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Research on Teacher Questioning in Small Class Science Collective Teaching Activities

Luo Yuchen, Ma Lisha

Zunyi Normal University, School of Teacher Education, Zunyi, 563006, China

*Corresponding to: Luo Yuchen

Abstract: Effective teacher questioning in collective science teaching activities can guide children to better explore and love science, enhance their scientific literacy, and is an important way to achieve educational goals and connect the teaching process. Through literature and observation methods, it was found that in current small-class science collective teaching activities, teachers ask questions about excessive cognitive and memory issues, short waiting times for answers, tending to call collectively, and teachers' feedback methods too monotonous. These situations are analyzed and studied to seek appropriate improvement strategies to promote effective scientific collective teaching activities

Keywords: small class children, scientific collective teaching activities, teacher questions

1 INTRODUCTION

Teacher questioning is a way for teachers to set up question scenarios based on children's existing knowledge and experience, based on the teaching objectives, thereby inspiring children to think and answer. At appropriate times, teachers ask developmental questions to children, providing scaffolding for further thinking development based on the children's current level. In this process, effective questioning acts as a catalyst that improves the quality of scientific activities, stimulates children's curiosity and desire to learn in scientific fields, guides them to explore scientific phenomena through practice, facilitates smooth and in-depth scientific activities, and promotes the development of children's thinking abilities

Teacher questioning is one of the most frequently triggered types of language in early childhood classrooms, especially in the United States, where research on teacher-child language interaction has confirmed this. In recent years, Chinese scholars have also begun to pay attention to teacher questioning. Gao Cuijuan pointed out: strategies for effective questioning should include emphasizing the use of interactive questioning, scientifically and reasonably designing questioning steps, and fully stimulating children's interest in learning. Regarding the design of effective questioning, Xu Yanwei studied the conceptual, design, and formal factors affecting the effectiveness of teachers' classroom questioning, proposing that to improve the effectiveness of classroom questioning, teachers' desire for control should be avoided to interfere with questioning orientation, and teacher-student perspectives should be integrated based on question design, using questioning formats to balance differences in students' cognitive levels. Li Shuting pointed out that in science education activities, the content of children's questions is detached from the activity objectives, and the design of questions does not effectively stimulate children's active thinking tendencies. Besides the impact of question design, there is also a mismatch between the quantity and quality of teachers' questions in current kindergarten science activities, making it difficult to provide deeper and more effective guidance and inspiration for the quantity and quality of teachers' questions. Additionally, Liu Qiufeng pointed out that teachers ask questions too frequently, which affects children's enthusiasm for participating in teaching activities. Additionally, Liu Lihua pointed out that the number of types of questions children ask varies greatly depending on timing, with children's questions at a relatively low level, teachers paying less attention to their questions, and teachers responding positively to children's questions with fewer positive responses.

In summary, existing research mainly focuses on the design of teacher-questioning segments in teaching activities, the current situation of the number and frequency of questions asked, and the exploration of strategies to improve questioning effectiveness. However, few scholars examine the impact of teacher feedback methods on children's enthusiasm for answering and the way questions are called up in collective science teaching activities on children's participation. This article will study the problems arising from teachers'

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questioning in small class science collective teaching activities and offer suggestions

2 Research Subjects And Methods

2.1 Research Subjects

Kindergarten A is located in Xinpu New District, Zunyi City, and is a provincial-level model public kindergarten. The kindergarten's environment matches the characteristics of Anji Games, with buildings arranged safely and reasonably, and facilities fully functional. There are 7 teaching classes with 19 full-time teachers. The kindergarten places great emphasis on organizing science teaching activities, with an average of 1-2 science group teaching sessions per week

Based on the actual needs of the thesis, teachers C and X from Class 1 and children were selected as research subjects. Teacher C has 10 years of teaching experience at Kindergarten A, serving as a small class teacher and small group research group leader, with rich and solid professional practice experience and abilities. Through in-depth observation and understanding of the class, I found that Teacher L fully respects and loves children, possesses a sense of responsibility and mission in the early childhood education field, and emphasizes the integration of theory and practice. Kindergarten teachers X and C are in the same class and serve as assistant teachers for that class, with 2 years of teaching experience. They actively participate in training related to scientific activities organized by the kindergarten, absorb and receive advanced and excellent educational concepts, and continuously improve their teaching and teaching level

2.2 Research Methods

2.2.1 Literature Review Method

By conducting advanced searches in the CNKI database for keywords such as "small class science collective teaching activities" and "kindergarten teacher questions," keyword searches were performed in VIP Chinese journals; Reviewed and organized domestic and international journals, books, and master's and doctoral theses related to preschool teachers' science activities, including the current research status and effective questions posed by kindergarten teachers, to understand the latest research trends in this field, and to organize and summarize based on actual conditions.

