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Research on the Innovative Models and Practical Effects of Science Education for Preschool Children

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Abstract: The aim of the study is to explore the application of innovative models in science education for pre-school children and their practical effectiveness. In the current educational context, science education for pre-school children is particularly important, not only because of its role in promoting the development of children's cognitive, social and emotional skills, but also because it provides children with initial ways to explore the world. The study analyses innovative educational models such as inquiry-based learning, play-based learning and living teaching, and explores the effectiveness and challenges of these models in practical application. Through case studies and practical feedback, the study aims to provide a comprehensive perspective on how these innovative models can be effectively integrated into pre-school science education to stimulate children's interest, enhance motivation for learning, and promote children's holistic development.

Keywords: pre-school children, science education, innovative model, practical effect research

Introduction

With the rapid development of society and the advancement of science and technology, there is a growing demand for science education for pre-school children. Science education not only provides children with a window to the natural world, but is also an important means of developing their critical thinking and problem-solving skills. However, the traditional teacher-centred education model can no longer fully meet the current needs of children's learning. Therefore, this study focuses on innovative educational models such as inquiry-based learning, game-based learning and life-based teaching, aiming to explore the application of these models in pre-school science education and their potential for improving educational outcomes.

1.The significance of science education in kindergartens

1.1The role of science education in early development

Science education plays an integral role in the early developmental stages of preschool children. Through exploration of the natural world and their surroundings, children begin to develop a basic understanding of how the world works. Science education not only stimulates children's curiosity, but also promotes the development of their cognitive, social, and emotional skills[1]. For example, when children watch plants grow outdoors or learn about the changing state of water through experiments, they learn not only to observe and categorise, but also to be patient and work as a team. This type of education encourages children to ask questions, conduct experiments and explore solutions, developing their problem-solving skills. Through these interactive and hands-on activities, children learn how to apply logical thinking and

the scientific method to understand the world around them. In addition, early science learning helps children develop self-efficacy, the belief that they can influence their environment and achieve their goals, which is a key factor in their future success in school and life.

1.2The need for innovative educational models

Although science education is crucial to the development of pre-school children, traditional education models often fail to fully stimulate children's potential and interest. In the face of a rapidly changing society and an increasingly complex body of scientific knowledge, traditional models - often adult-centred, with an emphasis on memorization and repetition - are no longer able to meet today's educational needs. Therefore, the adoption of innovative educational models, such as inquiry-based learning and game-based learning, is a necessary way to enhance teaching effectiveness and meet the diverse learning needs of preschoolers. By providing hands-on opportunities and encouraging children to actively participate in the learning process, innovative education models can more effectively attract their attention and increase the fun of learning. For example, inquiry-based learning allows children to become masters of their own learning process, exploring scientific phenomena by asking questions, experimenting and observing. This approach not only promotes children's critical thinking and problem-solving skills, but also enhances their interest and enthusiasm for learning. In addition, with the advancement of technology, digital tools and resources offer more possibilities for personalized and differentiated learning. Using these innovative educational tools, teachers are able to adjust the content and methods of teaching according to each child's interests and learning speed, providing each child with a learning experience that best suits his or her development. Adopting innovative educational models is therefore not only a response to the needs of the times, but also a key way to achieve equity in education and promote the holistic development of all preschool children.

