

Active Learning and its Impact on Higher-Order Thinking Skills in Preschool Science Education

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Abstract: Active-learning strategies encourage preschool children to use higher order thinking skills such as critical thinking and problem solving. However, teaching methods that encourage active learning are underused in favor of traditional methods. This article will offer a background to establish the effectiveness of using active learning strategies with early learners in science instruction. It will then present common reasons teachers do not implement active-learning strategies and address how to implement active learning effectively. The most important point is that a teacher does not need to have mastered this strategy in order to implement it. Suggestions and examples will be given to show how to transform a standard preschool lesson into one that engages higher-order thinking skills using active-learning strategies.

Introduction

The education of preschoolers, children ages 3-5 years old, has been long overlooked by the education community at large and has been considered a low priority in favor of K-12 issues. Some parents and even people within the education field view preschool as alternate form of daycare. For example, Neal McCluskey, the director of the Cato Institute's Center for Educational Freedom has even stated that preschool is oversold (Wong, 2014). Yet in recent years the education community has started recognizing the importance of preschool as the foundation for future learning. Research has concluded that the development of non-cognitive skills in early childhood such as persistence and curiosity, are some of the strongest indicators of adult success in acquiring new knowledge (Warash & Workman, 2016).

Since the importance of a preschool education has only recently become a serious consideration, standards for instruction at this level are relatively new. In 1999 only 10 states had formal expectations for what young children should know before entering kindergarten. By 2002, 27 states had standards and 12 states were in the process of developing standards. However, when early learning standards have initially been adopted, most states have only posted guidelines without any indication of how early childhood teachers could practically implement them in the classroom (Scott-Little, Lesko, Martella, & Milburn, 2007). As a result, early-childhood instruction and implementation of these standards remains varied.

In order to provide a template for what early childhood education should look like, the National Association for the Education of Young Children (NAEYC) has established a position statement for developmentally-appropriate practices in the education of young children. According to the NAEYC, the greatest impact on children's development and learning derives from moment-to-moment interactions and the teacher's responsiveness to each child. The position statement goes on to state that because of this a curriculum cannot be fully planned ahead of time without deviation (NAEYC, 2009). At the same time, NAEYC acknowledges that while the study of child-centered active learning based on constructivist approaches to

education is relatively new, it has been shown to be an effective way to teach children higher-order thinking skills. However, despite the call for child-centered active learning, many teachers in early childhood education are still relying on teacher-directed methods in their classrooms. This article examines and addresses the reasons for this discrepancy.

Active Learning

Active learning is defined as an approach that utilizes activities and experiences to allow children to think critically, to generate in-depth ideas, and to implement these ideas (Pekdogan & Kanak, 2016). The ability to think critically in education was a prominent concern of John Dewey, who felt that critical thinking was something that all citizens needed to participate in on a daily basis (Abrami et al., 2015). Dewey's philosophy on education was that it should be informal and experiential and occur within a social context with guidance (Lake, Winterbottom, Ethridge, & Kelly, 2015). Another philosopher who stressed the importance of experiential education was Lev Vygotsky, who noted that preschool learning experiences in structured environments make important contributions to children's cognitive development (Pekdogan & Kanak, 2016). Jean Piaget is yet another theorist who described children as scientists who try to explore the world (Sapsaglam & Bozdogan, 2017).

The beliefs of these theorists contributed heavily to constructivism, a learning theory that places emphasis on the active role of learning, where the learner drives the process, guided carefully by an instructor. The basis of constructivism is that the work must be intrinsically motivating to the student, self-directed, and guided by the teacher through scaffolding, context, relevance, and feedback (Cattaneo, 2017). A related educational theory, cognitivism, which arose around the 1950s, views the learner as an information processor that processes information based upon past knowledge and experience. The learner receives information from the environment, processes the information, stores information in the memory, and retrieves the information later.