2.2.2 Observation Method

This paper references the four question types proposed by Zhang Yucheng in Liu Zhanlan's "Preschool Children's Science Education," the waiting times in Chen Ling's "A Review of Research on Teachers' Classroom Questions at Home and Abroad," and the feedback methods from Li Xiaoping's "Observational Study on Teachers' Classroom Questions in Kindergarten Language Teaching Activities." The four types of questions include cognitive memory questions, reasoning questions, creative questions, and critical questions; The waiting time is observed as 3-4 seconds, divided into no waiting time, 0-1 second, and over 5 seconds; Teachers provide feedback by answering correctly, answering incorrectly, remaining silent, or giving incomplete answers

This paper mainly uses a non-participatory observation approach to observe teachers' questions in small class science group teaching activities. Non-participatory observation ensures that the teaching activities of the study subjects are not influenced by the researchers, making the observation results more authentic and objective. Then, observation record forms are used to record and analyze the specific questions posed by the teachers and the responses of the children

3 Problems And Analysis Of Teachers' Questions In Small Class Science Collective Teaching Activities

3.1 Too Many Cognitive And Memory Problems, But Few Creative Problems

Based on Zhang Yucheng's proposal for four types of questions related to scientific inquiry, teachers need to learn to adjust the cognitive level of the questions, using questions of different levels as frameworks to help children mobilize experience and think divergently. Teachers can first pose cognitive and memory questions to engage children's knowledge and experience, then use reasoning questions to enhance their thinking abilities. Finally, creative questions are used to divert and inspire children's thinking; such questions are effective. However, most of the questions raised by teachers are cognitive and memory-based, requiring children to think in a specific direction. Having only one or a few fixed answers cannot effectively engage children's thinking, and the questions lose their value

Observation Record 1: Preschool Science Activity "Whose Hands and Feet Are These?"

Teacher: Do you recognize your own little hands and feet?

Child: Know/Don't.

Teacher: Let's get to know what is in the picture together.

Children: Little hands and feet.

Teacher: What are they like?

Child: Chang Chang / There are five / Don't know.

Teacher: Amazing, every hand and every foot has five fingers.

Teacher: So what can we do with them?

Children: Eat/jump/run/crawl.

Teacher: Great! Our little hands can be used for eating, crafts, and playing with toys; Our little feet can be used for walking, jumping rope, and running.

Teacher: Children, look, what is on the picture?

Children: Little duck / kitten / bird / monkey.

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Teacher: The pictures show the duck's feet, the kitten's paws, the gorilla's arms, and the bird's claws.

Teacher: Look at the duck's feet in the picture. What can be done?

Child: Pointy/Don't know, playing in the water/Walking.

Teacher: The duck's paws have webs, like little fans. It allows the duckling to glide through the water.

From observation record 1, we can see that the teacher raises questions such as "What is it?" "What are you doing?" There are many such cognitive and memory questions, while creative and reasoning questions that expand children's thinking are not fully applied in the activities. During the activity, teachers teach by asking questions based on pictures. After raising cognitive and memory questions, children can quickly respond without much thought based on the pictures. Over time, this can lead to decreased enthusiasm and poor concentration among children, and fail to fully stimulate their interest in inquiry

3.2 Short Waiting Time For Answers, Children Lack Time To Think

The waiting time refers to the time teachers spend waiting for children to respond after asking a question. Some researchers suggest that teachers should allow at least 3-4 seconds for children to think after asking low-level questions, and increase to 15 seconds after asking higher-level questions. High-level questions refer to questions that children need to use their existing knowledge and experience to answer, while low-level questions are those that children can answer directly using their existing knowledge and experience. After conducting experiments, psychologists found that increasing the waiting time after asking questions has a positive effect on both children and teachers. Teachers pay more attention to enriching questioning strategies to enhance the effectiveness of questioning. At the same time, it provides children with more space for thinking and more time to think, thereby inspiring thinking. However, after teachers ask questions, in order to rush children to answer quickly, without giving them enough time to think, they simply let them answer, which fails to effectively inspire thinking, and such questioning loses its effectiveness

Observation Record 2: Toddler Science Activity "Animal Hibernation"

Teacher: Let's take a look together. Who is this?

