Chapter 16

# Biology Education in Preschool Period

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**Abstract**

This study addresses the importance of biology education in early childhood and explores effective teaching methods. Biology education plays a crucial role in developing children's understanding of the environment, connecting with nature, and enhancing scientific thinking skills. The fundamental teaching principles aim to help children comprehend biological concepts through concrete experiences and increase their environmental awareness. Play-based and inquiry-oriented learning methods engage children actively, making learning both fun and meaningful. The interdisciplinary teaching approach is a key method that enhances the effectiveness of biology education. When biology is integrated with fields like art, mathematics, and technology, children learn from a broader perspective and develop creative thinking skills. Art projects provide opportunities to explore biological diversity aesthetically, while mathematical activities strengthen numerical thinking and data analysis skills. The integration of technology allows children to experience biological processes in virtual environments and develop digital literacy. Conducting experiments and engaging in observation activities improve children's skills in forming hypotheses, collecting data, and analyzing information. Learning through observation deepens their understanding of ecosystems and those of the behavior of living organisms. Creative methods like storytelling and dramatization teach biological concepts through emotional connections and stimulate children's imagination. In conclusion, biology education promotes environmental awareness, healthy living habits, and scientific thinking. Interdisciplinary teaching and creative methods aim to foster curiosity and a desire for lifelong learning, preparing children to become lifelong learners.

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## 1. Introduction

Biology is a fundamental discipline that allows us to understand the principles of life, make sense of our interactions with the environment, and explain the workings of nature. Introducing biology education in the early childhood period is essential, as it nurtures children's innate curiosity about the natural world and fosters the development of scientific thinking skills from a young age (Piaget, 1952; Inhelder & Piaget, 1964). Awareness of biological concepts during early childhood enhances children's sensitivity to their environment and contributes to the formation of a conservation-oriented mindset in the future (Kellert, 2002). Children exhibit a strong desire to explore and understand the world around them during their early years.

This natural curiosity forms the foundation of learning, providing opportunities for them to question, discover, and make sense of their surroundings (Bruner, 1966). Biology education is crucial in supporting this curiosity, enabling children to acquire basic knowledge about plants, animals, and the environment. Knowledge gained through direct experiences helps children comprehend abstract concepts and fosters the development of scientific process skills (Lind, 1998).

One of the primary goals of early childhood biology education is to familiarize children with living organisms and ecosystems in their environment. Experiences in nature not only support cognitive, affective, and psychomotor development but also contribute to children's emotional well-being and foster a positive attitude toward the environment (Wilson, 1997). For example, activities such as nature walks, planting seeds, and observing animals help children develop an appreciation for nature and learn to live harmoniously with their surroundings (Sobel, 1996). Another crucial aspect of biology education in early childhood is the enhancement of children's scientific process skills. These skills include observing, hypothesizing, classifying, measuring, and drawing conclusions. Engaging in such activities allows children to develop analytical thinking and problem-solving abilities from an early age (Eshach & Fried, 2005).

Acquiring these skills is beneficial not only in scientific endeavors but also in everyday life, significantly impacting children's academic success in later years (Gelman & Brenneman, 2004). Moreover, biology education aims to instill a sense of environmental responsibility in children. Cultivating environmentally conscious individuals from a young age is crucial for a sustainable future. When this awareness is developed early, children become more sensitive to issues like pollution, climate change, and biodiversity

conservation (Palmer, 1995). In this context, biology education teaches children to respect and protect natural resources and understand the importance of minimizing their ecological footprint (Chawla, 1999).

The methods and techniques employed in teaching are pivotal in determining how well children grasp biological concepts. Constructivist approaches emphasize active engagement and experiential learning, which are crucial for meaningful understanding (Vygotsky, 1978). In this sense, hands-on experiences, where children learn through exploration and interaction, can be more effective than traditional teaching methods. Interactive and play-based learning environments make biology concepts memorable and enjoyable for children (Fleer, 2009). Biology education also encourages children to develop an inquisitive mindset. By asking "Why?" and "How?" questions, children engage in cognitive processes that support their intellectual growth and understanding of scientific inquiry (Kuhn, 2000). This type of education helps children embrace scientific thinking as a way of life. In addition, involving children in scientific thinking processes boosts their self-confidence and nurtures a lifelong interest in learning (Tunnicliffe, 2001).

