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Meaningful science: A look at elementary science education practices

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Abstract

This honors project examines best practices in elementary science education. It focuses on how arts integration, technology, children's literature, discussion, group work, and hands-on activities all maintain engagement in elementary students.

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Meaningful Science:
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"How can I teach this without a worksheet?" This question has recently become one of my most repeated teaching mantras. My own personal experiences combined with education research have shown me that the best teaching practices are those grounded in engaging, hands-on, and meaningful experiences. Science experiences in the early years can inspire a love of problem solving and experimentation. It gives us a chance to impact children's relationships to the natural world. Asking myself "how can I teach this without a worksheet?" when planning any lesson supports my goal of provoking wonder and amazement in children that will last beyond their elementary education.

It is no news that science education is important for children today. We are living in a society that values both discovery and invention. We often hear successful professionals described with words like innovative, groundbreaking, and visionary. Children deserve education that supports their development as thinkers and creators. Let us give children worthwhile experiences that lead to necessary 21st century skills through arts integration and social experiences. Today's teachers should be intentional in their planning of lessons, working to encourage new ideas through discussion and exploration. (Bosse, Jacobs, & Anderson, 2009). These activities will help children find interest in elementary science content but also support the development of skills that children need to

become well-versed in the problem solving and critical thinking that is so highly valued today. Quality science instruction utilizes: technology, discussion, cooperative work, hands-on activities, arts integration, and children's literature.

Technology. Our ability to create rich science lessons, ones that "include inquiry, concrete models and materials, and discussion among students," (Staver 18) is more attainable than ever with technology that enhances our discussion. While reading aloud One Tiny Turtle by Nicola Davies, a first grader asked me how the baby sea turtles could pull their bodies across the dry sand. It took me but seconds to pull up a National Geographic video that I could project for the whole class. I did not allow the video to speak for me, I turned off the sound and the conversation in my classroom flourished.

There is a constant influx of new technology available to enhance teaching and give children insight into our world. When we use media in the classroom we are exposing children to "visual images [that] give meaning to words and offer an alternative to words as a means of communication...When words and visual elements are closely tied, students are better able to comprehend and synthesize new information" (Vasquez, 2002, p.8). The difference between reading the steps of the life cycle of a butterfly and watching a time-lapse video showing the life cycle is huge. We can show children images of animals in their natural habitats, play them the sound of a bull frog, watch a video of sharks feeding under water, or read the weekly blog of a polar explorer. The possibilities provided by technology to engage and excite our students are endless.

Beyond providing interesting support for our lessons, when we use online videos, pictures, and articles with our class, we are modeling how to find and use quality resources. This skill is a challenging one for children, as the impulse to choose the most easily accessible source is strong. Teachers should address the questions regarding children's ability to do meaningful and self-regulated research online by working to give them the tools needed to discriminate between high quality and low quality sources (Doolittle & Hicks, 2003).When looking at animal habitats, we can show children that resources from National Geographic or the San Diego Zoo are reliable and utilize information we can trust based on the authors and organization's credibility.

Discussion. Meaningful science activities melded with discussion help create a classroom community that values questions and opinions. Discussion gives way to unique insights of children's thought processes. It supports the child-teacher relationship as well as child-child relationship. In my own elementary education and in many classroom observations, I have seen the very strict, teacher enforced raise-your-hand classroom. Instead of this, we should create classrooms in which children learn to have daily whole group conversations and practice the common social norms of conversation and debate. Through class discussion, we can work to change the out-of-date school norms like "competitiveness, an emphasis on right answers, the assumption that teachers have the answers, rejection or nonstandard ways of working or thinking, and patterns reflexive of gender and class biases" (Ball, 1991, p.3).

