A Comparative Study of Classroom Questioning between Novice and Expert Teachers in Primary and Secondary School Information Technology Subject

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Abstract: *Classroom questioning is an essential component of teaching activities and a vital means of communication between teachers and students. Research has shown that teachers' questioning skills significantly impact students' learning outcomes. However, it is challenging for every school to ensure that all teachers possess consistent and high-standard abilities, especially in the field of information technology, which is characterized by slow development, obscure theoretical knowledge, and high difficulty in hands-on operations. Therefore, exploring the differences between teachers at different stages of development in primary and secondary school information technology subjects holds great value and significance. It can not only analyze the excellent teaching abilities of expert teachers and assist them in transforming their practical experience into theoretical achievements but also help novice teachers identify their shortcomings and gaps with others, thereby promoting their professional growth.*

Keywords: Classroom questioning; Information technology subject; Novice teacher; Expert teacher

1. Introduction to the Problem

China is a populous educational powerhouse with a high degree of emphasis on education. Government agencies continuously promote the implementation of new curricula and textbooks, and the general public constantly pursues self-improvement. When it comes to education, the first thing that comes to mind is the teachers working on the front line. They are important participants, service providers, and promoters of the educational cause. Therefore, the teaching level of teachers is of great importance. In classroom teaching, "questioning" is a very important link. The famous Brazilian educator Paulo Freire once said, "Without dialogue, there is no communication; and without communication, there is no true education.[1]"Also, the American teaching methodology expert Sterling G. Calhoun once stated, "Questioning is the basic control means for teachers to promote students' thinking, evaluate teaching effects, and help students achieve expected goals." This requires teachers to make their questions in class meaningful and precise, using classroom questioning to promote the efficient implementation of classroom teaching. Reasonable use of classroom questioning can also create a relaxed and pleasant classroom atmosphere and play a good role in stimulating students' enthusiasm for learning. Moreover, teachers can obtain feedback through questioning and thus conduct a diversified evaluation of students. Especially for beginners in the field of information technology, the subject is obscure and relatively "boring." Teachers need to design questions, using questions as keys to unlock students' minds and as guides to stimulate their interest in learning, helping them overcome various difficulties and making the teaching of information technology more flexible and simple.

At present, the teaching level of front-line information technology teachers is uneven. It is possible to explore the differences between novice and expert teachers from the perspective of teacher professional development. As a master's degree student in the normal specialty, about to enter the novice teacher stage, conducting this research can promote thinking about questions such as "Where exactly are the differences between novice teachers and expert teachers in classroom questioning?" and "How can we promote the faster growth of novice teachers into expert teachers?" The research explores these differences from aspects such as the number of questions, types of questions, relevance of questions, teacher waiting for answers, and response to answers, thereby providing effective suggestions for improving the classroom questioning of novice teachers.

2. Research Design

2.1. Research Subjects

Domestic and international studies generally divide the professional development process of teachers into three main stages: novice stage, proficient stage, and expert stage, These stages reflect the professional growth trajectory of teachers from their initial entry into teaching to becoming senior experts in their field[2]. This study selected two teachers each from the fifth grade of primary school, the second grade of junior high school, and the second grade of senior high school in the information technology subject, totaling three expert teachers and three novice teachers as the subjects of analysis.

Novice teachers are mostly those with a relatively short teaching experience: The "Modern Chinese Dictionary" defines them as "young teachers who have just entered the workplace"; Haixia Shi described "teachers who graduated from undergraduate normal universities and have a teaching experience of 1-3 years" as novice teachers[3]; Xiaonan Wang believes that "teachers with 0-2 years of work experience, graduated from undergraduate normal universities" are novice teachers[4]. Therefore, in this study, novice teachers are those who have been working for less than three years (including undergraduate students in the third year and above, master's students in the second year and above, and doctoral students in the first year and above). According to this criterion, the study selected three novice teachers, two of whom were recent graduates from provincial normal universities, and one was an outstanding young teacher with two years of teaching experience.

The definition of expert teachers is more rigorous: Among foreign scholars, Sternberg is representative. He believes that expert teachers have three main characteristics: solid and systematic subject knowledge, the ability to quickly solve teaching problems, and keen insight and rich creativity[5]. Based on this view, the study believes that it is more appropriate to select expert teachers according to their professional titles and teaching years. Teachers' professional titles largely reflect their professional level, while teaching years can reflect the experience accumulated by teachers. Therefore, this study defines expert teachers as senior teachers with more than 15 years of teaching experience. According to the selection criteria, the author selected three senior teachers through the public display on the school's official website and the enthusiastic recommendations of school leaders, teachers, and students.

