Teaching Science that Promotes Language and Literacy Development

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Abstract

How can you fit science into a literacy-dominated elementary school day? This is the question and special challenge faced by the science methods instructor who is charged with the responsibility of preparing early childhood (preK-3) teachers to teach science. This paper explores some of those science challenges created by the great emphasis on reading and mathematics instruction as well as a reflection on how teaching practice has changed.

Keywords: early childhood pre-service teachers, science, literacy, language development

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A group of 4 pre-service teachers sit around a table at lunch and discuss the most recent assignments due in their methods courses. "I'm not worried about teaching a math lesson in my 1st grade class" Tiffany states. "Me neither, my host teacher has already given me my standard. I'll be teaching about sorting by color" Nia remarks. "My teacher has a whole closet full of math manipulatives I can use for my lesson" adds Carson. "I am worried about my science lesson though" says Laura. All four students moan. "My teacher hasn't offered any advice on what science lesson I should teach." "Well, at least your mentor teacher teaches science, mine doesn't even teach science."

It is late in the semester and several field assignments are due in the science method course. The main field assignment is the requirement of teaching a science lesson in the field. Tina, an early childhood teacher candidate who has been assigned a kindergarten class must email her method course instructor requesting a due date extension. Tina originally planned a Force & Motion lesson, but her mentor teacher unexpectedly changed her schedule and now that topic doesn't align with her current curriculum. Tina graciously develops another science lesson plan on living and nonliving things. She plans for a 30-minute introduction lesson and on the day of her lesson, her teacher informs her that due to a school-wide assembly she will only have 10 minutes. The lesson doesn't go as planned, and Tina is devastated. She worked really hard on planning and implementing this lesson. She doesn't want her grade to reflect her inability to teach a full science lesson.

The above scenarios are just two examples of situations I've come accustomed to hearing from pre-service early childhood teachers in my science methods courses. The teacher candidates are placed in an early childhood classroom (preK-3rd grade) for a total of 70 hours over the duration of one full semester in their junior year. Teacher candidates are expected to observe, reflect, and participate in daily classroom activities as well as implement assignments during the field experience to demonstrate their progress in planning, teaching and professionalism in a classroom setting. One of the field assignments is planning and implementing a developmentally appropriate science lesson and/or activity. In many instances, my students find it difficult to acquire the needed materials, teacher assistance and time to execute a science lesson in their field placement, especially preK and kindergarten classrooms. On the last day of my science methods course, I informally ask my students, "How hard was it to teach a science lesson in comparison

to teaching your other lessons. Teaching a lesson in each of the four content areas (mathematics, reading, science, social studies) is a requirement in our teacher education program. More times than not, the majority of my students found that meeting with their mentor teacher to identify a science standard as well as planning and implementing a science lesson took the most time and was the most challenging. One pre-service teacher candidate stated that at times she felt more confident and knowledgeable about the science standards than her mentor teacher did. Why is this? Why have the above mentioned examples become more of the norm than a rare instance?

For one, it appears that designated times for science and the arts in elementary schools are at an all-time low. According to the Report of the 2012 National Survey of Science and Mathematics Education, the average number of minutes per day teaching science in grades K-3 has declined from 24 in 2000 to 19 in 2012 (Banilower, Smith, Weiss, Malzahn, Campbell, & Weis, 2013). When I visit the local elementary schools and talk with mentor teachers, they acknowledge that they have very little time to fit science into a literacy-dominated day. This is due in part to school districts placing great emphasis on reading and mathematics instruction from pressures from local, state and federal legislation. There has been legislation in a number of states that mandates rigorous assessment of students' learning in reading and mathematics. For example, the South Carolina General Assembly passed the Read to Succeed Act of 2014. *Read to Succeed* is a comprehensive state plan to improve reading achievement in public schools by assessing the readiness and reading proficiency of students progressing from prekindergarten through twelfth grade. This one piece of legislation mandated curriculum changes at the university level as well as how professional development is offered at the district level. *Read to Succeed* requires that pre-service early childhood and elementary teachers take a twelve credit-hour sequence in literacy. The topics to be addressed are comprehension, oral language,

phonological awareness, phonics, fluency and vocabulary. For current certified early childhood and elementary education teachers, *Read to Succeed* requires that they earn the literacy teacher add-on endorsement within ten years of their most recent certification.