Toddler: Little hedgehog. (0-1 second).

Teacher: What does it do inside?

Child: Sleep. (0-1 second).

Teacher: That's right, it's sleeping. Where is it sleeping?

Children: Inside/under the leaves. (0-1 second).

Teacher: Where is it?

Child: Under or inside the leaf. (0-1 second).

Teacher: It's in the pile of fallen leaves.

Teacher: When winter comes, what is it called when it sleeps inside?

(After the teacher asks the question, the children do not respond. After 1-2 seconds, the teacher directly gives the answer.)

Teacher: It's called hibernation. Hibernation means to sleep.

Teacher: So let's take a look. What is this?

(After the teacher asks the question, the children do not respond. After 1-2 seconds, the teacher directly gives the answer.)

Teacher: This is soil. Can you guess whose home this is?

Child: The little hedgehog's home. (0-1 second).

Teacher: Is this the little hedgehog's home? We just saw where the little hedgehog's home is.

Child: Pile of leaves. (1-2 seconds).

From observation record 2, it can be seen that the teacher continuously asks children questions about the animals' "where they live" and "what they do," with the waiting time for the children to answer generally between 0-1 seconds after the teacher asks. Based on the analysis of observation records, it can be found that the teacher's questions are relatively simple, and the children can quickly answer with brief language. The teacher does not wait for the children to explain in detail. When the children do not answer immediately, the teacher does not give them time to think independently but quickly provides answers without waiting too long. However, children lack time to understand and think about problems, which not only affects the effectiveness of their responses but also hinders the development of their thinking

3.3 The Way They Call And Respond Tends To Be Collective, Ignoring Individual Differences Among Children

There are three types of call-to-answer methods: group answers, answering by raising hands or not raising hands, and free answers. Every child has their own unique thinking abilities. Science teaching activities require teachers to guide children to explore and discover, stimulate active thinking, and encourage children to describe their discoveries with their own unique thinking. In small class science group teaching activities, effective teacher questioning should consider all children, allowing each child to freely express their exploration and discoveries. However, in group teaching activities, teachers only ask questions to the group; children simply answer in unison, failing to notice different children's different views on the same question, which is a sign of inefficient questioning.

Table 1. Statistics Table Of Call-And-Answer Methods In Small Class Science Collective Teaching Activities

The way to call out	Collective answer	Raise your hand or not raise your hand	Answer freely

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Frequency	221	115	0
percentage	65.8%	34.2%	0%

From the table, it is found that in small class science group teaching activities, 65.8% of the call-up methods used by teachers are collective responses by children, 34.2% are children who raise their hands or do not raise their hands, and 0% answer freely. It can be seen that teachers tend to prefer collective responses by children. Although children in the same age group share common developmental characteristics, individual differences in development among children of the same age group should not be ignored. Some children do not think independently during group answers and only echo other children. Teachers also easily overlook whether all children are participating in answering, and individual independent thinking ability is not developed.

3.4 *Teachers' Feedback Methods Are Too Simplistic*

Teacher feedback types include correct answers, incorrect answers, silence, or incomplete answers. Correct answers include targeted praise, simple affirmation, follow-up questions, repetition, and summarizing children's answers; Incorrect answers include direct denial, teacher substitute answers, substitute answers, and ignoring children's answers; Silence or incomplete answers include teacher prompts, repeated questions, and teacher substitute answers. For the same question, different children answer from different angles, and different feedback methods can produce different effects. After children answer, teachers must promptly provide effective feedback to make questions more complete. In science activities, the value of teacher questioning lies in inspiring children to think independently and explore scientific knowledge together. Therefore, appropriate response methods can provide children with positive and effective feedback to enhance their initiative in exploring science and their divergent thinking. However, after the child is asked a question and cannot answer, the teacher simply answers on behalf of the teacher and moves on to the next question. This fails to effectively stimulate children's thinking and expression, nor to tap into their unique thinking abilities. Such questions lose their effectiveness and value.

Observation Record 3: Preschool Science Activity "The Magical Tail"

Teacher: What does a swallow's tail look like?

Child: Like scissors.

Teacher: That's a correct answer. The swallow's tail is pointed like scissors.

Teacher: What is its tail used for?

Child: You can move.

Teacher: Its tail helps swallows determine the direction of flight.