2.2. Research Methods

This study mainly adopts the literature method, classroom observation method, interview method, and comparative analysis method. The specific research methods are as follows: 1) Literature method: The literature research method refers to the method of forming a scientific understanding of facts by searching, collecting, identifying, organizing, and analyzing literature materials. This study needs to be based on previous research and analyze the research materials related to the differences in classroom questioning, classroom interaction, and classroom dialogue between novice and expert teachers in information technology courses at home and abroad by collecting, identifying, and organizing them. 2) Classroom observation method: The essence of the classroom observation method is that researchers collect various information materials related to classroom teaching in a unified manner, combining their own experience and using professional tools to achieve the final research goal. This study focuses on comparing the differences in classroom questioning between two different types of teachers, novice and expert teachers in information technology courses. It selects the method of retrieving listening records and uses classroom video and audio recordings to record the teaching work of expert and novice teachers. 3) Interview method: Also known as the conversation method, it is a basic psychological research method that understands the psychology and behavior of respondents through face-to-face conversations between interviewers and respondents. Interviews were conducted with the three expert teachers and three novice teachers involved in this study to analyze the differences between novice and expert teachers in how they prepare questions before class and how they reflect on the questions in class, thereby exploring the differences between novice and expert teachers and finding out the problems of novice teachers.

2.3. Research Plan

Step one: First, collect a large number of related documents, including journals, conferences, forum lectures, or master's and doctoral dissertations related to the differences between expert and novice teachers in classroom interaction, classroom dialogue, and classroom questioning. Summarize and

integrate domestic and foreign related documents, extract the definitions of related concepts, research methods, differences, and other theoretical foundations, and compile classroom questioning behavior observation scales and interview outlines on this basis.

Step two: Repeatedly watch the listening records, classroom audio and video recordings, and other materials of the six teachers, and fill in the data into the observation scales to form a complete classroom questioning behavior observation scale. In addition, conduct one-on-one interviews with the six teachers during spare time to understand their teaching styles and their own preparation and reflection on classroom questioning.

Step three: Use Excel and SPSS software to process the obtained data and analyze the differences in various aspects of classroom questioning by information technology teachers at different stages of development, such as the number of questions, types of questions, relevance of questions, teacher waiting for answers, and response to answers, from a quantitative perspective.

Step four: Analyze and summarize the comparative study of the two types of teachers, and give optimization suggestions for classroom questioning of novice teachers in places where there are differences between novice and expert teachers, helping novice teachers grow faster.

2.4. Compilation of Scales

Firstly, through consulting relevant literature, it was found that research on classroom questioning is mostly divided into the following five parts: the attributes of questions, the ways of questioning, students' answers, and teachers' responses to answers. After reviewing a large number of journals and master's and doctoral dissertations, this paper refers to the observation scales in the dissertations of Duanyang Liu and Zhongxin Zhao, and adjusts and improves them on this basis to obtain the observation scales of this paper. The following table is a detailed record of the six teachers' classroom observations from the aspects of "number of classroom questions", "types of classroom questions", "relevance of questions", "teachers' questioning methods", "waiting time for questions to be answered" and "teachers' reasoning and answering methods" (see Table 1).

Table 1: Statistics of Classroom Dialogue Records of Six Teachers.

Dimension	Observation Point		Novice Teachers	Expert Teachers
Attributes of Questions	Number of Questions		54	45
	Types of Questions	Memory Questions	17	4
		Comprehension Questions	15	9
		Application Questions	10	10
		Analytical Questions	6	13
		Synthesis Questions	4	5
		Evaluation Questions	2	4
	Timing of Questions	Class Introduction	7	12
		Course Presentation	20	17
		Content Summary	8	8
		Exercise Section	19	8
	Level of Questions	Simple, Direct Repetition Answers	35	18

		Difficult, Requires Student Thinking	17	25
		Very Difficult, Cannot Answer in a Short Time	2	2
Ways of Questioning		Whole Class Answering	8	0
		Individual Student Answering	0	0
		No Need to Answer	0	3
		Waiting for Students to Think, Then Whole Class Answering	30	17
		Waiting for Students to Think, Then Individual Student Answering	16	18
		Waiting for Students to Think, Then No Need to Answer	0	7
		Whether There is Follow-up Questioning	NO	YES
Students' Answers		Correct Answers	25	28
		Incorrect Answers	24	14
		No Answer, Silence	5	3
Teachers' Responses to Answers	When Students Answer Correctly	Praise	25	18
		No Reaction	0	0
	When Students Answer Incorrectly	No Reaction	0	0
		Interrupt, Do Not Point Out the Mistake, Ask Another Student	0	0
		Interrupt, Point Out the Mistake, Continue Answering	0	0
		Point Out the Mistake After Answering	24	13
		Comfort and Encourage	24	11
		Criticize	0	4
	No Answer	Ask Another Student	0	0
		Encourage and Guide to	0	3