In conclusion, biology education in early childhood is a vital component that allows children to explore the natural world, develop scientific process skills, and grow into environmentally conscious individuals. The biology knowledge and appreciation instilled during this period have long-lasting effects, shaping children's attitudes toward the environment throughout their lives. Thus, integrating biology topics into early childhood curricula is a crucial step in supporting both the scientific and emotional development of young children (Monroe, 2003).

## 2. The Fundamental Principles of Biology Education

### 2.1 Age-Appropriate Biological Concepts

When planning biology education for early childhood, it is essential to consider the children's age and cognitive development level. According to Piaget's cognitive development theory, preschool children are in the concrete operational stage, meaning they struggle with abstract concepts (Piaget, 1969). Therefore, biology teaching should be enriched with concrete materials and real-life experiences. For instance, observing the growth of seeds or witnessing the metamorphosis of a caterpillar into a butterfly provides children with valuable insights into biological processes (Tardif & Doudin, 2011). These types of activities nurture children's sense of curiosity and increase their interest in nature.

When introducing biological concepts to young children, it is crucial to engage their senses actively. Research has shown that children learn biological knowledge more effectively through multisensory experiences, such as touch, sight, and smell (Baldwin, 2012). For example, a child who touches and examines a plant or smells the soil finds the experience more meaningful. Such tangible interactions help children better understand abstract concepts and support their cognitive development.

### 2.2 Play-Based and Inquiry-Oriented Learning

Play-based learning is a highly effective approach to helping children grasp biological concepts. According to Vygotsky's (1978) social interaction theory, play is a powerful tool for developing children's cognitive and social skills. When biology education is integrated with play-based activities, children are more likely to engage with complex biological ideas in a meaningful way. For instance, role-playing games that mimic animals or gardening projects enable children to connect with the natural world (Wood, 2013; Yılmaz, Uysal & Nacar, 2024).

Inquiry-oriented learning encourages children to ask questions, make observations, and draw conclusions, fostering scientific thinking skills and promoting independent exploration (Chaille & Britain, 2003). For example, allowing children to study the life cycle of an insect firsthand enhances their observation and analytical skills. In this learning approach, teachers act as facilitators, guiding and supporting children's inquiries and discoveries (Siry, 2014). This hands-on, inquiry-based approach cultivates a deeper understanding of biological concepts and helps children develop problem-solving abilities.

### 2.3 Relating Biological Concepts to Daily Life

Connecting biological topics to children's everyday experiences makes learning more meaningful and memorable. When children relate what they learn in biology to real-world events they observe, they are more likely to internalize the information (Gelman, 2004). For example, learning about why plants need water while watering a plant helps children understand and remember the concept better. By fostering awareness of the living things in their surroundings, biology education also promotes environmental consciousness from an early age (Chawla, 1998).

Biology education can also raise awareness about healthy living and nutrition. For instance, teaching children about the nutritional value of fruits and vegetables can help them develop healthier eating habits (Story, 2002).

Such activities make biology relevant to children's daily lives and ensure that knowledge is integrated into their routines and decision-making processes.

### 2.4 Effective Teaching Methods for Biology Education

Experiments, observations, and interactive activities are essential methods for developing children's scientific process skills in biology education. When children learn biological concepts through hands-on experiences, they are more likely to understand and retain the information (DeVries, 2001). For example, using a simple microscope to observe plant cells or setting up an aquarium to study fish behavior can spark a lifelong interest in biology. Besides experiments, storytelling and art activities can be effective teaching tools. For instance, a story about the life cycle of plants can improve children's listening and comprehension skills (Reifel, 2004).