Active learning is thought to be based upon these two theories, which combines the self-directedness of constructivism and the environmental influence of cognitivism (Pekdogan & Kanak, 2016). While active learning centers around the activity of the child, the teacher's role in active learning is not simply that of an observer, as some believe. Rather, the teacher is rather a guide who observes, then carefully designs the environment using materials and projects that will push student learning to the next level. As students interact with materials, teachers should encourage them to make observations and to ask pointed questions that will push them to think critically. In such a role, instruction can often lead to places that were not originally planned. This improvisational quality requires the teacher to possess a working knowledge of early childhood development.

There are different types of active learning methods, including problem-based learning, discovery-based learning, inquiry-based learning, project-based learning, and case-based learning. Cattaneo (2017) discovered that though there are theoretical differences in each of these methods, in practice they have become intertwined. However, the confusion between them can act as a barrier for teaching implement-

ing active learning strategies in the classroom; this will be discussed in more depth later.

Literature Review

The research on active learning is somewhat limited, however, research to date has shown that teachers utilizing the active learning approach are more successful (Pekdogan & Kanak, 2016). A study by Andiemma (2016) found that there was a positive correlation between the use of child-centered or active-learning approaches and the acquisition of science skills in early childhood schools in Kenya. This makes sense because active learning encourages higher-order creative thinking as well as social and cognitive learning. Children who learn in this type of environment have better problem-solving skills and learning capacity (Pekdogan & Kanak, 2016). In addition to supporting the cognitive elements of science education, active learning also helps promote language proficiency in relation to science education. Ohio science standards state that children ages 3-5 years old should be able to make careful observations, pose questions, and describe the subject of study. These standards require a proficiency in language and the ability to communicate effectively. A study by Jawaid (2014) found that using active learning in a preschool in Malaysia motivated children learning English to speak and read with confidence. This study concurs with a study by Dresden and Lee (2007) that showed that the number of words used by first graders in responding to an open-ended question about the subject matter increased from a mean of 7.93 words after completing a teacher-directed activity to a mean of 22.00 words after completing an active-learning activity. This study also found that student responses were more general in nature after the teacher-directed study and more specific after the active-learning study.

Not only has active learning been proven to be effective in teaching young learners, it also can be used to meet all early childhood standards and domains. Active learning meets the increasing demands of state and district requirements. Encouraging children to learn through active learning should be viewed as a supplement to an existing curriculum and not as a replacement (Dresden & Lee, 2007). Teaching students through this method not only can cover all academic standards, but because it encourages active and meaningful learning experiences, is also consistent with the best practices listed by the NAEYC (Lake et al., 2015).

Barriers

A study by Ntumi (2016) found that some barriers that early childhood teachers face regarding implementation include not understanding the curriculum deeply, not having appropriate learning materials, and not having proper in-service training. The same study found that teachers also view their role in implementing instruction as an autonomous one. The implementation of active-learning methods does not generally follow a script or come with a teacher's manual, which can make a teacher feel uncertain or unsure (Vartuli, Bolz, & Wilson, 2014). As stated previously in this paper, there also exists some confusion between the different active learning strategies, further adding to the uncertainty a teacher might feel when attempting to implement active learning strategies in the classroom.

Practical Steps

The first step in active learning is to identify a topic that the students will be interested in. This can be done by starting the year polling the children about what topics they would like to learn more about. Write down every answer, no matter how silly. When the kids know their answers are heard and valued, they will not be afraid to speak up. Learning topics can also come from things in the environment in which the children show a natural interest.

Design the environment to encourage active learning. Sometimes simplicity is the key to fostering these skills. Always have paper and writing utensils available for children to use for writing about or drawing their findings. Have materials out that encourage higher-order thinking such as scales and rulers. If a toy breaks in the room, figure out together how it was put together instead of just throwing it away.

Model how to ask and answer questions. Always have children explain their thinking. The use of questioning is crucial to pushing higher-order thinking skills. In the beginning you will have to model your thought process and reasoning skills. As you repeatedly model your thinking processes the children will begin to naturally copy the ways that you explain yourself. They will also copy your questioning. Students will begin asking “why” and “how” questions and answering with “I know because...” with more frequency because you modeled how to do so for them. Learning becomes more self-directed when active learning strategies are used.