		Answer		
		Encourage and Ask Another Student	5	0
		Criticize	0	1
		No Reaction	0	0

3. Differential Analysis

3.1. Attributes of Questions

According to the statistical data, novice teachers asked a total of 54 questions, with an average of 18 questions per novice teacher; expert teachers asked a total of 45 questions, with an average of 15 questions per expert teacher. It can be seen that there is not much difference in the number of questions between novice and expert teachers, with novice teachers having a slightly higher number of questions.

There is indeed a significant difference in the types of questions raised by teachers[6]. Novice teachers tend to use more low-level questioning, such as memory, comprehension, and application questions, while using fewer analytical, synthetic, and evaluative questions. Expert teachers have a more balanced use of high-level and low-level questioning, which indicates that expert teachers can better employ questioning strategies. It also reflects that teachers can design questions according to the differences in knowledge, and the design of questions is more inclined towards valuable questions. In low-level questioning, the number of comprehension questions is much higher than that of memory questions, which reflects that in the classroom questioning, expert teachers are more inclined to ask students questions that require thinking to arrive at answers. This can further deepen students' understanding of knowledge points and is more conducive to mastering knowledge content[7].

The targeting and difficulty of teachers' questions also vary[8]. As the above data shows, novice teachers' questions mostly appear in the course presentation and exercise sections, while expert teachers usually ask questions during class introduction and course presentation. This also indicates that novice teachers focus more on the explanation of the course, with the requirements for students mainly focusing on memorization, recitation, and repetition. Expert teachers, on the other hand, pay more attention to guiding students, helping them learn how to learn, and thus assisting students in completing inquiry-based learning. This not only stimulates students' interest in learning but also promotes the improvement of students' thinking level[9].

3.2. Ways of Questioning

Both types of teachers prefer to use the method of whole-class collective answering, but there are differences in the specific operations of the two teachers: Expert teachers mostly use the method of "waiting for students to think, then whole-class answering" plus "waiting for students to think, then individual student answering"; novice teachers mostly use the method of "waiting for students to think, then whole-class answering." Although the method of collective answering can make the classroom atmosphere more lively, this method can "eliminate" the personalized thinking of many students and also give students the opportunity to take advantage of the situation, thereby reducing the individual participation of students. Expert teachers have considered this kind of problem, so they use the method of collective answering and individual questioning, which not only enlivens the classroom atmosphere but also gives students the space and opportunity to think and express themselves.

Neither novice nor expert teachers almost use the method of "no need to answer," which shows that teachers are aware of the importance of students' participation and interaction in the classroom[10]. Expert teachers may use the method of "no need to answer" in content summary or exercise parts, leaving students with a blank space for thinking about the course. This method proves that expert teachers are more capable than novice teachers in stimulating students' interest in learning, developing students' thinking, and promoting students' in-depth learning.

In terms of "follow-up questioning," teachers at different stages of development also show differences[11]. Expert teachers pay more attention to the follow-up questioning link: When students

answer incorrectly or cannot answer, teachers will ask follow-up questions with the purpose of guiding students to think and finding out the problems of students; when students answer correctly, teachers will also ask follow-up questions, which are intended to diverge students' thinking and sublimate students' answers. Novice teachers often ignore this link, and none of the three novice teachers asked follow-up questions after questioning.

3.3. Teachers' Responses to Answers

At present, there are few studies on teachers' responses to answers alone at home and abroad. Therefore, the author, based on the basic theories in a large number of documents, divides teachers' responses to answers according to the actual situation of the classroom and his own experience:

1)After students answer correctly, after students answer incorrectly, and no answer. From the data analysis, it can be seen that the way teachers respond to answers is very unified when students answer correctly, which is "praise"; while when students answer incorrectly and there is no answer, there is a big difference between novice teachers and expert teachers. Fortunately, none of the six teachers used the "no reaction" method in any situation, which shows that teachers recognize the importance of responding to answers and the integrity of questioning.

