not ideal.

According to the above situation, the researcher of this thesis interviewed students majoring in network engineering from March to April 2021 and found that students' common problems in professional course learning can be summarized as follows: 1. Students' classroom participation is low and there is no strong classroom expression; 2. Students' self-control ability is poor. Some students ignore classroom discipline and play mobile phones, sleep and read novels in class; 3. Students lack a sense of achievement and self-confidence in learning. In the face of slightly difficult learning problems, they will be afraid of difficulties and unwilling to learn. According to these practical problems reflected by students, the researcher of this thesis believes that in order to solve these problems, it is necessary to change the traditional teaching methods. A problem-based learning method PBL teaching approach is proposed as an alternative teaching method in the classroom of network engineering specialty.

PBL is a teaching approach developed as an alternative pedagogical approach for students of medicine at the McMaster Medical School in Canada (Barrows, 1986). The main goals of PBL are to prepare students to be self-directed, lifelong learners and practical problem solvers (Hung et al, 2003; Bridges and Hallinger, 1995; Wee and Kek, 2002). Empirical research supports the effectiveness of these goals (Donahue, 1999; De Grave et al.2001; Wood and Head, 2004; Ahlfeldt, 2004; Saengrutsamee, 2000; Chikotas, 2005). Thus, problem-based learning is the most eye-catching innovation in the field of professional education over the years (Li Xiaoxia, 2005), more supporters call it "PBL is an idea whose time is coming. (Yu Shengquan, 2000)"

With the update and development of computer network technology, PBL has been widely valued and recognized in computer-aided education all over the world. Document explores the design of PBL online information technology environment. This paper analyzes how to effectively carry out PBL activities in the information technology environment and what role students play in the activities. Document describes how to build PBL teaching into a hierarchical e-learning model. Document discusses how to carry out group cooperative learning in PBL mode under the environment of information technology.

This thesis studies the basic course of information technology, adopts the student-centered teaching method, teachers' guidance, and students' own thinking and construction of theoretical knowledge. Participate in theoretical and practical teaching through group learning mode or cooperative learning mode. At present, the ratio of theoretical class hours to practical class hours is 1:1. Students and teachers evaluate each other, realize the combination of theory and practice, cultivate students' critical thinking, improve students' information processing ability, help students build a learning platform from "learning" to "teaching", let students accumulate practical experience, become computer students who meet the national requirements, and lay a solid foundation for four-year professional courses. On the other hand, it is hoped that this research result can provide a reference for the revision of talent training program and the setting of syllabus for network engineering specialty and contribute a little to the curriculum reform of Zhoukou Normal University.

The significance of this study for theoretical research is to determine the relationship between PBL and students' learning achievements and students' satisfaction, that is, students' learning process under the guidance of PBL is their learning process, and there is a positive driving relationship between PBL and students' learning achievements and students' satisfaction.

The significance of this study for time research lies in: proposing and determining the specific implementation steps of PBL with the main goal of cultivating students' learning achievements. Through empirical research, this teaching approach can improve students' learning achievements, especially in the six aspects of determining learning objectives, making learning plans, collecting and identifying information, eliminating interference, insisting on learning and collective responsibility, improving learning enthusiasm, and promoting the learning and application of knowledge. At the same time, it improves the students' academic performance of fundamentals of information technology.

A fundamental of information technology is a public basic course for network engineering major, which has the characteristics of strong practicality and open content. Therefore, PBL teaching approach is just as customized for this course, which can reflect the advantages of this teaching approach in teaching: 1. Help students master information technology skills; 2. Help to improve students' learning achievements; 3. Help to improve students' satisfaction; 4. Help to cultivate students' ability of cooperation with others and develop students' ability of high-level thinking; Help college students better adapt to the society.

In view of the above reasons, PBL 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 Ruyan et. al., 2016) The basic course of information technology is developed with the learning method of PBL 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 PBL in the whole curriculum teaching.

1.2 Research Questions

1.2.1 How does the learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University before and after using Problem-Based Learning approach?

1.2.2 How does the learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University comparing with the determined criteria at 70 percent?

1.2.3 How does the student's satisfaction on the Problem-Based Learning approach after receiving the Problem-Based Learning approach?

1.3 Objective

1.3.1 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 approach.

1.3.2 To compare learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach with an expectation of passing with the criteria 70 percent.

1.3.3 To assess the student's satisfaction toward the Problem-Based Learning approach.

1.4 Hypothesis

1.4.1 The learning achievements posttest mean score on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University using Problem-Based Learning approach was higher than before pre-test score at .05.

1.4.2 The learning achievements posttest mean score on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach was higher than the criterion set at 70 percent.

1.5 Scope of the study

1.5.1 Population and sample

1.5.1.1 The research population of this study was 399 students (5 classrooms) majoring in network engineering in Zhoukou Normal University, Henan Province, China.

1.5.1.2 The sample of this study were 66 students (1 classroom), from Zhoukou Normal University and network engineering university which selected through cluster random sampling.

1.5.2 Variables

1.5.2.1 Independent variable is the Problem-Based Learning Approach.

1.5.2.2 Dependent variables are the learning achievements on Fundamentals of Information Technology course and student's satisfaction toward learning the Problem-Based Learning Approach.

1.5.3 Area of content "Fundamentals of Information Technology" course is a professional basic compulsory course for the first year of network engineering. The main purpose of this course is to enable students to comprehensively master the basic knowledge and operation of computer application in completing multiple specific tasks through task driven teaching approach, focus on cultivating students' practical operation ability, improve application skills, and cultivate students' consciousness and ability to analyze and solve practical problems by using computer, so as to make them become innovative and applied talents, Lay a foundation for the follow-up courses.

1.6 Conceptual framework

Independent variable   Dependent variable

| The Problem-Based Learning Approach | → | 1. learning achievements on Fundamentals of Information Technology course |
| | → | 2. students' satisfaction toward learning the Problem-Based Learning Approach |
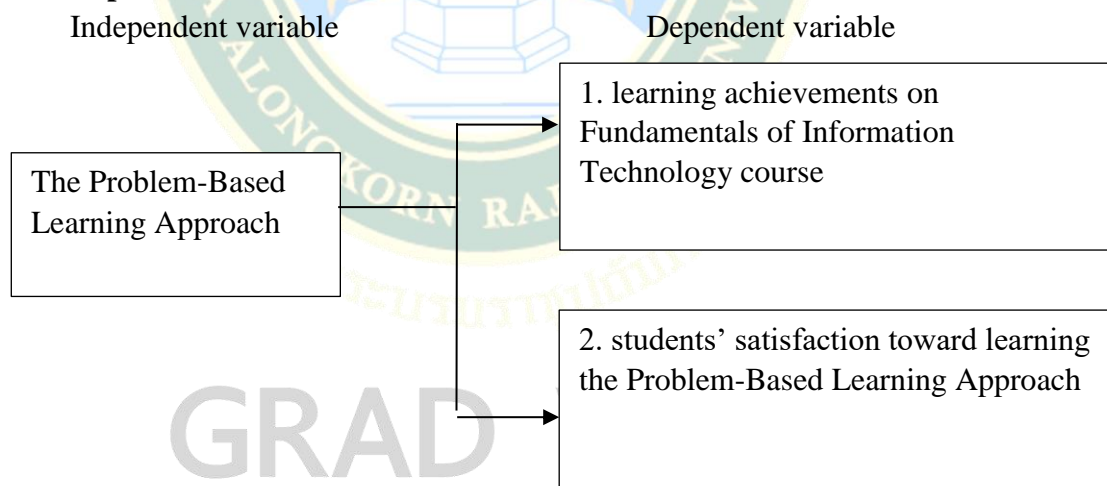
1.7 Operational Definition

Problem based learning approach refers to a kind of teaching approach which makes use of problem situation to urge students to seek solutions to problems. Based on PBL, students' learning process includes three main stages: 1. Define problem in this stage, students define problems. This stage includes selected items (discover problems) and draw up a plan (explore existing knowledge and make learning plans);

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. This stage includes activity exploration (put forward assumptions and possible mechanisms), production of works (identify learning problems and apply self-study) and achievement exchange (reassess and apply newly acquired knowledge); 3. Evaluation. At this stage, teachers and students jointly evaluate the impact of PBL process on students' learning achievement and students' satisfaction. This stage means: activity evaluation (assessment and reflective learning).

Learning achievements refers to the comprehensive achievements of the course "fundamentals of information technology", including students' computer literacy, basic computer skills, and practical ability of practical courses.

The fundamentals of information technology course using PBL refers to a three credit one semester professional foundation course in the College of network engineering, which is a compulsory course. The content is to enable students to fully master the basic knowledge and basic operation skills of computer application in completing several specific tasks. It is a basic computer course for the first-year students. The course is taught by problem-based learning approach. In the learning process, students can learn purposefully and meaningfully, and discuss possible solutions in cooperative groups.

The students refer to the first-year students majoring in network engineering of Zhoukou Normal University.

The students' satisfaction refers to first-year students' feelings or opinions toward a problem-based learning approach while taking the fundamentals of information technology course.

1.8 Practical Application

Problem-Based Learning approach is introduced into the common tool software classroom of computer professional courses, and the teaching effect is verified by setting up comparative experiments and questionnaires:

1. Studied the development history of Problem-Based Learning approach, read relevant literature, and sorted out the application fields of Problem-Based Learning approach.

2. Study the current teaching situation in the field of computer specialty courses in colleges and universities, issue learning questionnaires to students, preliminarily collect relevant data, analyze the data, and explore the problems existing in the professional teaching in this field and the feasibility analysis of PBL.

3. Make an in-depth analysis of the characteristics of the fundamentals of information technology course and design a complete PBL teaching process and comprehensive evaluation system with students as the main body and giving full play

to students' subjective initiative in combination with students' characteristics and various performances in the classroom.

       4. Compare and analyze the changes of students' classroom performance, group discussion and learning habits, learning methods and learning effects before and after the experiment, analyze the differences in students' learning achievements and students' satisfaction, and verify the effect of Problem-Based Learning approach in the application of computer professional courses.

CHAPTER 2
REVIEW OF LITERATURE

This chapter reviews literature related to the study. The major contents of the review involve 5 parts. There are as following:

2.1 Basic information (course)

2.2 Problem-Based Learning Approach

2.3 Learning achievements

2.4 Students' satisfaction

2.5 Related research

2.1 Basic information (course)

Through the approach of comparative experiment, this paper compares the influence of traditional teaching mode and PBL teaching approach on students' learning achievements, and analyzes the data through data analysis, questionnaire survey and class students' comprehensive learning situation.

Computer course: computer related courses in colleges and universities, this paper selects the basic course of Network Engineering College: Fundamentals of information technology.

This paper analyzes the application value of PBL target teaching mode in the basic course of information technology. Methods: the first-year students of network engineering major in Zhoukou Normal University were selected as the research group, and the teaching intervention measures were PBL teaching target teaching approach. The students' academic performance of theoretical knowledge, practical skills, and self-evaluation satisfaction before and after the problem-based learning approach were compared. The theoretical knowledge, practical skills, and self-evaluation satisfaction of PBL teaching approach are higher than those of traditional teaching approach, and the difference is significant. Conclusion: the application of PBL teaching approach in the basic course of information technology can not only effectively improve students' mastery of theoretical knowledge, but also improve the quality of teaching, and help to improve the level of computer practical operation skills.

Table 1 Course plan of computer application on "Fundamentals of Information Technology" course

Content of Courses	Class hours	Teaching Objectives and Requirements
1. basic application - making detailed list of water and electricity charges 1. Common terms in Excel 2010 2. Creating and saving workbooks 3. Data input, formula 4. Cell format setting and table beautification	4	1. The meaning of terms such as workbooks, worksheets, cells, ranges, etc. 2. The data input, especially the regular data input Approach 3. The basic operation of formatting worksheet, including font format, merge, alignment, row height and column width, border shading and automatic format 4. The skills of formula use and cell reference 5. Worksheet page setup
2. advanced application of Excel 1. Making the whole structure of worksheet 2. Function, chart, data validity 3. Sorting and screening 4. Classified summary 5. PivotTable report 6. PivotChart	4	1. Insert, move, copy, delete and rename the worksheet 2. Use of common functions (sum, average, min, Max, count, count if, SUMIF) 3. Database validity settings 4. Application of data statistics and analysis Approaches (chart, sorting, screening, classification and summary, PivotTable, PivotChart)
3. PowerPoint basic application -- making excellent class election presentation 1. Basic operation of presentation 2. Basic operation of slide 3. Slide design 4. Adding and editing common objects in slide 5. Slide show	2	1. The basic concepts of PowerPoint 2010, such as window composition, view mode, and placeholder 2. The basic operation of creating, saving, opening, and closing blank presentation, and the operation of selecting, creating, copying, moving, and deleting slides 3. The design of page setting, theme and background of the slide 4. The text, a variety of graphics and images, tables and charts, albums,

Table 1 (cont.)

Content of Courses	Class hours	Teaching Objectives and Requirements
		links and other common objects to add and edit 5. The settings of slide show
Chapter 4 PowerPoint advanced application -- making multimedia courseware presentation 1. Overall appearance design of slide 2. Add sound, add video 3. Slide animation effect settings 4. Slide switching effect settings 5. Advanced slide show 6. Recording slide narration	2	1. The basic concepts of PowerPoint 2010 Master, media, dynamic effects, rehearsal timing, etc. 2. The overall appearance design of slides using slide theme, master, header and footers 3. The insertion and setting of audio and video 4. The adding, setting, and copying of slide animation effect, and the setting of animation playing order 5. The setting of slide switching effect 6. The applicable occasions and specific usage of rehearsal timing 7. The applicable occasions and specific Approaches of recording slide narration

2.2 Problem-Based Learning Approach

Problem based learning (PBL) is a typical student-centered teaching approach, which puts learning in a complex and meaningful problem situation, allows students to solve problems in the learning process in the form of group cooperation, and learn the scientific knowledge hidden behind the problems, to promote the development of their autonomous learning and lifelong learning ability.