Technology integration is another important strategy for enriching biology education. Digital resources can make biological processes more understandable and engaging. For example, virtual lab simulations or educational apps that explore animal habitats can capture children's attention and make learning exciting (Plowman & McPake, 2013). However, it is crucial to use technology in a balanced and thoughtful way. Combining traditional and digital teaching methods often yields the best outcomes in early childhood biology education, creating a well-rounded and engaging learning experience.

## 3. Relating Biological Concepts to Daily Life

### 3.1 Utilizing Children's Daily Experiences

Children constantly observe biological phenomena in their environment, which provides significant learning opportunities. For instance, a child playing in the garden might watch plants grow or observe insects, gaining a better understanding of biodiversity and natural interactions (Chawla, 2006). Teachers can make these observations more meaningful by incorporating them into classroom activities. Involving families in this process further expands learning opportunities. For example, parents can take children to parks to observe different species or engage them in plant-growing activities at home (Kirkby, 2003; Öztürk, 2023).

Leveraging children's daily experiences makes abstract concepts in biology more tangible. For instance, watering a plant at home or in the schoolyard can be an effective way for children to learn about the life cycle of plants (Wilson, 1997). When children understand that plants need moisture,

light, and soil to grow, they can apply this knowledge to their everyday life. These hands-on experiences facilitate the comprehension of abstract biological concepts.

### 3.2 Integrating Biological Knowledge into Lifestyle

Integrating biological knowledge into daily life can help children become healthier and more environmentally conscious. For instance, connecting healthy eating habits to biology enables children to understand how their bodies function and how different foods affect their health (Story & Stang, 2005). Teaching children that fruits and vegetables are rich in vitamins and minerals can encourage healthier eating habits. Similarly, linking biological knowledge to hygiene practices helps children grasp the importance of actions like handwashing (Curtis & Cairncross, 2003).

Recycling and environmental awareness are also critical components of biology education. Teaching children about the benefits of recycling and the environmental impact of waste can promote a sustainable lifestyle (Palmer, 1995). For example, when children learn that plastic waste remains in nature for hundreds of years if not recycled, they become more environmentally responsible. This kind of education fosters a more conscientious relationship with nature.

### 3.3 Nature Walks and Field Trips

Direct experiences in nature enhance children's understanding of biological concepts. Nature walks and field trips offer opportunities to observe nature, recognize different plant and animal species, and understand how ecosystems function (Fleener, 2000). For example, during a forest walk, children can observe the photosynthesis process in trees and the habitats of various animals. Such activities help children connect with nature and increase their interest in biology (Louv, 2008).

Out-of-classroom learning environments provide excellent opportunities for children to reinforce what they have learned in the classroom. During nature trips, children can observe plants and animals under the guidance of teachers. For example, a field trip to a riverbank allows children to study the impact of water on the ecosystem and examine aquatic life (Ayyıldız & Yılmaz, 2021; Bebbington, 2005). These activities make learning fun and unforgettable.

### 3.4 Supporting Biological Concepts with Art and Play

Incorporating art and play into biology education makes learning more engaging for children. They can learn biological concepts by drawing, singing songs, or acting out scenarios. For example, in a drama activity, children can act out how flowers grow, learning about the plant life cycle through role-play (Eckhoff, 2008). Such creative activities contribute to children's cognitive and emotional development (Öztürk & Demiroğlu Çiçek, 2024).

Art projects are effective tools for sparking children's interest in biology. For example, during a drawing activity, children can illustrate different animal species and discuss their habitats (Thompson, 2005). These projects allow children to blend biological knowledge with their imagination. Moreover, when biology education is supported by games, children's participation increases, and they retain the information more effectively (Fisher, 2002).

## 4. Effective Teaching Methods for Biology Education

### 4.1 Conducting Experiments and Observation Activities

Biology education should be enriched with experiments and observation activities to develop children's scientific process skills. These methods encourage active learning and help children better understand scientific concepts. For example, using a microscope to examine plant cells or observing the photosynthesis process of a leaf allows children to explore biological processes (Driver et al., 1994; Yılmaz, 2023). Research shows that inquiry-based learning enhances children's analytical thinking skills and helps them approach information more critically (Harlen, 2000).