2. Innovative models and practical effects of science education for pre-school children

2.1Inquiry-based learning model

The inquiry-based learning model is rooted in constructivist theory, which emphasizes the importance of individual active participation and experience in the construction of knowledge. In the said model, learning is viewed as a process of active exploration and meaning construction, in which the role of the teacher is transformed into that of a guide and facilitator, while the student becomes the leader of learning[2]. The model is particularly suitable for science education because it encourages children to become personally involved in scientific exploration through activities such as observation, questioning, experimental design, and analyzing results. The implementation of the inquiry-based learning model usually involves the following key steps: first, the curiosity of preschool children is stimulated to get them interested in the learning topic. Next, children are guided to ask questions and design experiments to explore the answers to those questions. During the process, teachers provide the necessary resources and support to help children understand the results of their experiments and guide them to explore them in depth. Finally, children are encouraged to share their findings and learning experiences to facilitate peer-to-peer learning and discussion. Examples of the use of inquiry-based learning in pre-school science education include learning life science concepts by observing plant growth or exploring the principles of physics through floating and sinking experiments. This type of learning significantly improves children's learning outcomes, not only because it increases children's engagement and motivation to learn, but also because it promotes the development of children's critical thinking, problem-solving skills, and scientific literacy. Through inquiry-based learning, children learn how to observe, categorize, reason and verify, skills that are essential to their overall cognitive development.

2.2Game-based learning model

Game-based learning models play a vital role in pre-school education by incorporating game elements and principles into the learning process, which not only increases the enjoyment of learning, but also improves children's engagement and motivation. The core strength of gamified learning is its ability to capture children's attention and promote knowledge acquisition and skill development in a natural and interactive way. Gamified learning greatly enhances learning by

providing immediate feedback, setting achievable goals and rewards, and encouraging children to learn through trial and error in a safe environment[3]. This approach promotes children's active participation while providing rich contexts that help them connect new knowledge with existing knowledge. In addition, gamified learning encourages children to develop important social skills such as co-operation and turn-taking during play, which are essential for their overall development. In practice, for example, teachers can teach the scientific concept of the water cycle through a well-designed "Water Cycle Adventure" game. In this game, children take on the role of water droplets that need to pass through different stages (e.g., evaporation, condensation, precipitation, etc.) and complete tasks to move to the next stage of the cycle. Each stage is designed with interactive activities and challenges, such as solving puzzles to "escape" clouds or jumping and moving to "collect" rainwater. In this way, children not only learn about the water cycle, but also experience the application of scientific principles in play.

2.3 Living teaching model

The living teaching model is widely respected in preschool education for its unique advantages. This model closely integrates learning content with children's daily life experiences, and triggers interest in learning and promotes the construction of knowledge by exploring the natural and social environments around them[4]. Living learning emphasizes the use of children's direct experiences to make the learning process natural and meaningful through observation, manipulation and communication. The main advantage of lifelike learning is its ability to provide authentic learning situations that enable children to learn new knowledge in a context that is relevant to the real world. This type of learning helps children to understand the connection between what they are learning and their daily lives, enhancing the relevance and usefulness of their learning. In addition, life-long learning promotes children's spirit of enquiry and critical thinking skills by guiding them to observe and explore their environment, and encouraging them to ask questions and find answers. In this way, children not only learn specific scientific knowledge, but also develop problem-solving skills and a lifelong learning attitude. For example, teachers can teach changes in matter through kitchen activities. Teachers can organize a cooking activity in which children are involved in the process of making dough with their own hands. In the process, children observe the changes when flour is mixed with water and learn that solids and liquids can be mixed into different forms of matter. Next, children can bake the dough and observe the changes in the state of matter and understand the chemical reactions that occur during the heating process. Living learning can significantly increase the appeal and engagement of learning by linking the content closely to children's life experiences. Children are more likely to be interested in content that they can directly observe and experience, thus increasing their motivation to explore the unknown and solve problems. In addition, through life-long learning, children are able to see the practical application of the content, which not only stimulates their interest in learning, but also increases their self-confidence in learning.

3. Conclusion

Through in-depth analyses and discussions on the application of inquiry-based learning, game-based learning and life-based teaching models in preschool science education, the study highlights the important value of innovative educational models in stimulating children's interest in learning, enhancing learning engagement and promoting their holistic development. Future research and practice should continue to explore more innovative educational models, while paying attention to individual differences, in order to personalize and differentiate science education and ensure that every child can achieve success and satisfaction in their journey of scientific exploration.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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