

# Exploration and Practice of Question-based Teaching Method in University Digital Logic Course

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**Abstract:** This paper mainly discusses the application of question-based teaching method in digital logic course of university. By raising questions related to the course content before class, this method guides students to think and explore independently, aiming to improve students' learning initiative and promote knowledge in-depth understanding and long-term memory. The results show that the question-based teaching method can effectively improve students' learning effect and interest, and provide useful practical experience for the teaching reform of digital logic course.

**Keywords:** Digital Logic, Teaching Methods, Ask Questions, Learning Motivation.

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## 1. Introduction

With the way of asking questions before class, students are guided to explore independently, which provides a new idea for improving the quality and effect of teaching.

## 2. Theoretical Basis of Question Teaching Method

This part will explain the theoretical basis of question teaching method, including constructivism learning theory, heuristic teaching thought and so on. By analyzing these theories, the paper reveals the mechanism of question-based teaching in promoting students' knowledge construction and improving their learning initiative.

The theoretical basis of question teaching method mainly includes constructivism learning theory and heuristic teaching thought. These theories provide important theoretical support and practical guidance for the question-based teaching method, and help us to better understand its mechanism.

Constructivism learning theory holds that learning is an active process in which learners take the initiative to construct knowledge meaning through interaction with the environment. Constructivism learning theory emphasizes the initiative, sociality and situationality of learning, and holds that learners take the initiative to explore, discover and construct new knowledge with the help of existing knowledge and experience in their interactions with others. In question-asking teaching, teachers guide students to actively think, explore and discover by raising questions to promote students' understanding and construction of knowledge. This teaching method fully embodies the core idea of constructivism learning theory, namely, the initiative and constructivism of learning[1].

The idea of heuristic teaching emphasizes on guiding students to actively think, discover and solve problems through inspiration, so as to achieve the purpose of cultivating students' thinking ability and innovative spirit. The idea of heuristic teaching focuses on students' subjectivity and believes that students are the masters of learning, and the role of teachers is to guide students to discover and solve problems, help students master knowledge and improve thinking ability.

Question-asking teaching method is the concrete practice of heuristic teaching thought. It stimulates students' thinking and inquiry by asking questions, and cultivates students' independent learning and problem-solving ability.

## 3. Function Mechanism of Question-based Teaching Method

### 3.1. Promote Students' Knowledge Construction

Problem-based teaching promotes students' understanding and construction of knowledge by guiding them to think and explore actively. Under the guidance of the question, students need to use their existing knowledge and experience to conduct in-depth analysis and reflection on the problem, so as to form a deep understanding and construction of knowledge.

### 3.2. Improve Students' Learning Motivation

The question-based teaching method fully embodies students' subjectivity and makes students become the master of learning. Under the guidance of questions, students need to actively think, explore and discover, so as to stimulate students' learning enthusiasm and motivation[2].

### 3.3. Cultivate Students' Thinking Ability and Innovative Spirit

Problem-based teaching cultivates students' thinking ability and innovative spirit by guiding them to find, analyze and solve problems. In the process of problem solving, students need to use creative thinking and critical thinking to discover new ideas and methods, so as to cultivate their innovative spirit and practical ability.

### 3.4. Promote Teacher-student Interaction and Cooperative Learning

Question-based teaching method requires interaction and cooperation between teachers and students, and promotes students' understanding and construction of knowledge through communication and discussion between teachers and students. At the same time, the cooperative learning among students is also helpful to improve the learning effect and cultivate the students' teamwork ability.

To sum up, the theoretical basis of question teaching method includes constructivism learning theory and heuristic teaching thought. The mechanism of this teaching method is mainly embodied in promoting students' knowledge construction, improving learning initiative, cultivating thinking ability and innovative spirit, and promoting teacher-student interaction and cooperative learning. Therefore, question-based teaching method is of great significance to improve teaching quality and learning effect[3].

## **4. Implementation Process of Question-based Teaching Method**

This paper introduces the concrete implementation steps of the question-asking teaching method in the digital logic course, including the design principle of the question, the timing of the question, the guidance and management of the students' solution process and the organization of classroom discussion. At the same time, combined with the actual teaching cases, the key links in the implementation process are deeply analyzed. The following is the concrete implementation steps of the question-based teaching method.