A classroom where discussion works "require[s] a classroom culture in which students respect and trust one another and are comfortable sharing thinking, challenging one another, and taking risks" (Worth et al., 2009). If time and energy is dedicated into helping children be successful at whole group discussion, the short and long term advantages are valuable for both teachers and students. Secondary educators have expectations for students' ability to work and think in a college-ready manner. As elementary educators, we are not only preparing our students with content but giving them opportunities to develop the learning attitudes that will benefit them in middle school, high school, and college.

Group Work. When children work in small groups they can talk through their thoughts, get new ideas, and develop relationships that support communication. Children can help one another, hear new perspectives, and practice conflict resolution, all while gaining new knowledge and insight. (Gilles, 2003, p. 35). Research shows that group work can be one of the most effective teaching methods if it is given enough dedication in the classroom. Group work helps develop meaningful social relationships in the classroom and allows children to think of one another as co-learners (Blatchford et al., 2003). Whole class discussion is teacher facilitated which is beneficial in many situations but the learning that is done in small group situations, when setup correctly, is child-led. Small group work gives teachers the opportunity to listen and support learning in a more personal manner.

In science, small group work is a time where students can do research together, explore materials, complete experiments, and create together. I have heard of many teachers who abandon group work after one unsuccessful try. For group work to be successful, children need consistent opportunities to practice and figure out how group dynamics work. Group work in early childhood years introduces children to the collaboration that will be integral to the rest of their education.

Arts Integration. Through music, dramatic play, literature, and explorations of different art materials, children in childcare and preschool settings have constant interactions with the arts. These experiences can continue on to enrich education in the elementary years as well. In the *Journal for Teaching Through the Arts*, Lisa LaJevic (2013) maintains that "the arts have undergone a slow transformation from being the fun free-time coloring activity to an essential subject with significant benefits" (p.2).

Like LaJevic, many educators agree that arts integration, or teaching content through the arts, is both necessary and effective in education. (Fisher & McDonald, 2004, Purnell et al., 2007). Teachers want to help students succeed academically and socially. With arts integration, teachers are giving students a chance to actively participate and "make connections between what they are learning and what they are living" (Gail Burnaford, Arnold Aprill, & Cynthia Weiss, 2009). Arts integration makes the content more real to children. With

arts integration, children may retain content better and make connections between areas within content more easily (Rinne et al., 2011). Successfully implemented arts integration creates deep connections between the arts and other content in the classroom. Many aspects of art and science overlap: observation, modeling, and problem solving are all prominent in both domains (Poldberg, Trainin, & Andrzejczak, 2013). Developing and using models is one of eight practices for science classrooms that The National Research Council has outlined to "reflect those of professional scientists and engineers" ("A Framework for K-12 Science Education," 2012). Within elementary science, modeling can take many different forms through arts integration. For example, children can model the life cycles of animals through movement, they can make a diorama model of an animal's habitat, or they can model observations of living things through drawings. Children can use creative writing, like stories or poetry, to explain their understanding of various science concepts. Teachers "can introduce or reinforce a science topic with a poem in just a few minutes with language that is rich,vivid, and memorable and activities that are engaging and interactive" (Vardell & Wong, 2014). Music can enhance a child's comprehension of animal movements and concepts of descriptive words like light, soft, heavy, slow, or fast. When science and art are integrated in the elementary classroom, teachers benefit from the extended engagement of children and the potential for increased retention of content and concepts.

Hands-On. When we imagine scientists, we think of paleontologists digging up dinosaur bones or a mad scientist mixing bubbling concoctions in a lab. The field of science is naturally hands-on. To teach children science, we need to help them see themselves as scientists. To help children see themselves as scientists, elementary science needs to be hands-on. Research has shown that "greater levels of student motivation, enjoyment, and future orientation towards science were found in classrooms where students reported that various measures of interaction, hands-on activities, and applications in science took place frequently" (Hampdon-Thompson & Bennett, 2013, p.1340).