In PBL teaching approach, students have changed from passive receivers of knowledge to autonomous learners, collaborators, and researchers, and become the main body of this teaching mode. In this teaching mode, students should strive to change their roles, enhance their sense of participation, change their focus from theoretical learning to practical application of theory, and change their focus from listening to being good at communication, listening, and taking responsibility, so as to play a leading role in PBL teaching.

PBL is a new teaching approach which is in line with the current education reform. It emphasizes the integration of subjects and the cooperation between students. It advocates that student should take the initiative to explore in real situations, and cultivate students' ability to collect and process information, solve problems, and communicate and cooperate.

2.2.1 Definition and theoretical principles of problem-based learning approach

2.2.1.1 Definition of problem-based learning approach

PBL is a new teaching approach. The core concept and basic principle are the main purpose of problem learning. It guides students to learn relevant knowledge and improve their ability and skills from solving and learning the subject project problems. It is the construction of their own learning system through the production of the works. (Kirum et al., 2012)

PBL is a teaching approach which is closely related to real life and closely related to the content of the course, which can promote and provide learning experience.

The above definition of PBL is typical. The researcher of this thesis concludes that: (1) PBL can promote students' autonomous learning ability (2) PBL is to let students learn skills and improve their ability by solving practical problems. (Othman et al., 2010)

PBL is centered on the concepts and principles of learning and research disciplines and solves problems through students' participation in the investigation and research of learning, to construct their own knowledge system and can be applied to the real society. (Li Jiahou, 2011)

In conclusion, PBL is a approach that helps to connect teaching activities with problem based learning on problem situations. Students cooperate in learning, effectively manage the learned content and find possible solutions.

2.2.1.2 Theoretical principles of problem-based learning approach

1. Constructivist learning theory

The most important theoretical support of PBL teaching approach is constructivism learning theory. Construction refers to the process in which learners form and integrate their own knowledge and experience structure through mutual repetition and interaction between new and old knowledge and experience (Wu Qinglin, 2003). Constructivism is a structuralism developed based on Jean Piaget's theory. It is a part of cognitive theory and its main idea of knowing (Ding Jiayong, 2000). Constructivist learning theory holds that knowledge is constructed one by one by students in a specific situation, using the knowledge they have learned and the resources around them. Constructivism emphasizes that in the process of learning, students should focus on the active exploration and discovery of knowledge, and the construction of time and meaning of knowledge repeatedly (Ma Limei, 2014). In the process of cognition, students are the masters of activities, the active constructors of meaning, and teachers are the supervisors and guides of the process. In a specific

learning situation, students use their own learning knowledge to screen the collected information, select the knowledge that meets their needs for processing and construction, and finally obtain new knowledge while deepening the understanding of the original knowledge, to achieve a win-win situation.

PBL teaching approach emphasizes that students are the main body, and teachers are the guide of students' learning. Students are guided in a reasonable situation, based on problems, through group discussion and group cooperation, so that students can take advantage of all available learning resources to actively construct. This process fully reflects the active construction of students' meaning. Teachers only act as the supervisor and guide of students' meaning construction, which is in line with the constructivist learning theory.

2. Situational learning theory

Situational learning is a kind of learning method proposed by Professor Jean lave and independent researcher Etienne Wenger of the University of California, Berkeley around 1990. According to leave and Wenger, learning cannot be simply regarded as transferring abstract and contextualized knowledge from one person to another; Learning is a social process, in which knowledge is constructed by everyone; Such learning is always in a specific situation, infiltrating in a specific social and natural environment.

Situational learning is to create a real situation in the daily teaching process, so that students can learn in this situation. For learners, this is not only the process of building theoretical knowledge, but also the process of making learners practice in learning. The western scholar anancy, W.J.'s "situational learning guide" once proposed that situational learning is not only to establish a situation in the teaching process or use the content related to the situation to guide students' learning, but also to study how knowledge is generated in the teaching process and how to form the essence of knowledge (Clancey, 1995). The process of learning knowledge is in a specific situation and learning and cognition should be a part of the whole knowledge. Background helps to construct meaning and promote the learning of knowledge, skills, and experience. Therefore, background is not only the physical structure and conceptual structure of the problem, but also the social environment in which the intention and problem of the activity are embedded PBL teaching approach is to create a real problem situation, let students in the problem situation through group discussion and cooperative learning in the form of to find a way to solve the problem, in solving problems at the same time, improve students' ability to solve problems. So situational learning theory provides a solid theoretical basis for the implementation of PBL teaching approach in teaching (Li Liping, 2012). Situational learning theory has strong requirements for the authenticity of the situation, the participation of students, the guidance of teachers and the application of knowledge (Ma Dongyan, 2008). Situational learning theory emphasizes that students should be in a real situation, students can really participate in learning, teachers play a guiding role in this process,

and the knowledge that students eventually learn should be applied. In the process of learning, knowledge runs through the whole situation teaching. By creating a real situation, teachers let students participate in it, so that students can acquire knowledge through self-practice in the situation. In this process, teachers are only the guide and supervisor of students' learning, guiding students to actively construct knowledge; Students are the masters of the classroom, using all available learning resources around to think, explore, and ultimately acquire knowledge by solving problems (Wang Fengzhao, 2020).

      3. Cooperative learning theory

      Cooperative learning is a kind of creative and effective teaching theory and strategy which emerged in the United States in the early 1970s and made substantial progress from the mid-1970s to the mid-1980s. Because of its remarkable effect in improving the social and psychological atmosphere in the classroom, improving students' academic performance in a large area, and promoting students to form good non cognitive quality, it soon attracted the attention of all countries in the world, and became one of the mainstream teaching theories and strategies, and was praised as "the most important and successful teaching reform in the past decade". Since the end of 1980s and the beginning of 1990s, the research and experiment of cooperative learning have appeared in China and achieved good results. Cooperative learning mainly uses the way that students communicate with each other and learn together to deepen the understanding and cognition of knowledge, usually in the form of grouping students (Huang Junqiang, 2012). Cooperative learning theory requires students to be divided into several groups, group members work with each other, cooperate with each other, help each other, learn from each other, discuss with each other, and master the learning content arranged by teachers. Take the group as the unit, the group members have clear division of labor, learn together, and make progress together (Elevens&Melon, 2000). Cooperative learning theory mainly includes the following five characteristics: First, students must have the same learning purpose and task; Second, members of the group should communicate, discuss, and help each other; Third, every member of the team must participate in it and complete their own tasks; Fourth, group members should communicate effectively; Fifth, group members should reflect on themselves and summarize the group learning results. It can be seen from the above that in the process of cooperative learning theory teaching, students are the masters of the classroom, learning to cooperate with each other and jointly complete the learning goal is the main form of teaching, in this process, the teacher is only the guide and supervisor of students' learning.

      The problem-based learning approach mainly relies on the teaching approach of group cooperation. Teachers divide students with different abilities into several groups reasonably. Group members divide the learning content assigned by teachers into different groups, and solve the problems encountered in the learning process through mutual discussion and help, to improve students' cooperative ability.

Therefore, cooperative learning theory provides a theoretical basis for the smooth implementation of PBL teaching approach.

2.2.2 Teaching process of Problem-Based Learning Approach

PBL is a new teaching approach. This learning approach emphasizes the students themselves as the center and emphasizes the cooperative learning of each member of the learning group. Generally, its process can be divided into six steps: selecting project, making plan, activity exploration, work production, achievement exchange and activity evaluation (Tang Ying, 2010). See Figure 1 for details
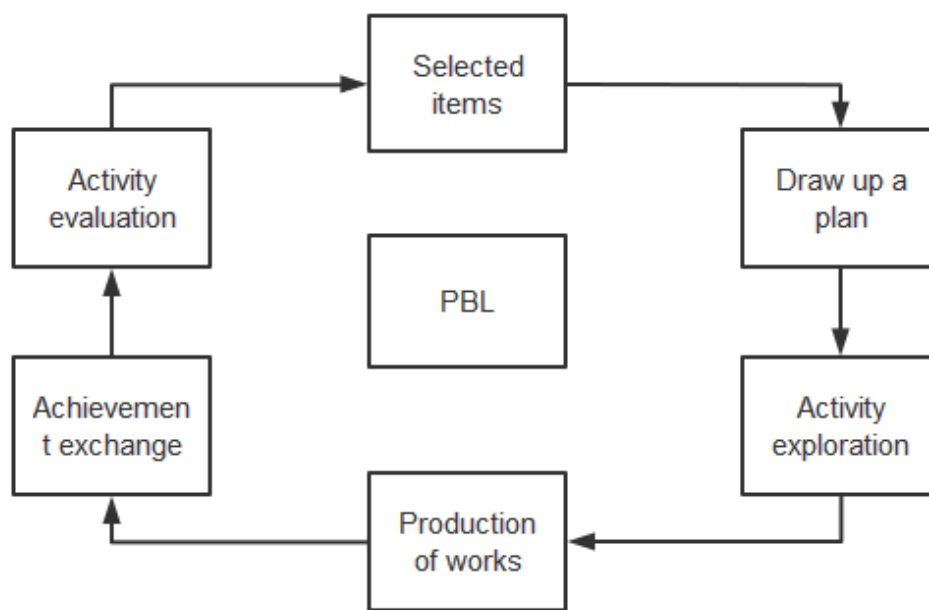
Figure 1 PBL process
Source: Tang Ying. (2010). Design and application of PBL model in University
Information Technology Course, 12

1. Selected items

In PBL teaching approach, the most important task is to select the item. The selection process should be determined according to the students' interests. The selected items should be related to the daily life of students so that students can raise some meaningful related problems. PBL teaching approach should fully consider the students' existing knowledge level and ability level, social experience, and whether students can achieve the expected goal, whether they can solve all kinds of problems in the item.

Teacher's activities: (1) provide learning content: teachers provide some learning content related items that meet students' knowledge level and social experience for students to choose; (2) Group the students. Because PBL teaching approach teaching pays attention to the way of team cooperation to learn, so the students through the way of group cooperative learning.

Students' activities: (1) primary project: students study the problems related to the project, to gain some perceptual knowledge, such as designing and making advertising bookmarks, tickets to scenic spots, etc.; (2) Project discussion: through communication and discussion, the team members express their opinions on the selection of projects and find the direction and problems worthy of study; (3) Project determination: PBL teaching approach adopts group learning approach. In general, a group undertakes a project together. Therefore, for the selection of the project of this group, the group members should also conduct full exchange and discussion. Each member should put forward their own ideas and suggestions and evaluate the opinions of other members. After a heated discussion, the project can be determined only after the group members agree.

2. Draw up a plan

The contents of the plan are the detailed process of learning time and the specific plan of activities.

The detailed plan can help students master the progress of the whole project activity, at the same time, it is also helpful for teachers to guide and evaluate the whole project learning and adjust the project content appropriately.

Teacher's activities: evaluate and review the project activity plan made by students and make some necessary modifications.

Student's activities: making time plan, determining action plan, reasonably dividing tasks, etc.

3. Activity exploration

This stage is especially important and is the core part of the whole project activities. Most of the students' knowledge and skills are learned in this stage. Activity exploration usually includes field investigation and investigation of the relevant factors involved in the necessary objects. During the investigation and research, students record the content of project activities and their feelings and ideas about the activities. Firstly, they propose the assumption of solving problems, then collect information with certain scientific and technological tools and different research approach, and then process the collected information, and verify the hypothesis put forward, The final solution to the problem or activity results.

Teachers' activities: (1) to effectively monitor students' inquiry process (2) Activity guidance.

Students' activities: (1) communication activity plan (2) Data collection and inquiry (3) Record the progress of the activity (4) The data were analyzed and processed.

4. Production of works

Production of works is a typical feature of PBL teaching approach which is different from other traditional teaching modes. In fact, the production of works and the exploration of activities sometimes blend. Here, for the convenience of discussion, we will distinguish them. In the production process, students use the knowledge and skills acquired in the learning process to complete the work. The forms of the works are various, such as painting, picture, video, recording, PPT, investigation report, physical model, website, and drama sketch performance. Through these works, the learning group describes the project they have studied and shows their research results to reflect the knowledge and skills they have learned in the project activities.

Teachers' activities: (1) To supervise the progress of project activities; (2) Encourage and guide students.

Students' activities: (1) Receive the teacher's guidance and revise it; (2) Making works.

5. Achievement exchange

After the production of students' works, each learning group should exchange their experience in the learning process. The forms of exchange of achievements can also be varied, such as holding reports, exhibitions, debates, competitions, etc.

Teacher's activities: (1) organize and hold achievement press conference, works exhibition, literature, and art performance, etc.; (2) Some excellent works and materials will be organized into demonstration cases to provide models for the future; (3) Give students spiritual or material rewards to enhance their sense of success and stimulate their enthusiasm for further activities.

6. Activity evaluation

Another important difference between PBL teaching approach and traditional teaching approach is learning evaluation. In PBL, a good combination of quantitative evaluation and qualitative evaluation, self-evaluation and others' evaluation, personal evaluation and group evaluation, formative evaluation and summative evaluation is really achieved.

The content of the evaluation includes topic selection, activity plan, schedule, result expression, students' performance in group learning and achievement display, etc. The evaluation of the process includes a variety of original data, questionnaires, interview forms, experimental records, activity records, learning experience, etc. the evaluation of the results mainly considers the degree of students' mastery of knowledge and skills.

Teachers' activities: evaluate students' learning process and learning results. The main contents of evaluation include original data, questionnaire, interview form, learning process, activity record form, final work, etc.

Students' activities: (1) Mutual evaluation among students; (2) Self-evaluation and reflection.