Even though there has been a great push to improve reading achievement in public schools, education policy makers have also been strongly advised of the need for more graduates in the fields of science, technology, engineering, and mathematics (STEM) (President's Council of Advisers on Science and Technology, 2012). Data suggest that American students are not well prepared in STEM fields at high school graduation (Nord, Roey, Perkins, Lyons, Lemanski, Schuknecht, & Brown, 2011). To increase the number of high school graduates interested and well prepared for STEM fields, research shows that early education in science and mathematics is the key (Harris Interactive, 2011; Osborne, 2003, Traphagen, 2011). Even in a preK or kindergarten classroom, we cannot view science as an optional extra-curricular activity but rather it should be regarded as an essential, indispensable building block.

As an early childhood science methods professor, I try to stress to my students as well as the mentor teachers that science in early childhood is much broader than we might traditionally think. Due to time limitations and restrictions, we can no longer think of science in terms of having a designated science time. "Doing" science at a set time, may prevent it from happening on a regular basis. Instead, we have to view science as an ongoing part of the total curriculum, integrated in all content areas and in daily activities and routines. It is imperative, as early childhood educators and professors in teacher preparation programs that we focus on not just teaching reading and math skills, but how to thoughtfully integrate all content areas in our lessons in order to provide our young students with foundational experiences that simultaneously allow them to acquire skills, concepts, and vocabulary and, most critically, the motivation to

learn (Huerta & Jackson, 2010). For example, Lightbown and Spada, (2006), noted that language and literacy were highly promoted when they were embedded into meaningful science activities. The researchers studied young English Language Learners (ELL) and found that they could learn the mechanics of reading, writing and content vocabulary and concept by being engaged in active science investigations. Current and future early childhood educators have the opportunity and responsibility to provide engaging, developmentally appropriate, rich and integrated learning experiences. Doing so will help establish critical foundations of language knowledge and literacy skills necessary for higher grades and high-stakes testing in all academic areas (Huerta & Jackson, 2010).

There are countless reasons why science should be emphasized and highlighted in the early childhood classroom on a daily basis to promote language and literacy. One reason is simply that children are born to investigate and explore. Looking at science through an early childhood lens, we can see that young children engage daily in science by exploring the world. Every single day, young children observe people, animals, and objects in their environment (Colker & Koralek, 2006). Because of their natural curiosity they are ready to ask questions, they are ready to interact with others and they are ready to explore (Conezio & French, 2002). With these engaging experiences, young children are then able to form concrete mental representations of complex science concepts. Another reason for science to not be forgotten in early childhood classrooms in regards to early literacy development is because science is so intriguing for young children, they become more engaged and therefore more attentive to and involved in the language of the classroom. (Conezio & French, 2002). A coherent, integrated curriculum allows for more complex language use and more sustained literature studies than does a disjointed approach to content.

Additionally, integrating content-related children's literature in a science curriculum is great way to promote language and literacy. With the inclusion of children's literature, scientific ideas are presented in a way that allows students opportunities to apply the content to various situations and applications (Stanaway, 2006). Reading children's literature can stimulate students to ask questions about the world as well as gain a deeper understanding of scientific ideas in a relevant, meaningful way.