Teacher: Children, look, who is this animal?

Child: Little Squirrel.

Teacher: That's right! What does the little squirrel's tail look like?

(If the children do not answer, the teacher will directly give the answer.)

Teacher: The little squirrel's tail looks like a broom. What is it used for?

Child: You can shake it around.

Teacher: Its tail can stand upright to block the sun in summer, cover itself as a blanket in winter, and keep its balance when jumping.

Teacher: Their tails are all very strong. What if they don't have tails?

Child: It will hurt a lot.

Teacher: Are there any other things?

(If the child does not answer, the teacher will directly give the answer.)

Teacher: If a swallow loses its tail, it will have trouble controlling its flight direction. A squirrel cannot maintain balance when jumping.

Teacher: Can their tails be swapped?

Child: No, you can't.

Teacher: Awesome! Each little animal's tail has a unique function; they cannot be interchanged.

From observation record 3, it can be seen that when children answer correctly, the teacher's feedback is mostly "Awesome!" "The answer is truly correct," a simple affirmative approach without concrete praise or deeper questioning of the children. When children answer incorrectly or their answers do not match the teacher's, the teacher chooses to ignore the child's response. When the child does not answer, the teacher directly gives the answer on their behalf. It can be seen that the teacher's feedback to the children's answers is rather mechanical and the feedback content is rather single

4 Suggestions For Teacher Questions In Small Class Science Group Teaching Activities

4.1 *Combining Multiple Question Types, Questions Should Be Asked With A Gradient*

Questions before the start of the kindergarten science group teaching activity can quickly focus all children's attention, shifting their thinking from a relaxed state to the science activity topic. At this time, teachers can use some cognitive and memory questions that interest children and are related to the goal, reduce questions unrelated to knowledge points, boost children's confidence and activity during activities, and also mobilize their existing knowledge and experience. Secondly, teachers need to

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flexibly ask questions based on lesson preparation during activities, encouraging children's thinking to continue moving forward and inspiring further thinking. At this time, reasoning and creative questions can be used to stimulate children's thinking, guide them to think more deeply, find solutions, and enhance their creative thinking abilities. After raising questions, teachers can encourage children to boldly express their ideas, thereby creating a positive and open environment. In this environment, children can easily and happily construct the meaning of knowledge independently, rather than being forced to accept fixed scientific knowledge. Finally, the questions raised at the end of the activity should help organize and elevate children's experiences and broaden their thinking. At this time, critical questions can be used to guide children to express their views and make judgments based on their prior experience. In summary, effective teacher questioning should be conducted within the children's proximal development zone, based on their prior experiences and using various types of questions as frameworks to awaken children's thinking abilities and inspire their thinking. Because different types of questions have different effects and effects on both children's development and the activity itself.

The questions asked should have a gradient, match the children's cognitive level, and meet their developmental needs. Questions should have a gradient, meaning they should be layered, progressively progressive, and stimulate deep thinking and active thinking activities; Teachers can break down difficult questions into smaller questions that children can understand, then ask questions step by step, gradually guiding children to develop deeper thinking. This can cultivate children's thinking abilities from multiple aspects, helping them grasp key points and overcome difficulties, thereby improving activity efficiency

4.2 Sufficient Waiting Time Should Be Given To Give Children Space To Think

In small class science teaching activities, teacher-organized collective science teaching activities always have teaching objectives. In these activities, teachers should focus on cultivating children's understanding of plants, animals, or natural phenomena, as well as their scientific inquiry skills. Questions should be directed to these knowledge to better achieve teaching objectives. The time required to wait for answers is very important. Therefore, after raising creative or reasoning questions, teachers can wait 3-4 seconds to allow children to think clearly before answering, rather than rushing to seek the "correct answer." If children cannot answer, they can wait about 5 seconds before repeating the question or giving simple hints. From the children's perspective, understand and analyze the reasons why they cannot answer, and further adjust their questions. Teachers should not only seek responses but lack professional awareness to analyze children. In scientific collective teaching activities, teachers should leave appropriate time for children to think based on the difficulty of the questions. Lower-level questions emphasize memory and understanding, focusing on mobilizing the knowledge and experience children already have. Therefore, the waiting time can be shorter. However, for higher-level questions, children need to undergo a series of in-depth thinking, including analysis, speculation, and comparison, before making judgments. At this time, waiting time can be appropriately increased, which helps children think and organize their answers, mobilizing more knowledge and experience, and thereby diverting their thinking. However, waiting time is not always better; young children are lively and energetic and cannot spend long periods quietly thinking and listening. At the same time, teachers must consider teaching efficiency and time constraints to avoid excessive waiting. Therefore, teachers should be good at analyzing key issues in teaching activities, identifying the most valuable content for children's thinking development, not rushing to answer on behalf of children, and giving children appropriate waiting time to enhance the effectiveness of questioning