### **4.1. Question Design**

Question design is the core of question-based teaching method, which directly affects the teaching effect. In designing questions, teachers should follow the following principles.

#### **4.1.1. Closely Integrated with the Course Content**

The content of the questions should be closely related to the subject matter of the course, ensuring that students have a deep understanding of the course content as they answer the questions. The questions raised can guide students to grasp the focus of the course and gradually enter and explore the course content.

#### **4.1.2. Moderate Difficulty**

The questions should be designed to challenge the students without leaving them feeling overwhelmed. Questions that are too easy will not motivate students, while questions that are too difficult may discourage students.

#### **4.1.3. Open Question**

The questions should trigger students to think from multiple perspectives and cultivate their innovative thinking and critical thinking.

#### **4.1.4. Moderate Quantity**

The number of questions in a class should not be too large, so that students will not get bored. At the same time, it is important to ensure the coverage of the questions and ensure that students can fully understand the course content.

### **4.2. Presentation of Problem**

When presenting problems, teachers need to pay attention to the following points.

#### **4.2.1. Advance Presentation**

Questions should be posted one class before class or earlier so that students have enough time to think and prepare.

#### **4.2.2. Clear Answer Request**

Teachers should clearly inform students how questions are to be answered (e.g. written reports, class discussions, etc.) and what depth and breadth of answers are required.

#### **4.2.3. Provide Necessary Information Or Resource**

Teachers can provide students with some reference books, network resources or experimental equipment to help students

better answer questions.

### **4.3. Guidance and Management of Student Solution Process**

In the process of solving students' problems, teachers need to play the following role.

#### **4.3.1. Supervision and Guidance**

Teachers should check the progress of students' answers in time, and give timely guidance and help to students' problems encountered in the process of answers, so that students can better think and research correctly.

#### **4.3.2. Encouragement and Motivation**

For students who perform well in the process of solving problems, teachers should give full recognition and encouragement to stimulate students' learning enthusiasm, so that the teaching progress can be better.

#### **4.3.3. Feedback and Adjustment**

According to students' answers, teachers should make appropriate adjustments to the questions to make them more in line with students' learning needs and actual situations[4].

#### **4.3.4. Understand Students' Learning Difficulties**

First of all, teachers need to understand the learning difficulties of students with learning difficulties, because of weak basic knowledge, improper learning methods, or incorrect learning attitude. Only by understanding the root of the problem can we provide targeted help and guidance. For some students with difficulties in independent learning, we should give affirmative and correct help and guidance, so that they can explore knowledge more confidently.

#### **4.3.5. Provide Personalized Tutoring**

For different students' learning difficulties, teachers can provide personalized guidance, for example, for students with weak basic knowledge, special training can be organized to help them lay a good foundation; For students with improper learning methods, we can guide them how to learn efficiently and cultivate their independent learning ability.

#### **4.3.6. Create Good Learning Environment**

Teachers can stimulate students' learning interest and motivation by creating a positive learning atmosphere. For example, to organize learning interest groups, carry out extracurricular activities, so that students can find fun in learning.

#### **4.3.7. Guide Students to Make Study Plans**

Help students to make a reasonable learning plan, clarify the learning objectives, and supervise the implementation of the plan. This helps students to develop good learning habits and improve learning efficiency.

#### **4.3.8. Work with Parents**

Keep close contact with parents of students with learning difficulties, pay attention to students' learning status, and jointly develop help plans. The support and cooperation of parents is essential to improve the learning efficiency of students.

#### **4.3.9. Regular Evaluation and Feedback**

Evaluate the learning situation of students with learning difficulties regularly, understand their progress and difficulties, and adjust teaching strategies and methods in time. At the same time, give students timely feedback and guidance to help them better grasp the learning content.

#### **4.3.10. Provide Additional Learning Resources**

For students with greater learning difficulties, teachers can

provide some additional learning resources, such as tutoring materials, online courses, laboratory equipment, etc., to help them better understand and master the knowledge.