Experiments help children develop hypotheses, collect data, and draw conclusions. For instance, children can conduct a plant growth experiment using control groups to learn that seeds need water and light to grow (Sampson & Grooms, 2009; Yılmaz, 2024). Teachers should guide and inspire curiosity while promoting independent thinking. Additionally, observation activities in biology education help children better understand nature and discover the behaviors of living organisms (Hodson, 1996).

### 4.2 Storytelling and Dramatization

Storytelling and dramatization can be effective teaching methods in biology education. Children comprehend biological concepts better through stories and reinforce their understanding by dramatizing what they have learned (Egan, 1986). For example, after listening to a story about the life cycle of a flower, children can dramatize this process as a group. Such

activities enhance both cognitive and social skills, making learning enjoyable (Ayyıldız, Yılmaz & Baltacı, 2021; Cornett, 1999).

Storytelling helps children learn by forming emotional connections. A story about the life of a plant or an animal can foster environmental awareness and empathy in children. Moreover, stories stimulate children's imagination and make abstract biological concepts more concrete (Wright, 1995). Dramatization, on the other hand, enables children to enact biological events and supports their collaboration skills.

### 4.3 Use of Technology

The use of technology in biology education significantly enriches children's learning experiences. Interactive educational software, simulations, and digital games allow children to explore biological processes virtually (Plowman & Stephen, 2003). For instance, watching a simulation of cell division on a tablet can help children understand this complex concept better. Technology increases children's engagement in learning and appeals to various learning styles (Buckingham, 2007; Yılmaz, Gülgün, Çetinkaya & Doğanay, 2018).

Digital tools used in biology education also foster independent learning skills. For example, an interactive microscope app can allow children to examine plant cells in detail. Additionally, teachers can make use of videos and animations to explain biological processes more effectively (Levin & Wadmany, 2006). However, it is important to use technology thoughtfully and in moderation. Combining traditional methods with technological tools often provides the most effective learning experiences.

### 4.4 Collaborative Learning and Group Projects

Biology education can be more effective when supported by collaborative learning and group work. Children can explore biological topics together in group projects and learn from one another (Johnson & Johnson, 1999). For example, in a group activity, children can research how an ecosystem functions and share this information with their classmates. Collaborative learning develops children's communication, problem-solving, and critical thinking skills (Slavin, 1996; Yılmaz, Şahin-Atılgan & Güzel-Sekecek, 2024).

Group work allows children to gain a deeper understanding of biological concepts. For instance, in a project, children can investigate the habitats of different animals and present their findings to the class. Teachers should support and guide children's learning processes throughout these activities.

Collaborative learning also teaches children responsibility and the value of working together.

## 5. Interdisciplinary Teaching Approach

### 5.1 Definition and Importance of Interdisciplinary Teaching

Interdisciplinary teaching is an educational approach that integrates knowledge and skills from different disciplines. This method allows students to examine topics from a broader perspective and enhances their ability to solve real-world problems (Beane, 1997). In the context of biology education, interdisciplinary teaching enables students to connect biological knowledge with fields such as mathematics, art, history, or technology, providing a more comprehensive learning experience (Drake, 2007).

Integrating interdisciplinary teaching into early childhood education fosters children's natural curiosity and supports their active engagement in the learning process. This approach helps make abstract concepts, such as those in biology, more meaningful (Fogarty, 1991). For example, in a project-based learning activity, children might analyze the factors affecting plant growth using mathematical measurements or express the life cycle of a plant through art projects. Such activities encourage creative thinking and help children synthesize knowledge from different disciplines (Jacobs, 1989).

### 5.2 Integration of Biology and Mathematics

The integration of biology and mathematics helps children understand biological processes while developing their mathematical skills. For example, children can measure the weekly growth of a plant and create graphs to represent this data (Caine & Caine, 1994; Yanarateş & Yılmaz, 2022). These activities enhance children's comprehension of both biological and mathematical concepts. Additionally, children can develop numerical thinking skills by analyzing biological data (Schmidt et al., 1997).