2.2.3 Role of teacher and learner in Problem-Based Learning Approach

The teaching process of traditional teaching mode emphasizes the teacher's dominant position, and students can only passively accept knowledge. This kind of "cramming" teaching approach limits the way for students to obtain knowledge. In the process of class, students can only learn what the teacher teaches, and what they learn is passive learning, which seriously restricts the students' way of thinking and limits the improvement of students' personal ability. But PBL teaching approach teaching emphasizes that students are the main body. Teachers are only the guide and supervisor of students' learning in the classroom. Taking students as the center can better let students express their ideas. Teachers only play the role of guidance. In the process of learning, students and teachers are in an equal position. In the teaching process of PBL teaching approach, students can constantly enhance their enthusiasm for learning and increase their interest in learning.

2.2.4 PBL Process

PBL are 3 steps: 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 PBL process on students' learning ability and learning achievements.
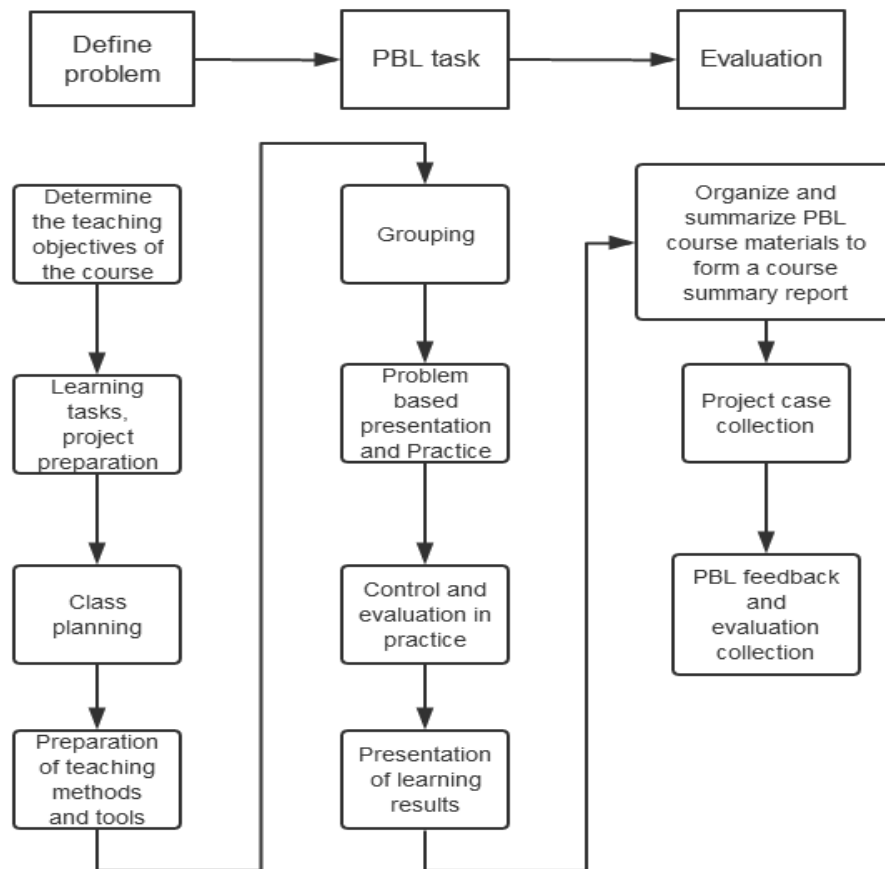
Figure 2 PBL implementation process
Source: Hui Ke (2020)

In this study, PBL teaching approach is combined with traditional teaching to carry out experimental research and compare from various aspects to analyze the influence of students' learning interest and operation skills. PBL is introduced into the teaching of fundamentals of information technology as a means to guide students to use their brains, improve their ability of learning and improve their ability of operation In the process of hands-on, "learning technology" and "using technology" are integrated together, actively learning knowledge and skills, understand and use the process and method of information technology to solve problems.

Through the application in practice, the researcher of this thesis thinks that PBL provides a reference for the curriculum reform of fundamentals of information technology and opens up a new idea for the use of PBL teaching approach in the teaching of computer courses in colleges and universities.

2.3 Learning achievements

2.3.1 Definition of Learning achievements

The dependent variable 1 of this paper is: learning achievements, and the theory is: the learning achievements of the fundamentals of information technology course in Zhoukou Normal University.

The Great Dictionary of education interprets learning achievement as "schoolwork of the school" (Gu Mingyuan, 1998), which specifically refers to the learning tasks specified by the school, with phased characteristics. Achievement refers to completing and reaching a certain level. In the English Chinese Dictionary of education, "achievement" refers to the actual level that students can achieve after a series of education or training, and achievement refers to the test results of students in a subject or the whole course (Wei Daozhi and LV Da, 2004). However, some scholars believe that it is pure achievement. It is precisely because scholars have different understandings and different definitions of learning achievements.

The academic understanding of the connotation of learning achievement can be roughly divided into broad sense and narrow sense. The broad sense of learning achievement refers to the improvement of students' comprehensive quality during school. For example, Cui Yunfei (2008) and other scholars define learning achievement as the result of students' learning. Astin (2010) believes that learning achievement includes cognitive and non-cognitive achievements, psychological and behavioral achievements, etc. Bloom (2014) believes that learning achievements mainly include knowledge, values and attitudes, skills or appropriate behaviors [Park et al., 2014]. The National Leadership Committee of American general education and American commitment believes that students' learning achievement can not only mean the admission rate and the proportion of degrees, as in the past. The more important question is "whether students can master the knowledge and ability essential for their future life, work and civic activities." Cai Wenbo and Cao Xu (2019) believe that learning achievement not only refers to students' academic achievement in school, but also includes the improvement of their knowledge, ability and literacy. In a narrow sense, learning achievements refers to the evaluation results obtained by students through examination at a certain learning stage. In the empirical research on learning achievement, a considerable number of researchers adopt such definitions of learning achievement, especially in the empirical research on primary and secondary school students, researchers often define learning achievement as students' test scores. For example, Chen Lihua (2015), Li Dongping (2016), Li Yu (2018) and others define learning achievement as learners' teaching evaluation scores in school, Test results at the end of the schedule.

To sum up, the researcher of this thesis believes that learning achievements in a broad sense refers to the progress and improvement of knowledge, ability and quality obtained by college students in a specific learning period. It is a multi-dimensional concept with phased, comprehensive, and educational attributes.

Learning achievements in a narrow sense mainly refers to the course examination results of college students during their study.

2.3.2 The importance of Learning achievements

Learning achievements should have three important attributes: phased, comprehensive and educational. Among them, periodicity means that students' learning achievements are different in different periods; Comprehensiveness means that students' learning achievement is a multi-element concept that includes knowledge, ability, emotion, achievement and so on; Education means that students' growth and harvest should be obtained through education during school, rather than a talent and ability unrelated to academic or school education (Liu Na, 2021).

Learning achievements is a standard to measure learning. For college students, the combination of professional theory and practice is obviously very important, which requires a solid theoretical basis. For the computer course with strong operability, it needs more practice, more creation, and constantly improve their professional ability and professional level. These all need to have an evaluation standard, that is learning achievements.

2.3.3 Components of Learning achievements

According to Bloom's taxonomy in 1956: 1. Knowledge: Remembering or retrieving previously learned material; 2. Comprehension: The ability to grasp or construct meaning from material; 3. Application: The ability to use learned material, or to implement material in new and concrete situations; 4. Analysis: The ability to break down or distinguish the parts of material into its components so that its organizational structure may be better understood; 5. Synthesis: The ability to put parts together to form a coherent or unique new whole; 6. Evaluation: The ability to judge, check, and even critique the value of material for a given purpose.

The composition of learning achievements follows Bloom's taxonomy psychomotor domain, including:

1. Class practice results.

The assignments and tasks in the theoretical class are considered and answered by the students themselves. The teacher checks the results of the exercises submitted by the students and gives them feedback.

2. Achievements of group cooperation projects.

Group cooperative learning is a creative teaching theory and strategy widely used in many countries in the world. Because of its remarkable effect, it is regarded as the most important and successful teaching reform in recent ten years. The specific forms and names of group cooperative learning in different countries are different. For example, it is called "cooperative learning" in European and American countries and "cooperative education" in the former Soviet Union.

Group cooperative learning is a kind of teaching activity that takes cooperative learning group as the basic form, systematically uses the interaction between dynamic

factors in teaching, promotes students' learning, and takes group performance as the evaluation standard to achieve teaching objectives together.

Professional probation results of fundamentals of information technology course.

Professional probation is a very important part of computer professional courses. Every student should skillfully use theoretical knowledge to practice. Professional internship is measured by the performance evaluation form of professional internship.

Computer operation results.

Computer operation is a weekly practice class, which will be carried out in the computer room. Each class focuses on the content of this week's theory class, allowing students to practice or group operation. Every time the computer is operated, the teacher will evaluate the students' works.

Course design results.

The course design is a two-week assignment for the fundamentals of information technology course. Systematic design scheme and design content are required. Investigate the students' overall ability to use the course.

Final examination results.

The final examination is a paper examination. At the end of the term, the total score of the paper is 100. The content of the test paper is divided into fill in the blanks, multiple-choice questions, judgment questions, question and answer questions and calculation questions. Comprehensive investigation of students' mastery of the course content.

2.3.4 Development/ construct the Learning achievements

In learning, the brain plays a huge role. Using the right brain in learning can not only improve memory and understanding, but also relieve the learning burden of the left brain with the physiological conditions of the right brain, which is of great significance to achieve happy learning and easy learning.

In learning, we should learn to subdivide the time by stages, and what we should do in each time can be long-term or short-term. The process of planning time is also the process of determining learning objectives.

The research results of Zhang Hongru and Shen liemin show that learning motivation can positively predict metacognition, learning motivation can positively predict learning achievement, and metacognition can positively predict learning achievement (Zhang Hongru, 2005). When studying the influencing factors of learning achievement, Zhang Xiang and Zhao Bihua found that favorable capital often helps students achieve higher learning achievement (Zhang Xiang & Zhao Bihua, 2012). Yu Haiqin and Li Chen found that the learning environment can affect the learning achievement and the learning style plays an intermediary role in the comparison of the learning achievements of the students in the experimental class and the ordinary class (Yu Haiqin et al., 2013). From the perspective of psychology, Li

Xianyin studied the factors affecting students' learning achievement and confirmed that gender, student cadre status and family location have a significant impact on students' cognitive ability, communication ability, self-management ability and interpersonal communication ability (Li Xianyin et al., 2016). Sun Jie used a combination of quantitative and qualitative methods to explore the impact of Higher Vocational Students' learning investment on learning achievement, analyzed it from the aspects of students, teachers and courses, and put forward countermeasures to improve academic quality (Sun Jie,2019). The results of Lin Jian's research show that the higher the students' internal motivation and good learning strategies are conducive to the improvement of learning achievement (Jiang Yan, 2014).

To sum up, the subject areas involved in learning achievement are mainly concentrated in psychology, pedagogy, sociology, etc. most scholars study primary and secondary school students, relatively less research on college students, and less research on network engineering students. Therefore, the research on the learning achievement of network engineering undergraduates needs to be further deepened.

2.3.5 Measurement and evaluation of Learning achievements

In the 1950s, the learning evaluation methods of students have appeared in western countries, among which the most representative is the national assessment of educational progress (NAEP) in the United States; and trends in International Mathematics and science study (TIMSS). In China, the rating model belonging to China first appeared in public in 2006. The Program for International Student Assessment (PISA) has aroused great repercussions once it appeared. Its evaluation is not for an individual student, but for the whole student group. The significance of Pisa is that it is the first international student achievement comparison project participated by China (Liu Xiaoqing, 2013)

In academic circles, the measurement of learning achievement is usually divided into the following two types: the first type is to measure students' examination results. For university students, they often use their compulsory course scores or all subjects plus moral education and practice scores. The second is the comprehensive evaluation structure different from the performance. The most common scale in China is the scale compiled by Wang Yanfei in 2002 (Wang Yanfei, 2002).

This research draws lessons from foreign student evaluation projects such as PISA and TMSS and evaluates the research samples on the basis of relevant research.

2.4 Students' satisfaction

2.4.1 Definition of Students' satisfaction

The dependent variable 2 of this paper is: students' satisfaction, and the theory is: The formulation of "satisfaction" comes from the concept and concept of American customer satisfaction. Customer satisfaction theory has become an important theoretical basis for learning satisfaction research. More and more researchers begin

to put "satisfaction" into the field of educational research. The research on learning satisfaction in China's educational circles is probably in the early 21st century. Satisfaction is a psychological state of one's subjective evaluation. It is a psychological state that changes with the satisfaction of learning needs produced by scholars in the process of learning. The more satisfied the learning needs are, the higher the satisfaction is (Tian Han, 2021).

Learner satisfaction is increasingly regarded as an important standard to measure teaching methods and teaching effects. Fang Baojun, a scholar, combined with relevant research results at home and abroad, tries to define students' teaching satisfaction. He believes that the so-called students' teaching satisfaction refers to the feeling formed by comparing the students' perception effect of the learning process with their expectation of the school. Jiang Zhihui and other scholars believe that learner satisfaction is the concrete embodiment of satisfaction in the learning field. From the perspective of cognition, it can be regarded as all the experiences provided by learners for learning providers (including learning content, learning objectives A subjective psychological state formed by comparing the expected effect of learning environment and learning methods with the actual perceptual effect (cognitive and emotional aspects). It is a psychological reaction for learners to feel that the learning experience such as education and teaching effect, teaching quality and teaching environment meet their own needs in the learning process. From the perspective of emotion, learner satisfaction is learners' pleasant feeling or attitude towards learning activities, and learners' happy feeling or positive attitude is "satisfaction", which can be used to explain the results of learners' learning (Jiang Zhihui et al. 2017). Scholar Xu Ke defines learning satisfaction as: when learners accept learning, they evaluate the satisfaction of teaching mode, learning environment, course content and learning environment, and evaluate the satisfaction of the overall learning state and learning effect (Xu Ke, 2018).