2)When students answer incorrectly, novice teachers all use the method of "pointing out the mistake after answering" plus "comfort and encouragement," and there is no situation of interrupting students' answers or criticizing. In terms of emotional attitude, novice teachers have considered students' feelings and emotions. Expert teachers, on the other hand, seem not to be so amiable. Teachers will use a combination of "pointing out the mistake after answering," "comfort and encouragement," and "criticism." They will adopt different response strategies for different types of students, which is very personalized; they will give different feedback for different types of mistakes. Some mistakes are due to students not thinking clearly for the time being, while some mistakes are caused by students not listening carefully in class; it is not terrible to make mistakes. When students make mistakes, the strategy of first praising and then criticizing or first criticizing and then praising is more effective for students to correct their mistakes.

3)When there is no answer from students, novice teachers mostly use the method of "encouraging and asking another student to answer," while expert teachers mostly use the method of "encouraging and guiding to answer." This reflects that novice teachers have a strong purpose in asking questions, eager to get the correct answer from students. Although they have adopted an encouraging attitude, they still have not given the first student the opportunity to answer correctly. Expert teachers focus on guiding students to answer questions. When students cannot answer, teachers do not give up on students but help them think and promote the operation of students' brains.

4. Interview Analysis

4.1. Pre-class Design Phase

All six teachers stated that they would carry out pre-class design, which shows that teachers understand the importance of pre-class design. However, there are differences in the focus of question design between the two types of teachers: Novice teachers design classroom questions focusing on the teaching process, designing classroom questions according to the teaching process; expert teachers focus on the key points and difficulties of this class when designing questions before class, designing questions according to the key points and difficulties. This reflects the gap in teaching concepts between the two types of teachers. Novice teachers pay more attention to the development and completion of classroom teaching content, and their questions are more procedural. Expert teachers' questions in the teaching process are more targeted.

4.2. Post-class Reflection Phase

Both types of teachers will carry out post-class reflection on classroom questions. Novice teachers focus on the correctness of the answers and the smoothness and completeness of the question development; expert teachers pay more attention to the specific answers of students after questioning, pondering the students' thinking in their answers, and thus summarizing the effectiveness of the question design and continuously improving the questioning link.

5. Summary and Suggestions

The purpose of this study is to find out the differences between novice and expert teachers in the classroom questioning link of information technology courses, clarify the gap between novice and expert teachers, and help novice teachers grow faster. After statistical and analytical data, the following preliminary conclusions are drawn:

1)Novice teachers ask more questions, and the types of questions are at a low level; expert teachers have a more balanced type of questions, focusing on high-level questions.

2)The timing of novice teachers' questions is mostly in the classroom presentation and exercise parts; expert teachers' questions are mostly located in the class introduction and course presentation parts.

3)The difficulty coefficient of novice teachers' questions is low, and there are few difficult questions; experts mostly ask questions that are slightly difficult and require students to think.

4)Novice teachers mostly use the form of waiting for students to think and then answering as a whole class, without follow-up questioning; expert teachers mostly combine whole-class answering with individual students answering, and there will be follow-up questioning.

5)In terms of teachers' responses to answers, novice teachers mostly use encouraging and comforting strategies, caring about students' psychological state; expert teachers' responses are more complete, adopting behaviors such as criticism, encouragement, and guidance, paying attention to students' psychological state as well as their learning dynamics.

6)Both types of teachers pay great attention to the questioning link, have spent effort on question design, and have reflected in time after class. However, their focuses are not the same: novice teachers focus on the teaching process, while expert teachers focus on the specific implementation effect.

In view of the above conclusions, the author would like to offer some suggestions to novice teachers, hoping to help young teachers:

1)In terms of question design, teachers should focus on the questions themselves and not blindly design "mindless" questions for the sake of progress[12]. It is recommended to increase high-level questioning to guide students to think and thus promote the entire teaching activity. Appropriately reduce the number of questions to improve the effectiveness of questions, find the right timing for questioning, stimulate students' interest in learning, and guide students to learn in depth[13].

2)The design of questions should be balanced. The types and levels of questions should not be overly simple. They should be progressive to help students improve step by step.

3)Teachers should pay attention to improving the coverage of questioning and the individual participation of students, ensuring that every student is involved in the classroom.

4)Novice teachers should pay attention to every student in the class, fully understand the characteristics of each student, and ask different types of questions for different students. When students answer incorrectly, they should not only encourage and comfort but also learn to use the "Socratic method" to guide students and help them complete the questions.

5) Reflection is an essential quality and ability for an excellent teacher. Therefore, teachers should learn to reflect on themselves, review the courses that have ended on the same day, find their own shortcomings, and then correct and improve.

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