4.3 Pay Attention To All Children And Increase Participation

When asking questions, teachers should address all children. A small group or free answers may be required, but most should be answered individually. It is important to observe both those who actively raise their hands and those who are unwilling to raise their hands. In teaching activities, teachers should understand each child in the class, analyze their personality and knowledge level, and then pose questions of different levels and levels so that every child can actively participate. Since each child has different personality traits, their level of enthusiasm for participating in activities also varies. Some children are very active and very enthusiastic during activities. When the teacher asks a question, they respond quickly, sometimes even jumping in to answer immediately. Some children are introverted; even if they know the answers, they don't dare to answer loudly. At this point, teachers need to ask questions tailored to the different situations of the children. For more difficult and flexible questions, you can invite children with active thinking and strong abilities, or answer them in groups. After careful consideration, they can have a positive impact on the thinking of all children. For children who lack confidence or are timid due to personality or other reasons, teachers can ask relatively simple or basic questions to build their confidence. Regardless of whether the answers are correct, teachers should offer positive and positive encouragement, encouraging children to actively answer questions and thereby increasing their enthusiasm for participation. Only by addressing all children can children's attention be focused on learning activities, and at the same time, teaching should be tailored to each child's abilities, so that they can gain something from the activity and develop through it

4.4 Provide Appropriate Responses To Children To Boost Their Enthusiasm

After a child finishes answering, teachers should not simply summarize with a single sentence like "Great answer." Faced with such praise, children do not know where their answers are great. Praise that is too frequent and purposeless causes children to ignore the teacher's praise and lose its original value. Therefore, teachers should provide explanatory evaluations of children's answers. If a child answers well, explain clearly what is good; If a child answers poorly, then where the mistake lies and how to do it well, while providing timely psychological

comfort to prevent negative emotions. When a child answers correctly, the teacher should affirm the child's viewpoint and then conduct simple follow-up questions. Based on the child's original answer, this approach guides children to a deeper understanding of the problem or encourages them to try thinking from different perspectives. Follow-up questions can be a retelling of the original question, using different tones to emphasize the main point, or posing a new question that allows children to solve it with their own way of thinking. This not only reflects children's subjectivity but also allows the teacher's guiding role to be fully realized. When children answer incorrectly, teachers should not immediately use verbal or nonverbal methods to deny the child, as this can make them feel frustrated and lose the courage to answer. Teachers can first ask the children for their thoughts, guide them to verify their answers and correct their mistakes, or encourage them to try thinking from a different direction. This not only protects their confidence but also leaves a deep impression. When children dare to answer, their enthusiasm increases. When children give incomplete answers, teachers can provide clues to guide them to supplement their answers. When children cannot answer the question, teachers should not directly state the answers; instead, they can break down the questions or provide simple hints to guide them to find answers. Therefore, teachers should be patient when asking questions, listen carefully to children describe their own minds, and appropriately add questions to guide children to express as much as possible and think differently.

5 CONCLUSION

In summary, scientific activities occupy an important position in the development of preschool education. Group teaching activities are one of the main teaching forms in kindergartens. Teacher questioning serves as a tool and means for teacher-child communication in collective teaching activities, effectively enhancing children's thinking and learning abilities. This paper selects "A Study on Teachers' Questioning in Science Group Teaching Activities for Small Class Children" as the research focus. Based on actual observations in kindergartens, it uses literature and observation methods to examine the types of teaching questions, waiting times for answers, methods of shouting, and teacher feedback. The main research conclusions are as follows:

Through observation and analysis, it was found that the types of questions teachers ask are relatively single, lacking comprehensive and holistic research on science education; Waiting time for questions does not increase or decrease with question difficulty, leaving little time for children to think; When teachers provide feedback, they mostly analyze children's answers from the perspective of whether the answers are correct, lacking attention to the development of children's thinking through answers. Through field observations in kindergartens, problems in teachers' questioning in small class science collective teaching activities are analyzed, and based on current observations, suggestions for improving the effectiveness of teacher questioning are proposed.

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