To sum up, the researcher of this thesis believes that students' satisfaction is a psychological state whether their expectations and needs are met in the learning process of PBL approach. The higher their expectations and needs, the higher their satisfaction is, on the contrary. The satisfaction of students with PBL approach studied in this paper refers to the satisfaction evaluation of freshmen majoring in network engineering on teaching methods, teaching modes, teaching effects, teachers and learners, and the score of their own satisfaction with the time arrangement, effects and methods of PBL teaching methods.

2.4.2 The importance of Students' satisfaction

1. Theoretical level

Students' satisfaction can be used as an index for the comprehensive evaluation of various elements of information technology basic course teaching by students who have not been evaluated. Therefore, the research about students' satisfaction of fundamentals of information technology course using PBL approach

can not only effectively evaluate the teaching methods and teaching quality, but also innovate the evaluation method of fundamentals of information technology course.

2. Realistic level

The research on students' satisfaction of fundamentals of information technology course can improve the timeliness of information technology theory course. Through the investigation and Research on University Students' satisfaction with PBL approach, we can better find the impact of new teaching methods on information technology basic courses, increase students' sense of self-efficacy, and better complete the teaching objectives of information technology basic courses. In addition, the survey of University Students' satisfaction can also fully mobilize students' enthusiasm and form a good atmosphere of teacher-student interaction and mutual benefit in the implementation of PBL approach.

2.4.3 Components of Students' satisfaction

"Fundamentals of information technology" is a computer basic course in higher education. It undertakes the educational task of computer basic courses for university students and plays a basic role in the construction of university students' professional knowledge. Therefore, when evaluating the teaching effect of information technology course under the new teaching method, we should pay attention to the index of students' satisfaction. Through the investigation and Research on students' satisfaction, we can evaluate the factors of teaching process and its design, provide the basis for teaching reform and innovation, and play a very important role in improving the teaching quality of fundamentals of information technology course.

The constituent elements of PBL teaching evaluation of students' satisfaction are learning ability, social ability, learning attitude and achievement display.

Learning ability mainly includes: 1. Whether students have the ability to collect and sort out data in various ways; 2. Whether students have the ability to formulate assumptions; 3. The content shared by students is correct and contributes to the group; 4. The content shared by students is extensive or professional.

Social ability mainly includes: 1. Whether the oral expression ability is good (can speak clearly and indicate the key points); 2. Whether students can actively participate in activities; 3. Whether students can deal with conflicts and objections; 4. Whether students can discuss problems with group members.

Learning attitude mainly includes: 1. Whether they have the ability of self-learning; 2. Whether the students have a correct attitude and take the initiative.

The achievement display mainly includes: 1. Whether the scheme is reasonable and effective, the content is complete, creative, and feasible, and the achievement layout is reasonable and clear; 2. Whether the contents of the team achievements, the completed process and the division of labor of each person can be accurately explained during the display process.

2.4.4 Development/ construct the students' satisfaction

In this study, the questionnaire of students' satisfaction with the basic information technology curriculum using PBL method is set up as the following parts: guidance, students' own situation, curriculum and classroom situation, teachers and schools, and the expression of curriculum satisfaction and expectation.

The setting of students' own situation, curriculum and classroom situation, teachers and schools can not only have an overall understanding of the basic situation of the tested students, but also facilitate the comparison of different students.

The main part of the questionnaire draws lessons from the practice of "University Students' satisfaction scale" in the United States, and sets up two dimensions, namely satisfaction and expectation. Such a two-dimensional scale can not only evaluate students' satisfaction, but also evaluate students' expectations, that is, students' recognition and importance of PBL teaching. Through the comprehensive consideration of satisfaction and expectation, we can not only know the students' actual feelings about the application of PBL approach in the basic course of information technology, but also divide the measurement indicators into four categories according to the different scores of the importance of satisfaction: high expectation - high satisfaction; Low expectation - high satisfaction; High expectation - low satisfaction; Low expectations - low satisfaction. We can improve the satisfaction of information technology basic courses according to different types. In the specific scores of the two dimensions, likert scale is used to prepare. The satisfaction of each topic ranges from "1 = very dissatisfied" to "5 = very satisfied", and the expected value of each topic ranges from "1 = very unimportant" to "5 = very important". There are five grades to indicate the attitude and strength of students.

The last part of the questionnaire is an open topic, which can supplement the questions that the questionnaire did not expect but the students are willing to discuss. Some students will also put forward their own suggestions to improve the course satisfaction here.

2.4.5 Measurement and evaluation of Students' satisfaction

The research on students' learning satisfaction in China began in the 1990s. Cai Lifeng, a scholar, first put forward the concept of students' teaching satisfaction and applied it to the field of undergraduate teaching in colleges and universities. He believes that the satisfaction of undergraduate teaching should be evaluated and measured from three aspects: Students' attitude, needs and expectations (Cai Lifeng & Liang Hongkun, 2007).

In this paper, the measurement and evaluation of students' satisfaction can be described from the following aspects:

University Students' own factors: University Students' gender, learning initiative and learning attitude will have an impact on satisfaction. Correct their learning attitude by changing college students' views on the curriculum. University students who actively go to class, actively participate in class and spontaneously study

after class for a long time will have higher expectations and satisfaction. The more positive their attitude is, the higher their satisfaction and expectation will be. Teacher factors: Teachers' teaching attitudes and teaching methods will have an impact on expectations.

Therefore, the measurement of students' satisfaction should integrate many factors, so that the evaluation results are more convincing and valuable.

The forms related to the evaluation of this study are: PBL teaching evaluation form, PBL rating scale, Interview form of satisfaction with PBL approach of fundamentals of information technology course, Questionnaire on students' satisfaction in PBL teaching of fundamentals of information technology course, PBL student self-assessment and mutual assessment form.

2.5 Related research

Sheeba Sardar Ali (2019)'s research findings are: Problem-based learning is a teaching Approach in which students learn through the complex and open ended problems. These problems are real world problems and are used to encourage students' learning through principles and concept. PBL is both a teaching Approach and approach to the curriculum. It can develop critical thinking skill, problem solving abilities, communication skills and lifelong learning. The purpose of this study is to give the general idea of PBL in the context of language learning, as PBL has expanded in the areas of law, education, economics, business, social studies, and engineering. It encourages students to develop skills that can be useful for their future and in practical life within a team environment. For the language classroom in Arab countries, where English is spoken as a foreign language PBL can be very useful. Trained teachers can design problems to meet the needs of the learners, that can be useful to improve English practically in social context.

Jin Zeguo (2020)'s research finding is: PBL teaching design point of view combined with high school information technology teaching content, design specific teaching cases and implementation process, and statistical analysis of experimental data, verify the teaching effect of PBL teaching in high school information technology course and the feasibility and effectiveness of question answering system.

Tang Ying (2010) investigated the effects of PBL on University Information Technology Course. PBL teaching breaks the original teaching mode. The content of project-based learning comes from real life, and knowledge learning is vividly displayed in front of students. The projects that teachers guide students to choose to provide a platform for students to show themselves, and students' various abilities have been improved and developed. The work report improves students' personal ability and communication ability and enhances their ability to cooperate with others.

Pan Min (2020) investigated the effects of PBL on Computer Courses-Taking common software application courses. Through a comprehensive analysis of the

performance of secondary vocational students in the classroom and the characteristics of PBL teaching Approach, this paper designs a set of student-centered teaching process to give full play to students' subjective initiative and gives a complete teaching process for a chapter. After the experiment, it is found that after a period of study, the two classes with no significant difference begin to show more significant differences, including the results of the experimental class after PBL teaching Approach are significantly improved compared with the control class, and the experimental class is also better than the control class in passing rate and excellent rate.

Wang Fengzhao (2020)'s research is: The application of PBL teaching mode in dragon dance teaching significantly improves students' interest in dragon dance learning, and effectively improves students' love for dragon dance; PBL is better than the traditional teaching mode in improving the students' dragon dance. The students' Dragon Dance posture is correct, the shape of the dragon is fuller, the technical Approach is reasonable, and the walking is standard.

Brian R. Belland, D. Mark Weiss & Nam Ju Kim (2020) investigated the effects of students' agentic responses to modeling during problem-based learning. Strong information literacy, collaboration, and argumentation skills are essential to success in problem-based learning (PBL), and computer-based scaffolding plays a key role in helping students enhance these skills. As students search for information, identify root causes, and propose problem solutions, they are faced with choosing among alternatives that result in enhanced or diminished skill development. In this qualitative study, we use the agentic perspective of Bandura's social cognitive theory to examine how students' choices illuminate their priorities, values, and perspectives with respect to PBL inquiry. Results indicate that when seeking evidence to support claims in a PBL setting, given the choice between teacher-provided resources and their own research, students choose teacher-provided resources. This supports Barrows' original assertion about PBL that students are more likely to develop important skills like information literacy, self-directed learning, and problem solving when instructors refrain from providing domain specific knowledge prior to PBL activities.

2.6 Chapter summary

The literature review clarifies the learning achievements related to problem-based learning (PBL), basic curriculum research of computer specialty and students' satisfaction with relevant teaching methods.

PBL is a teaching approach based on problem situation. The main goal of PBL is to improve process skills and subject knowledge. In process skills, problem-solving skills are usually the focus of any problem-based course. Research strongly supports PBL to produce effective problem solvers. Students who have experienced PBL

usually have a positive attitude towards PBL. In addition, PBL is found to be beneficial to the practical ability of computer majors, because it pays more attention to the cultivation of students' operational ability, so that students can improve their professional knowledge and practical ability at the same time.

The topics of the literature review cover the outcomes of learning achievements and students' satisfaction.

This review shows that college students' own factors: College Students' gender, learning initiative and learning attitude will have an impact on students' satisfaction.

The theory and Research on PBL support the teaching process of this study. The literature review of curriculum development forms a research framework. A review of learning outcomes helps to shape the research design and provides guidelines for data collection. Figure 3 shows the research framework. The next chapter will introduce the research methods.
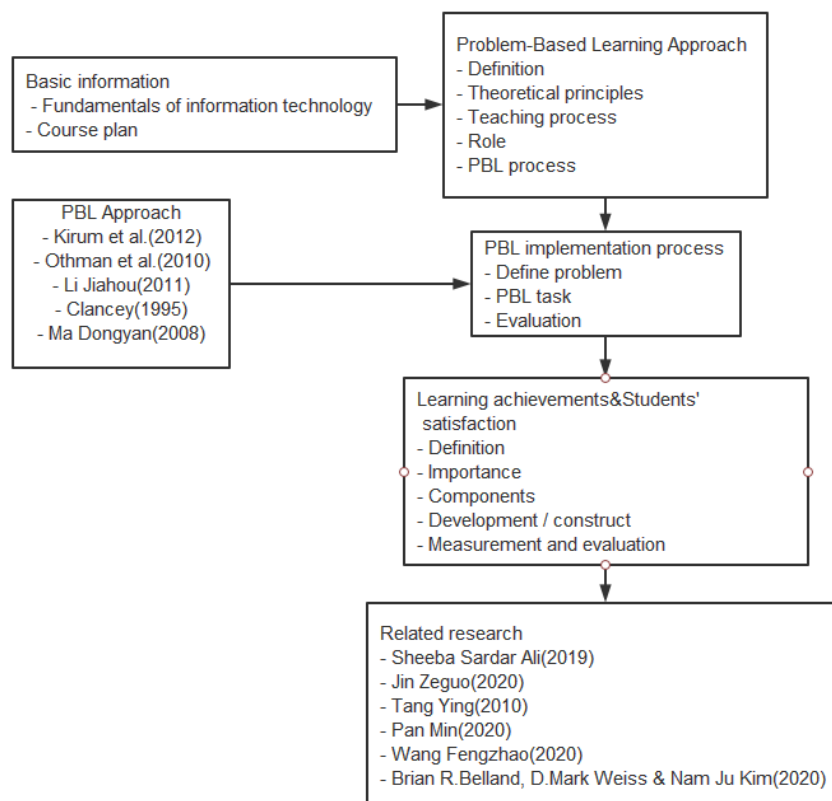
Figure 3 Diagram of the research framework

CHAPTER 3
RESEARCH METHODOLOGY

This chapter describes the research design and approach which are used in the conduction of the study. Since this study aims to: 1) 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 approach; 2) compare learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach with an expectation of passing with the criteria 70 percent; 3) assess the student's satisfaction toward the Problem-Based Learning approach. The description of population and samples, experimental design, research instruments, data collection, and data analysis are brought to be presented.

3.1 Population and samples

3.1.1 The population in this study was 399 students (5 classrooms) in Zhoukou Normal University, Henan Province, China.

3.1.2 The sample of this study was 66 students (1 classroom) of Zhoukou Normal University which was selected by using cluster random sampling approach.

3.2 Research Design

This study used one group pretest-posttest design

O1	X	O2

O1 was measurement of the students' learning achievements before an experiment

X was Problem-Based Learning Approach

O2 was measurement of the students' learning achievements after an experiment

3.3 Research instruments

Research instruments are the tools for conducting the research to collect data. The research instruments which are used in this study are:

3.3.1 Instrument for experiment

Lesson plan: There are eight lessons of "fundamentals of information technology" allocated with 16 hours It includes 8 theoretical hours and 8 practical hours.

3.3.2 Instruments for collecting data

Learning Achievement's test

Satisfaction questionnaire

3.4 Construction and examining/assessing the quality of research instruments

3.4.1 Construct the lesson plan

Table 2 Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation. (a large class consists of two sections, a total of 100 minutes)

Teaching steps by PBL	Step of fundamentals of information technology	Learning Activities
Define Problem		
Step 1 : Selected items	Discover problems (10 minutes)	Under the guidance of the teacher, ask each group to brainstorm and determine what experience they have or what problems they encounter when dealing with problems
Step 2 : Draw up a plan	Explore existing knowledge and make learning plans (5 minutes)	Complete in groups, discuss and formulate personal learning plans for this class
PBL Task		
Step 3 : Activity exploration	Put forward assumptions and possible mechanisms (5 minutes)	Encourage each group to generate assumptions and possible ways to help them with their team members
Step 4 : Production of works	Identify learning problems and apply self-study (35 minutes)	Ask each group to identify learning problems and what they should do. Allow each group to apply self-study (using textbooks and online resources, in the computer room) and focus on all

Table 2 (cont.)