Combining mathematical skills with biology education improves children's problem-solving abilities and strengthens their scientific thinking processes. For instance, in a class project, children might measure the germination rate of seeds and analyze the results statistically. Such interdisciplinary activities teach children essential skills like data collection, analysis, and inference (National Research Council, 2000).

### 5.3 Integration of Biology and Art

Art serves as an effective tool to make abstract concepts in biology more tangible. Children can better grasp biological topics by expressing them through art forms like painting, sculpture, drama, or music (Eisner, 2002; Sevgi & Yılmaz, 2023). For example, illustrating animal habitats through drawing can make biological concepts more meaningful for a child. Drama activities can also help children understand biological processes by acting out the behaviors of animals (Bresler, 1995).

The combination of biology and art also fosters children's creativity. Art projects enable children to explore biological diversity and the aesthetic aspects of nature. For instance, children might study the structure of a leaf and then create a three-dimensional project using clay or paint. These interdisciplinary activities offer deeper learning experiences in both art and science (Marshall, 2014).

### 5.4 Integration of Biology and Technology

Technology plays a crucial role in making biology education more effective and engaging. Digital tools facilitate children's observation, analysis, and creative project development in biological studies (Jonassen, 2000; Sevgi, Ayyıldız & Yılmaz, 2023). For instance, after observing cells under a microscope, a child can use digital drawing software to illustrate their findings. Children can also use tablets or computers for data collection and analysis during biological experiments (Bers, 2008).

The integration of biology and technology helps children develop digital literacy skills. They learn to use the internet safely for research and create innovative projects using technology. For example, children might produce short documentaries about biodiversity as a video project, effectively combining technology and biological knowledge (Resnick, 2006).

### 5.5 Advantages of Interdisciplinary Teaching

Interdisciplinary teaching enriches children's learning experiences and enhances their critical thinking skills. This approach allows children to evaluate information from various perspectives and encourages lifelong learning (Beane, 1997). In the context of biology education, interdisciplinary teaching fosters children's interest in nature and supports their creative thinking skills. Moreover, interdisciplinary activities teach children the value of collaboration and integrating knowledge from different fields (Drake, 2007).

## 6. Conclusion

Biology education plays a crucial role in helping children understand their environment, connect with nature, and develop scientific thinking skills. In early childhood, the fundamental principles of biology education focus on helping children comprehend biological concepts through concrete experiences and increasing their sensitivity to the environment (Yılmaz, 2021a; Yılmaz, 2021b). Play-based and inquiry-oriented learning methods encourage active participation, while integrating biological concepts with disciplines like art, mathematics, and technology makes learning more meaningful.

Interdisciplinary teaching significantly enhances the impact of biology education. By combining biology with mathematics, art, and technology, children gain a broader understanding of biological concepts and develop creative thinking skills. For instance, using mathematical measurements and graphs to study plant growth not only reinforces numerical thinking but also allows children to learn biological concepts through hands-on activities. Similarly, art projects enable children to explore biological diversity and the aesthetic aspects of nature (Yılmaz & Salman, 2022.

The integration of technology into biology education enriches children's learning experiences by allowing them to explore biological processes in virtual environments. Digital tools and interactive applications help children develop independent learning skills and increase their interest in biology. However, the use of technology should be balanced and thoughtful; combining traditional teaching methods with digital tools often yields the best learning outcomes (Küçük-Demir, 2023).

Experiments and observation activities are among the most effective methods for developing children's scientific process skills in biology education. These activities strengthen children's abilities to form hypotheses, collect data, and draw conclusions. Additionally, learning through observation helps children understand the behaviors of living organisms and ecosystems more deeply. Creative methods like storytelling and dramatization enable children to learn biological concepts by forming emotional connections.

In conclusion, biology education is essential for fostering environmental awareness, healthy living habits, and scientific thinking skills in children. Relating biological concepts to different disciplines deepens children's learning and enhances their critical thinking abilities. Interdisciplinary teaching and creative learning methods instill a lifelong curiosity and a desire to learn. Therefore, carefully planned and well-supported biology education in early childhood greatly contributes to children's overall development.

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