A Study on Acorns

Let’s consider a typical preschool study on acorns. A teacher will typically plan for a 1-2 week focus on the topic. Activities might include painting with acorns, singing songs about acorns, and reading books about acorns. Teachers might discuss facts such as that acorns are brown, that the word “acorn” starts with letter A, and that squirrels like acorns.

None of these things are wrong, yet simply introducing facts means that students are not pushed to think critically. The students are passively receiving information from the teacher. Even if they are producing the answer to questions like “What color are acorns?” or “What letter does acorn start with?” they are not thinking critically. Knowing letters and colors is good knowledge to have, however it is straightforward information that does not require deep thought. These activities are appropriate but should be supplemented with higher order thinking.

Let’s consider the acorn study from an active-learning perspective. The study should start with students noticing acorns in real life. The NAEYC states that learning is most likely to occur when it builds upon what a child already knows and has experienced (2009). If there are acorns on the playground and the students don’t naturally comment on them, the teacher should show an interest in them and the students’ interest will typically follow. The class can then collect acorns. Meanwhile, the teacher should be modeling questions that encourage higher order thinking. “What is the difference between these two acorns?” “How did the acorns get on the ground?” “They fell out of the tree? How?” “Why are some of these acorns green and some are brown?” “Look at this acorn. It is broken in two. What do you think this piece is? Should we look it up when we get in the classroom?”

In my classroom, my special-needs preschool students learned that our acorns came from an oak tree by comparing our collection to a chart I printed out that had pictures of different types of acorns. We discovered the chart together while researching acorns on our classroom iPad. The students weighed acorns to determine who had the heaviest one using balance scales that had been available in the science center. While researching on the classroom iPad we discovered the acorn float test, which determines if the acorn is good for growing. Before attempting the float test, we made predictions about which acorns would float. After the float test, we tried to find similarities between the acorns that had sunk in order to develop our own conclusions about what makes an acorn good or bad.

Through questioning and researching we also discovered that the little holes in our acorns were created by weevil larvae. We later found these larvae crawling in our sensory table, and we freed them in a special celebration. Note that you should expect the unexpected when trying active learning! The children then drew pictures of their acorns and the weevils after we found a “how to draw” video online. Creating these drawings gave them an opportunity to practice their fine motor skills and they were easy to label using the language from the Learning Without Tears handwriting curriculum utilized in our program.

The key to active learning is to constantly ask questions. The best questions for pushing critical thinking are “how?” and “why?” Another critical component is to constantly encourage the students to ask additional questions if they would like to find out more about topics that come up through natural conversation. Using this method not only taught the students but taught me a lot about acorns as well. Teaching this way requires thinking on your toes. And admitting that I didn’t always know the answer modeled for my students that it is OK to not know something and to research it when you do not know the information.

Lake et al. (2015) found that preservice teachers who used an active-learning approach felt that teaching in this manner was the closest they had come to their vision of themselves as teachers. After attempting this method, I would agree with this statement. I used to do the standard theme units and letter of the week but since I’ve begun pursuing active learning I will never go back to more traditional methods. By modeling higher-level thinking questions and self-directed learning, the children are now questioning things on their own and asking to research questions they come up with. Six months after our initial study children are still bringing acorns to me with excitement and using descriptive language as they do so. Using active learning strategies to push critical thinking has created an excitement to constantly learn in my students, which is the most fulfilling feeling a teacher can have.

Conclusion

The use of active learning strategies in preschool science instruction helps students become co-owners of their learning and makes knowledge more meaningful and longer-lasting. Not only does this method help children learn information, it also helps them learn how to learn. The use of active learning strategies gives students tools that help them investigate queries on their own long after their time in your classroom is done. The use of active learning does not conflict with curriculum requirements of school districts and ensures that teachers are using best practice

according to the NAEYC. To implement this strategy, teachers need not be masters of how to do so but must only be willing to try something new.

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Stephanie Trzaskowski received a Bachelor of Science in Education in 2010 from The Ohio State University with a license in Early Childhood Special Education. She is currently pursuing a Master of Education in Early Childhood Education. Stephanie has been a preschool intervention specialist for Toledo Public Schools since 2012.