Teaching steps by PBL	Step of fundamentals of information technology	Learning Activities
		the learning problems listed by the group members in step 3.
Step 5 : Achievement exchange	Reassess and apply newly acquired knowledge (30 minutes)	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form.
Evaluation		
Step 6 : Activity evaluation	Assessment and reflective learning (15 minutes)	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher made a result evaluation with reference to the PBL rating scale.

Table 3 Teaching activity design 1

Lesson plan design in training course: Advanced application of Excel (1)

Task name	Excel advanced application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: use Excel 2010 to make a detailed statement of water and electricity charges (I)	Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: if you are a staff member of a regional water and electricity management department, how can you use Excel 2010 to quickly operate the data? How to use Excel 2010 to make a	

Table 3 (cont.)

Task name	Excel advanced application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
		detailed statement of water and electricity charges, and edit and format the table?	
Define Problem- Draw up a plan	Master the application of Excel.	Guide students to design table interface and content.	
PBL Task- Activity exploration	Students think by themselves and then start group discussion to determine the overall structure of making "water and electricity bill.xlsx"; The specific contents include: (1) data input: text type, numerical type, date time type, filling. (2) Edit cells and ranges. (3) Use formula. (4) Table formatting. Based on discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to make using Excel.	Main questions: (1) establish excel document and input water and electricity meter reading data; (2) Calculate the water consumption and water fee of users; Electricity consumption and electricity charge; Statistics on the total value of water and electricity and the sum of various items. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively. Encouraged to think creatively.	
PBL Task- Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students'	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and	

Table 3 (cont.)

Task name	Excel advanced application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
	group members solve problems with each other; According to the activity content, complete the corresponding operation tasks: establish excel document and input water and electricity meter reading data; Calculate the water consumption and water fee of users; Electricity consumption and electricity charge; Statistics on the total value of water and electricity and the sum of various items. Further test the learning effect and consolidate the learning results.	give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.	
PBL Task- Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.	
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 4 Teaching activity design 2

Lesson plan design in training course: Advanced application of Excel (2)

Task name	Excel advanced application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: use Excel 2010 to make a detailed statement of water and electricity charges (2)	Create a real activity situation, guide students to create new situations according to learning or work needs, and stimulate their interest in learning. Situation: how to beautify your worksheet with Excel 2010? How to set the printing format of water and electricity bill details, preview the table and print reasonably?	
Define Problem- Draw up a plan	Master the application of Excel.	Guide students to design table interface and content.	
PBL Task- Activity exploration	Students think by themselves and then start group discussion to determine the overall structure of making "water and electricity bill. Xlsx"; The specific contents include: we have learned the calculation of tables in word, and we can also use formulas in Excel. 1. Operator. 2. Using formula: explain the creation, editing, moving and copying of formula in combination with the knowledge of cell address and cell area in the previous lesson.	Main questions: (1) cell formatting and table beautification; (2) Print the worksheet. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.	

Table 4 (cont.)

Task name	Excel advanced application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
	3. Cell reference: explain relative, absolute and mixed references respectively. 4. References to other worksheets and workbooks. 5. Tables and structured references. 6. Cell formatting: (1). Font; (2). Alignment; (3). Figures; (4). Style; (5). Cell; (6). Conditional formatting settings: cell formatting. 7. Print worksheet: 1. Page setting, setting method of header and footer in Excel. 2. Print preview, task: practical training print worksheet. On the basis of discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to make using Excel.		
PBL Task- Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: cell formatting, table	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.	

Table 4 (cont.)

Task name	Excel advanced application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
	beautification, setting print format and printing worksheet. Further test the learning effect and consolidate the learning results.		
PBL Task- Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.	
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 5 Teaching activity design 3

Lesson plan design in training course: Advanced application of Excel (3)

Task name	Excel advanced application (3) (using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make student achievement statistical analysis table (I)	Create a real activity situation, guide students to create new situations according to learning or work needs, and stimulate their interest in learning. Situation: if you are a middle school teacher, how can you automatically find the corresponding education method in Excel according to the quantitative integral according to the student's performance in the middle school teaching classroom? (introduce function)	
Define Problem- Draw up a plan	Master the application of Excel.	Guide students to design table interface and content.	
PBL Task- Activity exploration	Students think by themselves and then start group discussion to determine the overall structure of making "student achievement statistical analysis table. Xlsx"; Use relevant formulas and functions to calculate the total score, total evaluation and ranking column in the computer basic score table; On the basis of discussion, decompose the unsolved problems, and then assign	Main questions: table editing: rename, move, copy, delete; Function definition, classification, input method, etc. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other,	

Table 5 (cont.)

Task name	Excel advanced application (3) (using Problem-Based Learning Approach)	Class hour	2 class hours
	them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to make using Excel.	actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.	
PBL Task-Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: table editing rename, move, copy and delete; Function definition, classification, input method, etc. Further test the learning effect and consolidate the learning results.	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.	
PBL Task-Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward	

Table 5 (cont.)

Task name	Excel advanced application (3) (using Problem-Based Learning Approach)	Class hour	2 class hours
		opinions and suggestions for further improvement, and make a simple summary.	
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 6 Teaching activity design 4

Lesson plan design in training course: Advanced application of Excel (4)

Task name	Excel advanced application (4) (using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make student achievement statistical analysis table (2)	Create a real activity situation, guide students to create new situations according to learning or work needs, and stimulate their interest in learning. Situation: in the grade table of computer basic courses we have created, if we want to check the students' grades by major, what	

Table 6 (cont.)

Task name	Excel advanced application (4) (using Problem-Based Learning Approach)	Class hour	2 class hours
			are the methods? (import sorting and filtering) If you want to count the number of male and female students in various majors, what are the methods? (import subtotals, PivotTables, etc.)
Define Problem- Draw up a plan	Master the application of Excel.		Guide students to continue to complete the task of "statistical analysis table of student achievement".
PBL Task- Activity exploration	Students think by themselves and then start a group discussion on how to use the data management methods commonly used in Excel, such as data validity, sorting, screening, classification summary, PivotTable, etc., the creation and editing methods of Excel charts and PivotCharts. On the basis of discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try the operation.		Main questions: continue to make student achievement statistical analysis table by using Excel On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.
PBL Task- Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems and let students'		Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and

Table 6 (cont.)

Task name	Excel advanced application (4) (using Problem-Based Learning Approach)	Class hour	2 class hours
	group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: data management tools such as sorting, filtering, classification summary and PivotTable in Excel, as well as the method of using charts and PivotCharts to display the data comparison more intuitively. Students should understand and master these tools while completing the task And can flexibly use these tools to solve practical problems in table calculation.	give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.	
PBL Task- Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.	

Table 6 (cont.)

Task name	Excel advanced application (4) (using Problem-Based Learning Approach)	Class hour	2 class hours
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 7 Teaching activity design 5

Lesson plan design in training course: PowerPoint basic application (1)

Task name	PowerPoint basic application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make excellent class campaign presentation (1)	Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: if our school wants to make an excellent class campaign speech now, we need all the students in our class to make an excellent class campaign presentation. Finally, we will synthesize the production contents	

Table 7 (cont.)

Task name	PowerPoint basic application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
		of all the students and select the best work to participate in the school campaign presentation.	
Define Problem- Draw up a plan	The basic application of PowerPoint.	Guide students to Design ppt interface and content.	
PBL Task- Activity exploration	Students think for themselves and then start a group discussion on the operation and application of slides. Based on discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to use PowerPoint for production.	Main questions: 1. Establishment and preservation of presentation. 2. Slide page setting, theme, background, and other design, adding date and time, header, slide number and other information. 3. Create multiple slides with different formats Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.	

Table 7 (cont.)

Task name	PowerPoint basic application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
PBL Task- Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: 1. Understand PowerPoint: start and exit; Window composition; View mode (Application of four view modes). 2. Basic operation of presentation: create presentation (blank, template, network download template); Save presentation. 3. Basic operation of slide: select slide; Create a new slide (multiple creation methods); Change slide layout; Copy, move and delete slides. 4 slide designs: page setting; Theme; Background; Header and footer dialog box.	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time.	
PBL Task- Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the	

Table 7 (cont.)

Task name	PowerPoint basic application (1) (using Problem-Based Learning Approach)	Class hour	2 class hours
			same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 8 Teaching activity design 6

Lesson plan design in training course: PowerPoint basic application (2)

Task name	PowerPoint basic application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task.	Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning.	

Table 8 (cont.)

Task name	PowerPoint basic application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
	Task: make excellent class campaign presentation (2)	Situation: continue to optimize the content of the campaign presentation made last class	
Define Problem- Draw up a plan	The basic application of PowerPoint.	Guide students to Design ppt interface and content.	
PBL Task- Activity exploration	Students think for themselves and then start a group discussion on the operation and application of slides. Based on discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to use PowerPoint for production.	Main questions: (1) add hyperlinks, actions, and action buttons for slides. (2) The structure level is clear, the style is unified, and the pictures and texts are illustrated: introduce what objects constitute. (3) Play the presentation and watch the presentation effect. Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.	

Table 8 (cont.)

Task name	PowerPoint basic application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
PBL Task- Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: 1. Add and edit common objects on the slide; Text and text box editing (ordinary text, text box, WordArt); Pictures, clip art and screenshots (crop shape, resize and picture effect settings); Tables and charts (emphasis here) Insert table, input table text and edit table; Insert default chart, modify chart data source and edit chart; Photo album (pay attention to the photo album dialog box settings); From insert shape, edit shape point, add edit text; Create and edit SmartArt graphics (focus on format and design tabs); Create hyperlinks, actions and action buttons (mainly explained here); 2.3 different applications of hyperlinks; 3 ways to create hyperlinks; 3.	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and give correct guidance in time.	

Table 8 (cont.)

Task name	PowerPoint basic application (2) (using Problem-Based Learning Approach)	Class hour	2 class hours
	Simple slide show (2 ways). 4. Knowledge development: create presentations using sample templates; Use of the group dialog box.		
PBL Task- Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.	
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 9 Teaching activity design 7

Lesson plan design in training course: Advanced application of PowerPoint (1)

Task name	Advanced application of PowerPoint (1) (Using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Define Problem- Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: Making multimedia courseware.	Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: Teacher's question 1: do you like slides with uniform appearance or messy appearance in class? Teacher question 2: if some dynamic effects, such as animation and video, are added to the slide show, will the presentation be more vivid and attract everyone's interest?		
Define Problem- Draw up a plan	Advanced applications for PowerPoint.	Guide students to Design ppt, set the appearance theme of the slide and the use of the master in PowerPoint, and add various dynamic effects to the slide to make the slide more vivid.		
PBL Task- Activity exploration	Students think by themselves and then start group discussion to determine the design and production of a dynamic multimedia presentation of "Lin Daiyu entering Jia's house"; Various objects are added to the presentation, and various animation effects and page	Main questions: design and make a dynamic multimedia presentation of "Lin Daiyu entering Jia's house"

Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved (pertinence means combing around the | | |

Table 9 (cont.)

Task name	Advanced application of PowerPoint (1) (Using Problem-Based Learning Approach)	Class hour	2 class hours
	switching effects are set. Then assign the team members to individuals or groups according to their strengths. (1) First, set the unified appearance of slides through the theme. (2) Use the master to adjust the unified format of slides. (3) Add various objects in the slide, such as pictures, audio, video, etc., and set a variety of animation effects and switching effects. (4) The advanced slide show can be modified appropriately to see the final show effect.	objectives of this activity and taking its essence). In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.	
PBL Task- Production of works	1. Overall appearance design of slides. Application of slide master: when entering the master, there is a set of master for each topic, and each set of master is divided according to the plate; The background, theme and other objects in the master can be edited and modified; Format modification such as placeholder and insert object. Show headers and footers. 2. Add sound: insert sound; Sound playback settings; Sound format setting. 3. Add video: insert video; Video	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time.	

Table 9 (cont.)

Task name	Advanced application of PowerPoint (1) (Using Problem-Based Learning Approach)	Class hour	2 class hours
	playback settings; Video format setting. Add sign frame; 4. Slide Animation: add animation and animation settings for placeholder, smart graphics and sound; Copy the animation, using the animation brush. Use the animation pane to view the added animation, animation sequence, and animation effect settings. Here we mainly adjust the animation sequence and overlay the animation. 5. Slide switching effect: create switching effect, single effect and multi effect settings for the same presentation. Toggle effect settings.		
PBL Task-Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.	

Table 9 (cont.)

Task name	Advanced application of PowerPoint (1) (Using Problem-Based Learning Approach)	Class hour	2 class hours
Evaluation- Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

Table 10 Teaching activity design 8

Lesson plan design in training course: Advanced application of PowerPoint (2)

Task name	Advanced applications for PowerPoint (2) (Using Problem-Based Learning Approach)	Class hour	2 class hours
Preset link	Student activities	Teacher activities	
Selected items	Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: the company requires you to design a small home page for a children's dance training institution with PowerPoint.	Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: if you are practicing in a design company, to meet the needs of different customers, the company will design promotional	

Table 9 (cont.)

Task name	Advanced applications for PowerPoint (2) (Using Problem-Based Learning Approach)	Class hour	2 class hours
		videos in various formats with different software every day.	
Draw up a plan	Master the application of PowerPoint.	Guide students to design interface and slogan.	
Activity exploration	Students think by themselves and then start a group discussion to determine which elements in the design are already determined and which need to be explored together. Based on the discussion, the unsolved problems are decomposed, and then assigned to individuals according to the team members' strengths, or the team works together to solve them.	Main question: using PowerPoint to design the home page Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved (pertinence means combing around the objectives of this activity and taking its essence).	
	Through group discussion, students begin to try to make PPT and explore how to make the interface beautiful and generous? How to better attract the attention of the target population?	In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.	
Production of works	In the process of computer operation, students give full play to the function of the group when they encounter problems and let students' group members solve	Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and give correct guidance in time..	