#### **4.3.11. Adjust Teaching Methods**

According to the characteristics of students with learning difficulties, teachers need to adjust their teaching methods and adopt more vivid, intuitive and understandable teaching methods to help students better understand knowledge.

#### **4.3.12. Cultivate Students' Independent Learning Ability**

Teach students how to learn independently and cultivate their ability to learn independently. This includes how to develop a study plan, how to use learning resources efficiently, how to conduct self-assessment and feedback, etc.

In short, teachers need to pay attention to the learning status of students with learning difficulties, understand their difficulties, and take effective measures to help them improve their learning efficiency. At the same time, teachers need to guide students patiently and carefully, and give them enough support and encouragement[5].

### **4.4. More Details About Question Design**

When teachers help students with learning difficulties to improve learning efficiency, question design is a key link. Here are some more details on how to design questions.

#### **4.4.1. Set Clear Goals**

In designing the questions, the teacher should first clarify the teaching objectives and ensure that the questions will help the students achieve those objectives. For example, if the goal is to help students understand a certain concept, then the question should be designed around that concept.

#### **4.4.2. Moderate Difficulty**

When designing questions, teachers should take into account the actual situation of students with learning difficulties and ensure that the difficulty of the questions is moderate. Questions that are too easy will not motivate students, while questions that are too difficult may discourage students. Teachers can design questions of different difficulty according to students' level to meet the needs of students at different levels.

#### **4.4.3. Be Connected with Reality**

Connecting the question to a real life or situation can make the question more interesting and useful. By combining theoretical knowledge with practice, students can be helped to understand and remember knowledge better.

#### **4.4.4. Provide Guidance**

When designing questions, teachers should gradually guide students to think deeply. You can start with simple questions and gradually transition to more complex questions to help students gradually master the knowledge.

#### **4.4.5. Feedback and Adjustment**

When designing questions, teachers should also take into account feedback and adjustment. According to the students' answers, teachers can understand the students' mastery of knowledge and adjust the subsequent question design accordingly.

#### **4.4.6. Pluralistic Question Form**

In addition to the traditional multiple choice questions, short answer questions and other forms, teachers can also try other forms of questions, such as case analysis, practical operation, etc., to stimulate students' interest in learning in a variety of ways.

#### **4.4.7. Give Enough Hints**

For struggling students, sometimes they may not know how to start answering questions. When designing problems, teachers can give some hints or guidance to help them find ideas.

#### **4.4.8. Combine with Other Teaching Methods**

Problem design should not be carried out in isolation, but should be combined with other teaching methods. For example, teachers can combine problems with group discussion, experimental inquiry, etc., so that students can learn knowledge in interaction and practice.

#### **4.4.9. Feedback in Time**

After students have answered the questions, teachers should give feedback in time. Teachers should give recognition and encouragement to students who give correct answers. For students who give wrong answers, the teacher should point out the mistakes and give correct guidance and help. Timely feedback helps students better understand their own learning situation and adjust their learning methods and strategies in time.

To sum up, teachers need to comprehensively consider factors such as teaching objectives, students' actual situation, problem inspiration, connection with reality, feedback and adjustment when designing problems. Through well-designed questions, teachers can help students better understand knowledge and improve learning efficiency.

## **5. Cases for Question Design**

Here are some examples of specific questions to help you better understand how to apply the above techniques and methods.

### **5.1. Direct Question**

What is a logical operation? How does he implement the logical function?

### **5.2. Rhetorical Question**

Everyone thinks the answer to this question is A. Do you think A is really correct? Are there other possibilities? Everyone thinks the answer to this question is A, but have you ever considered that if the answer is A, then it raises a whole new set of questions. For example, how does it affect our understanding of the concept? Or does it contradict other known facts? Have you thought about other possibilities? This question uses a rhetorical technique that challenges students' initial perceptions and encourages them to further think and explore multiple aspects of the problem. This kind of question can help students develop the ability to think critically and analyze problems deeply.

Everyone thinks that this historical event was caused by a certain cause, have you ever wondered if this cause is really the only cause? Are there any other underlying factors or circumstances that may have influenced the development of this event? Using rhetorical questioning techniques, this question challenges students' initial perceptions and encourages them to further explore multiple possible causes of historical events. This kind of question can help students develop critical thinking and in-depth analysis of historical events.