So what does hands-on learning look like? Hands-on learning means exploring materials, letting students experiment and problem solve with tools, watching children work together, hearing them think, and letting them problem solve on their own. Hands-on activities give children the space to add to their prior knowledge and then "apply the process to real-world situations" (Greenspan, 2015, p. 33). When children work together and problem solve, they are collaborating, learning important social skills, and practicing building community. During hands-on activities "children learn to share ideas *and* materials" (Grambo, 1993, p. 33). Hands-on learning in elementary science classrooms strengthens community and provides children with experiences that strengthen the skills they will be using for years to come.

Children's Literature. Children's literature is an important way to introduce and enhance science concepts. Books can spark interest in a subject and many educators "believe that interest in a topic is a necessary precursor to understanding it" (Royce, Morgan, & Ansberry, 2012). For example, *Oscar and the Frog: A Book About Growing* by Geoff Waring can be used as an introduction to life cycles. *Do You Know Which One Will Grow?* by Susan A. Shea can get children interested in living things. *Guess What is Growing Inside This Egg?* by Mia Posada is a fun way to examine animal heredity. The integration of literature and science "takes children to places that they could not go on their own and allows them to explore natural phenomena that might be too small or take too long to observe directly in the classroom" (Abel, 2008, p. 54). Children can use the plots, pictures, or characters from various books as a reference during hands-on exploration or group discussion. Making these connections helps students understand concepts in a deeper way. Owens (2003) lays out some examples of how to successfully use fiction in the science classroom and avoid misconceptions from the exaggerated nature of some children's literature:

Read aloud from several fiction and nonfiction books on the same subject

- Model ways of asking questions and making comparisons between books
- Explicitly invite children to ask questions
- Maintain a non-threatening social environment in which children feel free to express their own developing opinions and conceptions

- Resist the impulse to provide answers until children have had the opportunity to fully explore their own thinking through conversation with other children
- Provide high quality nonfiction resources (books, videos, resource people) that can give scientifically accurate explanations for the questions raised by fantasy fiction (p. 59).

When teachers search out excellent children's fiction and nonfiction to support their teaching, children find a deeper connection to the content. Science and children's literature meld together in a way that strengthens both teaching and learning.

Conclusion: My first semester of student teaching was spent in a first grade classroom in a Detroit Public School. I quickly realized that science was my favorite subject to teach. The first graders looked forward to our science lessons and I found it easy to keep them engaged with hands-on and arts integrated lessons. I enhanced the lessons with technology and was lucky to be able to incorporate our learning into a trip to the Detroit Zoo. The children's natural interest in animal life made it easy to incorporate what we were doing into writing and math. I have since maintained a passion for science education.

My favorite science activity is exploring an octopus. I begin by reading *An Octopus is Amazing* by Patricia Lauber. I then reveal that I have a real octopus for the children to explore. (I typically purchase the octopus from a local fish market whose owner is always amused with its purpose.) Each child gets a pair of

gloves. We look at the octopus, talk about its body parts, how it feels, and how it might move. The children are engaged in observation and discussion. They use descriptive language to share what they are seeing and feeling, and they make predictions about its body and how it survives underwater. I do my best to answer their questions even though I don't always know the answer. I make sure to find answers in front of the children, either from a book or a reputable web site. Afterwards, we draw models of the octopus or use watercolors to paint what we observed. Thirty children watch a video showing an octopus escaping from a glass jar with the first hand knowledge of how its suction cups feel. Providing this kind of experience for children confirms all these important aspects of science education I've explored.

Teachers who use technology, arts integration, discussion, group work, hands-on learning, and children's literature in science units will find that they have provided an engaging and rich experience for children in the early elementary classroom. When we keep in mind the question "how can I teach this without a worksheet?" and present students with authentic opportunities to learn, we are respecting them as innovative and visionary creators. We are allowing them to see themselves as scientists and engineers. We are supporting their path to becoming problem solvers and independent thinkers. All children deserve high quality science education and teachers today can bestow that.

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