Table 9 (cont.)

Task name	Advanced applications for PowerPoint (2) (Using Problem-Based Learning Approach)	Class hour	2 class hours
	problems with each other; According to the content of the activity, complete the corresponding operation tasks, further detect the learning effect and consolidate the learning achievements.	Avoid students wasting too much time and improve the efficiency and quality of teaching	
Achievement exchange	Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.	Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.	
Activity evaluation	Assessment and reflective learning within and between groups.	Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.	

3.4.2 Constructing the learning achievement test was proceeded as follows

Step 1: Studying the construction of the learning achievement test and the relevant documents. Consideration was focus on purposes, types, and contents of the test. The construction of the test involving item analysis to clarify the item discrimination and item difficulty of the test, as well as the validity and reliability of the test.

Step 2: Analyzing the curriculum contents and the learning objectives by constructing the analysis table of curriculum regarding the coverage of objectives and content of the curriculum. The test items consisted of four types of cognitive domain: 1) knowledge, 2) comprehension, 3) application, and 4) analysis.

Step 3: Constructing the learning achievement test on "The fundamentals of information technology course". The test consists of 3 0 items of multiple-choice questions, each of which has four alternatives with one correct answer.

Step 4: The draft test is present to thesis advisors for their advice on the appropriateness, precision, accuracy, ambiguity, and wording of the test. After that, the draft test is revised according to the thesis advisors' suggestions. The test and the test evaluation form are offer to the three experts for the content validity check and suggestions such as the type of questions, accuracy of the test and wording. The quality of the test is considered from Index of Item Objective Congruence (IOC) obtain from the learning achievement test evaluation form.

Step 5: Analyzing the IOC index of the test items. The formula used to calculate the IOC index is:

$$IOC = \Sigma R/N$$

Where

IOC   means   Index of Item Objective Consistency
ΣR   means summation of experts' opinion marks
N   means number of experts

If the Index of Item Objective Congruence (IOC) of each item of the test is higher than 0.5 that means it can be used in the test.

Step 6: Revising the test according to the experts' comments and suggestions.

Step 7: Measuring the item difficulty (p) and item discriminability (r) including reliability by trying out the test to students who had learned this content.

Step 8: Analyzing each item of the test to find out the item difficulty (p) and item discriminability (r) including reliability. Item difficulty (p) should range from 0.20-0.80 and item discriminability (r) should be more than 0.20. The reliability of the test is computed using the formula of Kuder and Richardson formulas 20 and should be more than 0.7 (Kuder & Richardson, 1939: 681-687).

To analyze the PBL pre-test and post-test, we tested 66 sample students in Zhoukou Normal University, determined the difficulty index (P) of the PBL pre-test and post-test, and analyzed the difficulty of the scores. The results show that the PBL test difficulty index is between 0.25 and 0.35. For the calculation of the PBL test reliability, Kuder Richardson's KR-20 formula was applied. The reliability of the PBL test was 0.81. The contents validity of the PBL 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 appropriate in high level.

3.4.3 Constructing the satisfaction's questionnaire

The following are the steps of constructing the questionnaires:

Step 1: Studying documents related to constructing questionnaires.

Step 2: Constructing a questionnaire. The questionnaire consists of three sections: Section 1 recorded the students' personal information. Section 2 is the five-point scale Likert questionnaire ranging from very high, high, moderate, low, and very low. Section 3 is open-ended questions asking students' opinions toward using PBL. Also provide space is provided for additional opinions or other suggestions.

Step 3: The draft questionnaire is presented to thesis advisors for their advice on the appropriateness, precision, accuracy, ambiguity, and wording of the questionnaire. After that the draft questionnaire is revised according to the thesis advisors' suggestions. The evaluation form is offered to the three experts for the content validity check (IOC) and suggestions. The quality of the questionnaire is considered from Cronbach's Alpha Reliability.

Step 4: Prepare the complete questionnaire.

The contents validity of the satisfaction form was also examined by three experts and possessed the IOC of 0.67-1.00. The quality of the questionnaire is considered from Cronbach's Alpha Reliability was 0.91.

3.5 Data collection

The following are the stages of data collection:

The development methods of research tools are as follows:

3.5.1. 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 PBL test items consisted of four types of cognitive domain: 1) knowledge, 2) comprehension, 3) application, and 4) analysis.

3.5.2. The samples are taught by using the Problem-Based Learning Approach. Based on PBL, 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 PBL process on students' autonomous learning ability and academic performance.

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

3.5.4. The samples are given the students' satisfaction questionnaire. The questionnaire consists of three sections: Section 1 recorded the students' personal information. Section 2 is asked the opinion of students toward using PBL in five-point scale Likert questionnaire ranging. Section 3 is open-ended questions asking students' opinions toward using PBL. Also provide space is provided for additional opinions or other suggestions.

3.6 Data analysis

In this study, data will analyze by using the statistical program according to the research objectives.

3.6.1 Compare the learning achievements before and after receiving the Problem-Based Learning Approach by using t-test for dependent sample.

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

3.6.3 Study the student's satisfaction on the Problem-Based Learning Approach by using arithmetic mean and standard deviation.

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CHAPTER 4
RESULTS

This chapter describes the research result. The aimed of this study were:

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 approach.

2. To compare learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach with an expectation of passing with the criteria 70 percent.

3. To assess the student's satisfaction toward the Problem-Based Learning approach.

After that, it reveals the results of the curriculum implementation of the problem-based learning approach. Research tools include group discussion, pretest and posttest, PBL teaching evaluation form, PBL rating scale, interview form of satisfaction with PBL approach of fundamentals of information technology course. For data analysis. SPSS was used as analysis tool.

Statistical symbols

Statistical symbols	Description
$\bar{x}$	Sample mean
S.D.	Sample standard deviation
t	t Test
p	Statistically Significant

Section 1 Result of compare learning achievements on Fundamentals of Information Technology course before and after receiving the Problem-Based Learning Approach by using t-test for dependent sample

Table 11 The results of compare learning achievements before and after receiving the
Problem-Based Learning Approach

Test	n	score	$\bar{x}$	S.D.	t	df	P
before	66	30	17.21	2.02	37.37 *	65	.00
after	66	30	26.62	1.97			

* P<0.05

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

Section 2 Result of compare learning achievements on Fundamentals of
Information Technology course with the determined criteria set at 70 percent by using
t-test for one sample.

Table 12 The results of compare learning achievement with the determined criteria
set at 70 percent

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

* P<0.05

The table above 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.

Section 3 Result of student's satisfaction on the Problem-Based Learning
Approach

Table 13 The result of student's satisfaction on the Problem-Based Learning
Approach

Items	$\bar{x}$	S.D.	Levels of satisfaction
1.The formal difference between PBL teaching approach and traditional teaching approach	5.00	0.00	highest
2.Classroom atmosphere activity	5.00	0.00	highest
3.Students fully express their views	5.00	0.00	highest
4.Improve students' ability to solve problems	4.00	0.61	high
5.Improvement of students' learning enthusiasm	5.00	0.00	highest
6.Improvement of students' innovative thinking ability	4.55	0.50	highest
7.Classroom atmosphere created by PBL teaching approach	4.05	0.64	high
8.Students' mastery of classroom knowledge of fundamentals of information technology course	5.00	0.00	highest
9.Improve students' academic performance	5.00	0.00	highest
10.The change of teachers' role in the classroom	4.50	0.66	highest
11.Mutual help from team members	5.00	0.00	highest
12.Group cooperation mode can better promote the mastery of personal classroom knowledge	5.00	0.00	highest
13.Teaching effect of PBL teaching approach in fundamentals of information technology course	4.55	0.79	highest
Total	4.74	0.25	highest

The table above indicates that the student's satisfaction on the Problem-Based
Learning Approach after learning was ranked at the highest level ($\bar{x}$ = 4.74, S.D. =
0.25).

CHAPTER 5
DISCUSSION

5.1 Research conclusion

This research aimed to: 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 approach. 2. To compare learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach with an expectation of passing with the criteria 70 percent. 3. To assess the student's satisfaction toward the Problem-Based Learning approach.

The samples were 399 students majoring in network engineering in Zhoukou Normal University, Henan Province, China. The sample of this study were 66 students, from Zhoukou Normal University and network engineering university which selected through cluster random sampling.

The experimental design was used one group to compare pre-test and post-test, students' satisfaction questionnaire.

The research instruments were the lesson plan, PBL pretest and posttest form, and the satisfaction questionnaire. Data were analyzed by mean, standard deviation, IOC, and t-test.

Data collection were 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 PBL test items consisted of four types of cognitive domain: 1) knowledge, 2) comprehension, 3) application, and 4) analysis; 2. the samples are taught by using the Problem-Based Learning Approach. Based on PBL, 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 PBL process on students' learning achievements and students' satisfaction; 3. After finishing the instruction, the samples receive the posttest by using the same instrument which are used in the pretest; 4. the samples are given the students' satisfaction questionnaire. The satisfaction questionnaire mainly consists of two parts: Part 1: Questionnaire on purposes in PBL teaching of information technology basic course, using scales. Part 2: Interview form of satisfaction with PBL approach of fundamentals of information technology course, using open-ended questions.

The findings of the research 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.

5.1.1 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.

5.1.2 The purpose of our study is to apply. The best way to learn is to increase our learning ability by solving practical problems, which coincides with the learning mode of PBL approach. Therefore, through PBL approach, students' academic performance and practical ability will be improved. At the same time, 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.

5.1.3 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 PBL teaching practice, students, teachers, and teaching environment should be fully considered to better improve students' learning achievements and students' satisfaction.

5.2 Research discussion

According to the research results, the following points are discussed:

5.2.1 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.

5.2.2 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 PBL 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 Min, 2020).

5.2.3 Problem-based learning approach has achieved good results in this teaching practice. On the other 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. 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 Ting, 2018).

5.2.4 Problem based learning approach 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 approach is more challenging because learning begins with a real problem encountered in work (Pardimin, Arcana, & Supriadi, 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, Degeng, & Ulfa, 2020).

5.2.5 The student's satisfaction on the Problem-Based Learning Approach 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 (Sonam and Pema, 2021; Jiang et al., 2017).

5.3 Recommendation

5.3.1 Recommendation for implication

1) Teachers should strengthen theoretical study and improve the level of teaching and management. In problem-based learning approach, 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.

2) Combined with teaching practice, improve the teaching approach. Through the research results, it is found that problem-based learning approach can be applied to computer professional courses, but the teaching mode is not perfect in computer professional courses. 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. Finally, a more characteristic school-based model will be formed.

5.3.2 Recommendation for further research

Systematically develop and improve the application of PBL approach in fundamentals of information technology courses and try to apply it to other computer related courses.

Research on strategies to improve the efficiency of students' data collection under the environment and resources of the school, such as allowing students to collect books from the library and expand the collection of books in the library; Set time for each student practicing in the computer room to increase learning efficiency, etc.

Expand the research on PBL approach and find more effective methods for curriculum research in colleges and universities. More and more scholars will study the new teaching model in colleges and universities and face more problems. In the future research, we will also learn valuable experience from scholars and experts.

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APPENDICES

APPENDIX A
ACHIEVEMENT TEST

Achievement Test
(Fundamentals of Information Technology)

Test Description: The test is multiple-choice questions to test students' mastery of basic knowledge. There are 30 questions in total. Each question has 4 options. Please choose the best answer. 1 point for each question.
Single choice
==
1. The following functions cannot be realized in Excel 2010 spreadsheet system ( )
    A. Network monitoring
    B. Data management
    C. Tabulation function
    D. Data statistics and analysis
2. The workbook in Excel 2010 is ( )
    A. A Book
    B. A recording method
    C. Data
    D. Excel files
3. In the worksheet of exel2010, each cell has its fixed address, such as "A5" ( )
    A. Cell data
    B. "A" stands for row "a" and "5" for column "5"
    C. "A" stands for column "a" and "5" for row "5"
    D. None of the above
4. In the excel 2010 spreadsheet system, the default extension when saving a file is ( )
    A.exe
    B . dbf
    C.doc
    D.XISX
5. If you enter (13) in cell A1, the display content of cell A1 is ( ).
    A. String 13
    B. String (13)
    C. Number 13
    D. Number - 13
6. Suppose a workbook has a worksheet with labels shet1, shet2, shet3 and shet4 respectively. If the current worksheet is shet1 and the worksheet is copied to shee4, the label of the copied worksheet is ( ).
    A Sheet 1(2)
    B Sheet 2(2)
    C Sheet 3(2)
    D Sheet 4(2)

7. Format the data in the cell. The function area used is (   ).

      A. Start

      B. Data

      C. Documents

      D. Page layout

8. In Excel 2010, the command that can determine the column width according to the data needs is (   )

      A. Column width

      B. Default column width

      C. Standard column width

      D. Auto adjust column width

9. In Excel 2010 worksheet, it is known that there is formula "= Bi + C1" in A1 cell. Move C1 to E1, then A1 formula in is adjusted to (   )

      A.=B1+C1

      B.=B1+E1

      C.=D1+C1

      D.=D1+E1

10. You must (   )

      A. Set filter criteria

      B. Use data record sheet

      C. Sort data by classified field

      D. No action is required

11. Referencing cells in different workbooks is called (   )

      A. Remote reference

      B. Absolute reference

      C. External reference

      D. Internal reference

12. To exit excl2010, use the key combination (   )

      A. Alt+F4

      B. Ctrl+F4

      C. Alt+F5

      D. Ctrl+F5

13. Text data of exel2010 includes (   ).

      A. Chinese characters, phrases and spaces

      B. Figures

      C. Other imputable characters

      D. All above

14. In excd200, worksheet window freezing includes (　)

    A. Horizontal freezing

    B. Vertical freezing

    C. Horizontal and vertical freezing at the same time

    D. All above

15. In Excel 2010, the steps to create a formula are (　)

① Type "=" in the edit column ② type the formula ③ press enter ④ select the cell where the formula needs to be established

    A. ④③①②

    B. ④①②③

    C. ④①③②

    D. ①②③④

16. (　) view is the default view after entering PowerPoint 2010.