### **5.3. Follow-up Question**

What do you think was the impact of this historical event? Can you give some specific examples?

#### **5.4. Adaptability Question**

For starters, start with a simple question: What is logic? For advanced students, you can ask: Explain how logical relationships are implemented?

#### **5.5. Stimulating Question**

Have you ever wondered how voting works? What does this have to do with our circuit?

#### **5.6. Feedback and Evaluation**

Good, you answered the question correctly. You are doing very well. Keep up the learning attitude.

#### **5.7. Interaction and Cooperation**

What do you think is the key to a voting circuit? Each group gives its own answer and then the class discusses it together.

#### **5.8. Individualized Teaching**

For hands-on students, ask: Can you design a four-variable majority voting circuit? For students who are good at theoretical analysis, you can ask: What do you think of four-variable majority voting circuits or multivariable voting circuits from a logical point of view?

Through these specific problem cases, you can flexibly use questioning skills and methods according to the actual situation of students and teaching goals, and better guide students to think and learn knowledge. At the same time, it can also strengthen the interaction and cooperation between teachers and students, and establish a more positive and effective learning environment.

### **6. Application of Rhetorical Question in Teaching**

Rhetorical questions have many application scenarios in education and teaching. The following are some common application scenarios.

#### **6.1. Classroom Discussion**

In class discussions, teachers can ask rhetorical questions to guide students' thinking, challenge their initial perceptions, and encourage them to think from multiple perspectives. By asking rhetorical questions, teachers can help students develop the ability to think critically and analyze problems in depth.

#### **6.2. Student Questioning**

When students raise questions or question a certain point of view, teachers can further guide students to think in a rhetorical way. By asking questions, teachers can help students find answers for themselves and develop their ability to solve problems and learn independently.

#### **6.3. Historical Event Analysis**

In history teaching, rhetorical questions can be used to guide students to in-depth analysis of the causes, effects and backgrounds of historical events. By challenging students' initial knowledge of historical events, teachers can help students develop critical thinking and in-depth analysis of historical events.

#### **6.4. Scientific Experiment Inquiry**

In scientific experiments, rhetorical questions can be used to lead students to think about the design, methods, and

conclusions of the experiment. By asking questions, teachers can help students find problems in experiments and cultivate their ability of experiment design and inquiry.

#### **6.5. Discussion on Moral and Ethical Issues**

In exploring moral and ethical issues, rhetorical questions can be used to lead students to think about moral codes and values. By asking questions, teachers can help students reflect on their own moral concepts and develop their moral judgment and critical thinking skills.

In short, rhetorical questions can play an important role in a variety of application scenarios in education and teaching. By asking questions, teachers can guide students to think deeply and develop their critical thinking, problem solving and autonomous learning skills.

### **7. Organization of Class Discussion**

Classroom discussion is an important part of question-based teaching, which helps to improve students' oral expression skills, critical thinking and teamwork skills. When organizing class discussion, teachers need to pay attention to the following points.

#### **7.1. Reasonable Grouping**

According to the characteristics and learning level of students, the students are divided into several groups for discussion, ensuring that there are different levels of students in each group.

#### **7.2. Guide the Discussion Direction**

During the discussion, the teacher should guide the students to conduct in-depth discussion around the problem and avoid deviating from the topic.

### **8. Advantage of Question-based Teaching Method**

By comparing the traditional teaching method and the question-based teaching method, this paper analyzes the advantages of question-based teaching method in the digital logic course of university. The results show that the interrogative teaching method has significant advantages in improving students' performance, enhancing learning interest, cultivating independent learning ability and creative ability.

### **9. Practical Effect and Reflection of Question-based Teaching Method**

This paper summarizes the practical effect of question-based teaching method in digital logic course, including the feedback of students and the improvement of academic performance. At the same time, combined with the actual teaching process, the shortcomings of teaching methods are reflected, and suggestions for improvement are put forward.

### **10. Conclusion**

This paper summarizes the main points of view and research results, and points out the importance and application prospect of question-based teaching method in university digital logic courses. At the same time, the prospect of future research is put forward to provide direction for further improving the teaching method.

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