    A. Slide browsing

    B. Outline

    C. Slides

    D. Ordinary

17. For PowerPoint 2010, to select multiple slides in Slide Sorter view, press and hold the (　) key first

    A．Alt

    B．Ctrl

    C．F4

    D．Shift+F5

18. The following statement about slide animation effect is incorrect (　).

A. If you want to animate the objects in the slide in detail, you should use custom animation

    B. You can set the typewriter effect on the objects in the slide

    C. Slide text cannot be animated

    D. The order of animation determines the order in which objects appear on the slide

19. To save, open, create and print slides, you should operate in the (　) tab.

    A. Documents

    B. Start

    C. Design

    D. Review

20. The file extension of the presentation produced by PowerPoint 2010 is (　).

    A．. pptx

    B．. xls

    C．. fpt

    D．. doc

21. The main function of PowerPoint 2010 is (   ).
      A. Electronic presentation processing
      B. Sound processing
      C. Image division
      D. Word processing

22. In PowerPoint 2010, the design tab can customize the presentation (   ).
      A. New file, open file
      B. Tables, shapes and icons
      C. Background, theme design and color
      D. Animation design and page design

23. In PowerPoint 2010, the review tab can check (   )
      A. Documents
      B. Animation
      C. Spelling
      D. Switch

24. In PowerPoint 2010, the shortcut key for adding new slides is (   ).
      A．Ctrl+M
      B．Ctrl+N
      C．Ctrl+O
      D．Ctrl+P

25. The background group is in the (   ) tab of the ribbon.
      A. Start
      B. Insert
      C. Design
      D. Animation

26. In PowerPoint 2010, to select slides 1, 2 and 5 at the same time, you should operate in the (   ) view.
      A. Ordinary
      B. Outline
      C. Slide browsing
      D. Remarks

27. To set the slide page and select the theme, you can operate in the (   ) tab.
      A. Start
      B. Insert
      C. View
      D. Design

28. Among the following views, those that do not belong to PowerPoint 2010 view are (   ).

       A. Slide view

       B. Page view

       C. Outline view

       D. Notes page view

29. To animate the objects in the slide and how the animation appears, you should operate in the (   ) tab.

       A. Switch

       B. Animation

       C. Design

       D. Review

30. In PowerPoint 2010, the Insert tab can be created (   )

       A. New file, open file

       B. Tables, shapes and icons

       C. Align text left

       D. Animation

APPENDIX B
SATISFACTION QUESTIONNAIRE

Questionnaire for PBL teaching approach of Fundamentals of Information Technology Course

Directions:

The purpose of this questionnaire is to survey students' feelings or opinions toward a problem-based learning approach while taking the fundamentals of information technology course.

The questionnaire consists of three sections: Section 1 recorded the students' personal information. Section 2 is the five-point scale Likert questionnaire ranging from very high, high, moderate, low, and very low. Section 3 is open-ended questions asking students' opinions toward using PBL.

The survey results are only for research purposes. There are no right or wrong answers. Please fill in by yourself according to your actual situation.

Thank you very much for your cooperation and help!

Miss Li Xiaofeng
Learner of master's degree (Curriculum and Instruction)

Questionnaire on purposes in PBL teaching of Fundamentals of Information Technology Course

Section 1 personal information

Gender   1. ☐   Male   2. ☐   Female

Age   ………………………..

Section 2 The satisfaction toward study with PBL.

There are 5 levels of satisfaction. Please mark in the box representing your answer (✓)

5   means   very high satisfied

4   means   high satisfied

3   means   moderate satisfied

2   means   low satisfied

    1   means   very low satisfied

Item	Levels of satisfaction				
	5	4	3	2	1
1. The formal difference between PBL teaching approach and traditional teaching approach					
2. Classroom atmosphere activity					
Students fully express their views					
Improve students' ability to solve problems					
Improvement of students' learning enthusiasm					
Improvement of students' innovative thinking ability					
Classroom atmosphere created by PBL teaching approach					
Students' mastery of classroom knowledge of fundamentals of information technology course					
Improve students' academic performance					
The change of teachers' role in the classroom					
Mutual help from team members					
Group cooperation mode can better promote the mastery of personal classroom knowledge					

Teaching effect of PBL teaching approach in fundamentals of information technology course					

Section 3 Other suggestion toward using PBL.

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APPENDIX C
LESSON PLAN

LESSON PLAN   1

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Use Excel 2010 to make a detailed statement of water and electricity charges (I)
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional : 2 hours
Instructor's name   : Li Xiaofeng

1. Objectives
        1.1 Through this course, students can explain the basic concepts of Excel.
        1.2 Students will be able to fully operate and input various types of data in cells.
        1.3 Students can use simple formula input.
2. Content
        2.1 Establish excel document and input water and electricity meter reading data; Pay attention to data input: text type, numerical type, date time type, filling.
        2.2 Edit cells and ranges; Use formula; Table formatting.
        2.3 Calculate the water consumption and water fee of users; Electricity consumption and electricity charge; Statistics on the total value of water and electricity and the sum of various items.
3. Instructional Strategies (teaching methods)
        Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation.
        3.1 Define Problem.
        Step 1: Selected items. Discover problems (10 minutes);
        Student activities: Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: use Excel 2010 to make a detailed statement of water and electricity charges (I)
        Teacher activities: Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: if you are a staff member of a regional water and electricity management department, how can you use Excel 2010 to quickly operate the data? How to use Excel 2010 to make a detailed statement of water and electricity charges, and edit and format the table?
        Step 2: Draw up a plan. Explore existing knowledge and make learning plans (5 minutes).
        Student activities: Master the application of Excel.
        Teacher activities: Guide students to design table interface and content.
        3.2 PBL Task.

Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);

Students think by themselves and then start group discussion to determine the overall structure of making "water and electricity bill.xlsx"; The specific contents include: (1) data input: text type, numerical type, date time type, filling. (2) Edit cells and ranges. (3) Use formula.(4) Table formatting. Based on discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to make using Excel.

Teacher activities: Main questions: (1) establish excel document and input water and electricity meter reading data; (2) Calculate the water consumption and water fee of users; Electricity consumption and electricity charge; Statistics on the total value of water and electricity and the sum of various items. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students' group members solve problems with each other; According to the activity content, complete the corresponding operation tasks: establish excel document and input water and electricity meter reading data; Calculate the water consumption and water fee of users; Electricity consumption and electricity charge; Statistics on the total value of water and electricity and the sum of various items. Further test the learning effect and consolidate the learning results.

Teacher should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups,

make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

LESSON PLAN   2

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Use Excel 2010 to make a detailed statement of water and
electricity charges (2)
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional : 2 hours
Instructor's name   : Li Xiaofeng

1. Objectives
        1.1 Through this course, students can explain the basic concepts of Excel.
        1.2 Students will be able to fully operate cell formatting and worksheet
printing settings.
        1.3 Students can use worksheets effectively.
2. Content
        2.1 Using formula: explain the creation, editing, moving and copying of
formula in combination with the knowledge of cell address and cell area in the
previous lesson.
        2.2 Cell reference: explain relative, absolute and mixed references
respectively.
        2.3 References to other worksheets and workbooks.
        2.4 Tables and structured references.
        2.5 Cell formatting: (1). Font; (2). Alignment; (3). Figures; (4). Style; (5).
Cell; (6). Conditional formatting settings: cell formatting.
        2.6 Print worksheet: 1. Page setting, setting method of header and footer in
Excel. 2. Print preview, task: practical training print worksheet.
3. Instructional Strategies (teaching methods)
        Time schedule of three steps of Problem-Based Learning Approach using
fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3.
Evaluation.
        3.1 Define Problem;
        Step 1: Selected items. Discover problems (10 minutes);
        Student activities: Integrate into the situation, stimulate curiosity, carry out
relevant thinking, and generate the desire to complete the task. Task: use Excel 2010
to make a detailed statement of water and electricity charges (2)
        Teacher activities: Create a real activity situation, guide students to create new
situations according to learning or work needs and stimulate their interest in learning.
Situation: how to beautify your worksheet with Excel 2010? How to set the printing
format of water and electricity bill details, preview the table and print reasonably?
        Step 2: Draw up a plan. Explore existing knowledge and make learning plans
(5 minutes).
        Student activities: Master the application of Excel.

Teacher activities: Guide students to design table interface and content.

3.2 PBL Task;

Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);

Student activities: Students think by themselves and then start group discussion to determine the overall structure of making "water and electricity bill. Xlsx"; The specific contents include we have learned the calculation of tables in word, and we can also use formulas in Excel.1. Operator.2. Using formula: explain the creation, editing, moving and copying of formula in combination with the knowledge of cell address and cell area in the previous lesson.3. Cell reference: explain relative, absolute and mixed references respectively.4. References to other worksheets and workbooks.5. Tables and structured references.6. Cell formatting: (1). Font; (2). Alignment; (3). Figures; (4). Style; (5). Cell; (6). Conditional formatting settings: cell formatting.7. Print worksheet: (1). Page setting, setting method of header and footer in Excel. (2). Print preview, task: practical training print worksheet. On the basis of discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to make using Excel.

Teacher activities: Main questions: (1) cell formatting and table beautification;(2) Print the worksheet. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: In the process of computer operation, students give full play to the function of the group when they encounter problems and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: cell formatting, table beautification, setting print format and printing worksheet. Further test the learning effect and consolidate the learning results.

Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.:

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

LESSON PLAN 3

Course / Subject : Fundamentals of Information Technology
Instructional Topic : Make student achievement statistical analysis table (I)
Class Level : Students of class 1, grade 1 of network engineering major
Time for Instructional : 2 hours
Instructor's name : Li Xiaofeng

1. Objectives
    1.1 Through this course, students can explain the concept of Excel function.
    1.2 Students will be able to fully operate the common editing methods of worksheets; Fully operate the method of inputting functions in Excel.
    1.3 Students can understand the corresponding parameter settings.
2. Content
    2.1 Make the overall structure of the worksheet.
    2.2 Using formulas and functions to calculate the value of total score, total evaluation and ranking column in the "score table of computer basic course"; Summarize and search the results; And personal information about students.
3. Instructional Strategies (teaching methods)
    Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation.
    3.1 Define Problem;
    Step 1: Selected items. Discover problems (10 minutes);
    Student activities: Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make student achievement statistical analysis table (I)
    Teacher activities: Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: if you are a middle school teacher, how can you automatically find the corresponding education method in Excel according to the quantitative integral according to the student's performance in the middle school teaching classroom? (Introduce function)
    Step 2: Draw up a plan. Explore existing knowledge and make learning plans (5 minutes).
    Student activities: Master the application of Excel.
    Teacher activities: Guide students to design table interface and content.
    3.2 PBL Task;
    Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);
    Student activities: Students think by themselves and then start group discussion to determine the overall structure of making "student achievement

statistical analysis table. Xlsx"; Use relevant formulas and functions to calculate the total score, total evaluation and ranking column in the computer basic score table.

Teacher activities: Main questions: table editing rename, move, copy, delete; Function definition, classification, input method, etc. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: table editing rename, move, copy and delete; Function definition, classification, input method, etc. Further test the learning effect and consolidate the learning results.

Teacher activities: Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

LESSON PLAN   4

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Make student achievement statistical analysis table (2)
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional   : 2 hours
Instructor's name   : Li Xiaofeng

1. Objectives
        1.1 Through this course, students can explain the common data management methods in Excel, such as data validity, sorting, filtering, subtotal, PivotTable, etc.
        1.2 Students will be able to fully operate excel charts and PivotCharts.
2. Content
        2.1 Firstly, the data validity is used to standardize the data input.
        2.2 Then analyze the data by sorting, filtering, subtotal and PivotTable.
        2.3 Finally, charts and Pivot Charts are used to show the data comparison.
3. Instructional Strategies (teaching methods)
        Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation.
        3.1 Define Problem;
        Step 1: Selected items. Discover problems (10 minutes);
        Student activities: Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make student achievement statistical analysis table (2)
        Teacher activities: Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: in the grade table of computer basic courses we have created, if we want to check the students' grades by major, what are the methods? (Import sorting and filtering) If you want to count the number of male and female students in various majors, what are the methods? (Import subtotals, PivotTables, etc.)
        Step 2: Draw up a plan. Explore existing knowledge and make learning plans (5 minutes).
        Student activities: Master the application of Excel.
        Teacher activities: Guide students to continue to complete the task of "statistical analysis table of student achievement".
        3.2 PBL Task;
        Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);
        Student activities: Students think by themselves and then start a group discussion on how to use the data management methods commonly used in Excel, such as data validity, sorting, screening, classification summary, PivotTable, etc., the

creation and editing methods of Excel charts and Pivot Charts. On the basis of discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try the operation.

Teacher activities: Main questions: continue to make student achievement statistical analysis table by using Excel. On the basis of students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: In the process of computer operation, students give full play to the function of the group when they encounter problems and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: data management tools such as sorting, filtering, classification summary and PivotTable in Excel, as well as the method of using charts and Pivot Charts to display the data comparison more intuitively. Students should understand and master these tools while completing the task and can flexibly use these tools to solve practical problems in table calculation.

Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.
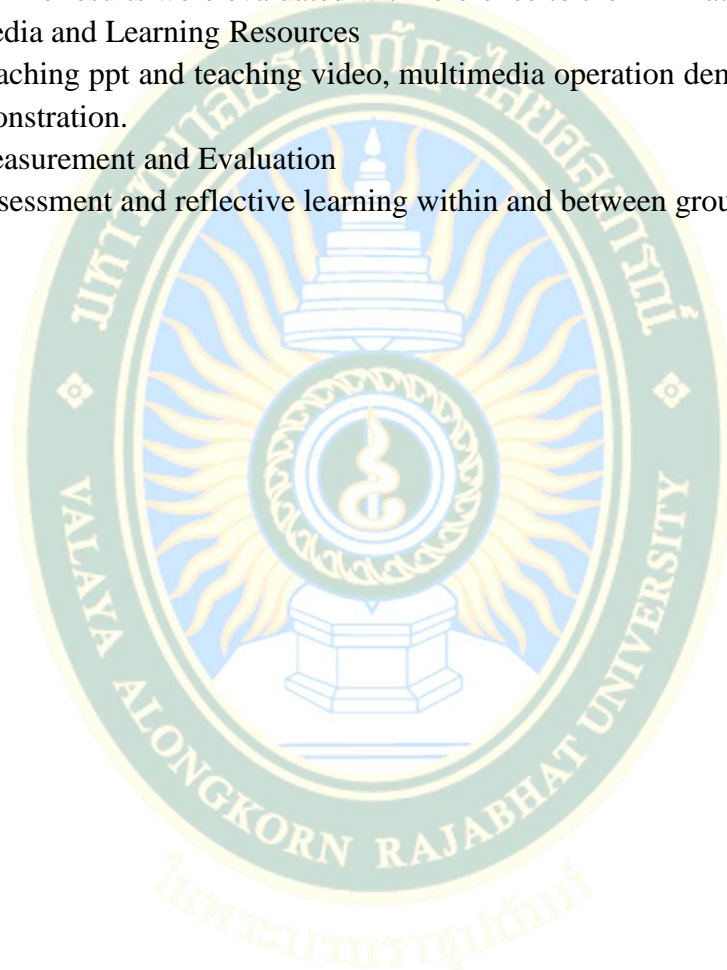
Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

LESSON PLAN   5

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Make excellent class campaign presentation (1)
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional   : 2 hours
Instructor's name   : Li Xiaofeng

1. Objectives
        1.1 Through this course, students can explain the page layout of presentations.
        1.2 Students will be able to create and save presentations and create multiple slides in different formats.
        1.3 Students will be able to fully operate the slide page setting, theme, background and other design, and add letters such as date and time, header, slide number and so on 1.2 Students will be able to fully operate excel charts and Pivot Charts.
2. Content
        2.1 Establishment and preservation of presentation.
        2.2 Slide page setting, theme, background, and other design, adding date and time, header, slide number and other information.
        2.3 Create multiple slides with different formats.
3. Instructional Strategies (teaching methods)
        Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation.
        3.1 Define Problem;
        Step 1: Selected items. Discover problems (10 minutes);
        Student activities: Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make excellent class campaign presentation (1)
        Teacher activities: Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: if our school wants to make an excellent class campaign speech now, we need all the students in our class to make an excellent class campaign presentation. Finally, we will synthesize the production contents of all the students and select the best work to participate in the school campaign presentation.
        Step 2: Draw up a plan. Explore existing knowledge and make learning plans (5 minutes).
        Student activities: The basic application of PowerPoint.
        Teacher activities: Guide students to Design ppt interface and content.
        3.2 PBL Task;

Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);

Student activities: Students think for themselves and then start a group discussion on the operation and application of slides. Based on discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the strengths of team members. Through group discussion, students begin to try to use PowerPoint for production.

Teacher activities: Main questions: 1. Establishment and preservation of presentation.2. Slide page setting, theme, background, and other design, adding date and time, header, slide number and other information.3. Create multiple slides with different formats. Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: In the process of computer operation, students give full play to the function of the group when they encounter problems and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: 1. Understand PowerPoint: start and exit; Window composition; View mode (Application of four view modes). 2. Basic operation of presentation: create presentation (blank, template, network download template); Save presentation. 3. Basic operation of slide: select slide; Create a new slide (multiple creation methods); Change slide layout; Copy, move and delete slides. 4 slide designs: page setting; Theme; Background; Header and footer dialog box.

Teacher activities: Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

LESSON PLAN 6

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Make excellent class campaign presentation (2)
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional   : Friday, November 19, 8 a.m. - 9:50 a.m
Instructor's name   : Li Xiaofeng

1. Objectives

    1.1 Through this course, students will be able to manipulate the insertion and editing of various objects (text and text boxes, pictures, clip art and screenshots, tables and charts, photo albums, shapes, SmartArt graphics).

    1.2 Students will be able to fully operate the addition of navigation design (hyperlink, action, action button).

2. Content

    2.1 Add hyperlinks, actions, and action buttons for slides.

    2.2 The structure level is clear, the style is unified, and the pictures and texts are illustrated: introduce what objects constitute.

    2.3 Play the presentation and watch the presentation effect.

3. Instructional Strategies (teaching methods)

    Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation.

    3.1 Define Problem;

    Step 1: Selected items. Discover problems (10 minutes);

    Student activities: Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: make excellent class campaign presentation (2)

    Teacher activities: Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning. Situation: continue to optimize the content of the campaign.

    Step 2: Draw up a plan. Explore existing knowledge and make learning plans (5 minutes).

    Student activities: The basic application of PowerPoint.

    Teacher activities: Guide students to Design ppt interface and content.

    3.2 PBL Task;

    Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);

    Student activities: Students think for themselves and then start a group discussion on the operation and application of slides. Based on discussion, decompose the unsolved problems, and then assign them to individuals or groups according to the

strengths of team members. Through group discussion, students begin to try to use PowerPoint for production.

Teacher activities: Main questions: (1) add hyperlinks, actions, and action buttons for slides. (2) The structure level is clear, the style is unified, and the pictures and texts are illustrated: introduce what objects constitute. (3) Play the presentation and watch the presentation effect. Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved. In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: In the process of computer operation, students give full play to the function of the group when they encounter problems, and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks: 1. Add and edit common objects on the slide; Text and text box editing (ordinary text, text box, WordArt); Pictures, clip art and screenshots (crop shape, resize and picture effect settings); Tables and charts (emphasis here) Insert table, input table text and edit table; Insert default chart, modify chart data source and edit chart; Photo album (pay attention to the photo album dialog box settings); From insert shape, edit shape point, add edit text; Create and edit SmartArt graphics (focus on format and design tabs); Create hyperlinks, actions and action buttons (mainly explained here); 2.3 different applications of hyperlinks; 3 ways to create hyperlinks; 3. Simple slide show (2 ways). 4. Knowledge development: create presentations using sample templates; Use of the group dialog box.

Teacher activities: Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and give correct guidance in time.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

GRAD VRU

LESSON PLAN   7

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Making multimedia courseware
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional   : Monday, November 22, 8 a.m. - 9:50 a.m
Instructor's name   : Li Xiaofeng

1. Objectives

      1.1 Through this course, students can explain the setting and layout of the overall appearance of the slide.

      1.2 Students will be able to fully operate the setting and use of single master and multi master, the setting of audio and video in slides, the setting of animation, and the setting of switching effect between slides

2. Content

      2.1 First, set the unified appearance of slides through the theme.

      2.2 Use the master to adjust the unified format of slides.

      2.3 Add various objects in the slide, such as pictures, audio, video, etc., and set a variety of animation effects and switching effects.

      2.4 The advanced slide show can be modified appropriately to see the final show effect.

3. Instructional Strategies (teaching methods)

      Time schedule of three steps of Problem-Based Learning Approach using fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3. Evaluation.

      3.1 Define Problem;

      Step 1: Selected items. Discover problems (10 minutes);

      Student activities: Integrate into the situation, stimulate curiosity, carry out relevant thinking, and generate the desire to complete the task. Task: Making multimedia courseware.

      Teacher activities: Create a real activity situation, guide students to create new situations according to learning or work needs and stimulate their interest in learning.Situation: Teacher's question 1: do you like slides with uniform appearance or messy appearance in class? Teacher question 2: if some dynamic effects, such as animation and video, are added to the slide show, will the presentation be more vivid and attract everyone's interest?

      Step 2: Draw up a plan. Explore existing knowledge and make learning plans (5 minutes).

      Student activities: Advanced applications for PowerPoint.

      Teacher activities: Guide students to Design ppt, set the appearance theme of the slide and the use of the master in PowerPoint, and add various dynamic effects to the slide to make the slide more vivid.

3.2 PBL Task;

Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);

Student activities: Students think by themselves and then start group discussion to determine the design and production of a dynamic multimedia presentation of "Lin Daiyu entering Jia's house"; Various objects are added to the presentation, and various animation effects and page switching effects are set. Then assign the team members to individuals or groups according to their strengths. (1) First, set the unified appearance of slides through the theme.(2) Use the master to adjust the unified format of slides.(3) Add various objects in the slide, such as pictures, audio, video, etc., and set a variety of animation effects and switching effects.(4) The advanced slide show can be modified appropriately to see the final show effect.

Teacher activities: Main questions: design and make a dynamic multimedia presentation of "Lin Daiyu entering Jia's house". Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved (pertinence means combing around the objectives of this activity and taking its essence). In the process of students' operation, teachers should patrol in time to find problems and guide students to solve them. At the same time, encourage group students to help each other, actively communicate and solve problems. Students who have spare capacity for learning are encouraged to think creatively.

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: 1. Overall appearance design of slides. Application of slide master: when entering the master, there is a set of master for each topic, and each set of master is divided according to the plate; The background, theme and other objects in the master can be edited and modified; Format modification such as placeholder and insert object. Show headers and footers. 2. Add sound: insert sound; Sound playback settings; Sound format setting. 3. Add video: insert video; Video playback settings; Video format setting. Add sign frame; 4. Slide Animation: add animation and animation settings for placeholder, smart graphics and sound; Copy the animation, using the animation brush. Use the animation pane to view the added animation, animation sequence, and animation effect settings. Here we mainly adjust the animation sequence and overlay the animation. 5. Slide switching effect: create switching effect, single effect and multi effect settings for the same presentation. Toggle effect settings.

Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand, and can't operate, and give correct guidance in time.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

LESSON PLAN   8

Course / Subject   : Fundamentals of Information Technology
Instructional Topic   : Design a small home page for a children's dance training
institution with PowerPoint
Class Level   : Students of class 1, grade 1 of network engineering major
Time for Instructional   : Friday, November 26, 8 a.m. – 9:50 a.m
Instructor's name   : Li Xiaofeng

1. Objectives
        1.1 Through this course, students will be able to fully operate the setting and
use of single master and multi master, the setting of audio and video in slides, the
setting of animation, and the setting of switching effect between slides.
        1.2 Students will be able to use PPT to design novel and unique pages.
2. Content
        2.1 The method of slide design home page.
        2.2 Use the master to adjust the unified format of slides.
        2.3 Add various objects in the slide, such as pictures, audio, video, etc., and set
a variety of animation effects and switching effects.
        2.4 The advanced slide show can be modified appropriately to see the final
show effect.
3. Instructional Strategies (teaching methods)
        Time schedule of three steps of Problem-Based Learning Approach using
fundamentals of information technology course: 1. Define Problem; 2. PBL Task; 3.
Evaluation.
        3.1 Define Problem;
        Step 1: Selected items. Discover problems (10 minutes);
        Student activities: Integrate into the situation, stimulate curiosity, carry out
relevant thinking, and generate the desire to complete the task.Task: the company
requires you to design a small home page for a children's dance training institution
with PowerPoint.
        Teacher activities: Create a real activity situation, guide students to create new
situations according to learning or work needs and stimulate their interest in learning.
Situation: if you are practicing in a design company, to meet the needs of different
customers, the company will design promotional videos in various formats with
different software every day.
        Step 2: Draw up a plan. Explore existing knowledge and make learning plans
(5 minutes).
        Student activities: Master the application of PowerPoint.
        Teacher activities: Guide students to design interface and slogan.
        3.2 PBL Task;

Step 3: Activity exploration. Put forward assumptions and possible mechanisms (5 minutes);

Student activities: Students think by themselves and then start a group discussion to determine which elements in the design are already determined and which need to be explored together. Based on the discussion, the unsolved problems are decomposed, and then assigned to individuals according to the team members' strengths, or the team works together to solve them.

Teacher activities: Main question: using PowerPoint to design the home page. Based on students' discussion, teachers guide students to collect and sort out the problems that need to be solved (pertinence means combing around the objectives of this activity and taking its essence).

Step 4: Production of works. Identify learning problems and apply self-study (35 minutes);

Student activities: In the process of computer operation, students give full play to the function of the group when they encounter problems and let students' group members solve problems with each other; According to the content of the activity, complete the corresponding operation tasks, further detect the learning effect and consolidate the learning achievements.

Teacher activities: Teachers should give timely guidance, find out the problems of most students and the places where they don't understand, don't understand and can't operate, and give correct guidance in time. Avoid students wasting too much time and improve the efficiency and quality of teaching.

Step 5: Achievement exchange. Reassess and apply newly acquired knowledge (30 minutes).

Student activities: Reassess and apply newly acquired knowledge. The group representatives will share the discussion results and design works of the group members, and the students will demonstrate the works to the whole class in turn.

Teacher activities: Each group is required to integrate new knowledge and operational skills and find solutions to problems by completing the PBL teaching evaluation form. Teachers encourage students to actively show and exchange learning experiences in groups. At the same time, teachers timely participate in some groups, make targeted comments, put forward opinions and suggestions for further improvement, and make a simple summary.

3.3 Evaluation.

Step 6: Activity evaluation. Assessment and reflective learning (15 minutes).

Student activities: Assessment and reflective learning within and between groups.

Teacher activities: Let each group reflect on the learning process, review the learning results, give feedback to each other, and evaluate how the group can work together better all the time. The teacher makes a summary explanation of the

problems missed by the students and the contents that need to be deepened and improved. The results were evaluated with reference to the PBL rating scale.

Media and Learning Resources

Teaching ppt and teaching video, multimedia operation demonstration, sample table demonstration.

Measurement and Evaluation

Assessment and reflective learning within and between groups.

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