Inquiry-Based Science

I believe novice teachers have a hard time knowing how to effectively integrate language and literacy experiences into a science-focused curriculum and are not aware of the many awards associated with providing children authentic situations to practice and learn language and literacy skills. Yet, the problem-solving approach associated with scientific inquiry is rich in language. Teachers can support children as they acquire and practice increasingly sophisticated language skills. When presented with a problem, and given time and appropriate prompts to answer and/or investigate, whether the conversation contributor or the conversation listener, young children can practice being involved in meaningful conversations (Their, 2002). Additionally, children gain important practice in how to maintain conversational coherence, switch and return to topics, use language to move between the past, present and future, and translate between linguistic and mental representations in science exploration and investigations (Their, 2002).

In my science methods course, one of my goals is to demonstrate how an inquiry-based science curriculum can provide rich possibilities for language and literacy acquisition. Inquiry-based classroom instruction supports learners as they construct their own knowledge while teachers facilitate and guide investigations. Instructional strategies that support inquiry allow

teachers to customize and scaffold learning experiences (Huerta & Jackson, 2010). Additionally, questioning techniques that promote higher-level thinking and provide speaking opportunities are important. Effective inquiry teachers skillfully use a mix of real-life tools and materials to create authentic experiences that support students as they observe and interact with scientific content and processes (Huerta & Jackson, 2010). Furthermore, students flourish when they are allowed to explore science in a non-judgmental learning environment (Huerta & Jackson, 2010). Inquiry-based science curriculum provides experiences that activate all five senses. This provides a natural, fertile ground for building vocabulary and background knowledge for all types of learners (Huerta & Jackson, 2010). Lastly, using science tools such as a science notebook can promote language and literacy development by collaborating with peers and collecting and recording data about concrete experiences which leads to constructing and solidifying scientific understanding (Huerta & Jackson, 2010).

Language and literacy development involves much more than just being able to talk, listen, read, and write. Language and literacy involves learning to comprehend, reason, and reflect. (Lee & Buxton, 2013). An effective early childhood teacher will incorporate reading and writing strategies in their science instruction to promote both science learning and literacy development for all students. With this knowledge, my goal is to change the next generation of early childhood teachers' perception of "not teaching science" to "always teaching science." As Conezio and French (2002) state,

> "Teachers who increase their understanding of what science is at the [early childhood] level will come to see that science can be incorporated into many, if not most, of the activities that they already do. Science itself is not an activity, but an approach to doing an activity (p. 17)."

Changes I've Made in My Science Methods Course

I have intentionally made some changes in my science methods course to address the challenging nature of teaching a science lesson. First, I continuously emphasize in class the importance of integrating science in various content areas, particularly language arts. I offer several hands-on examples of identifying an appropriate science standard and teaching that standard in conjunction with another content standard, particularly English Language Arts (ELA). I require teacher candidates to include two standards in their lesson plan: one science standard and one ELA standard. When done accurately and appropriately, this technique clearly demonstrates integration. For example, a teacher candidate can include opportunities for written language in science by using science notebooks during their investigation. Secondly, when recruiting new mentor teacher, I discuss the teacher candidate's expectations as well as the mentor teacher's expectations. This includes letting the mentor teacher know upfront that students will be required to implement a science lesson that will integrate literacy. The mentor teachers are expected to discuss the lesson in depth with the teacher candidate and give direction and suggestions on their approach(es). Thirdly, I model how using children's literature is a great way to introduce science concepts to young children. Research shows that children's literature including picture books, fiction and nonfiction books can be effective instructional tools in science instruction. Developmentally appropriate children's literature not only provides content knowledge and fosters science process skills; it also awakens children's curiosity and offers opportunities for inquiry (Sackes, Trundle & Flevares, 2009). For example, *Are You My Mother*? by P.D. Eastman is a classic story about a baby bird trying to find its mother after hatching from an egg. The baby bird leaves the nest and visits several animals and objects asking each, "Are you my mother?" Through this book, young children practice the science process

skills of observation (seeing similar physical characteristics of organisms), classification (identifying common features and traits for a family), and prediction (predicting if each animal/object is the baby birds mother). The text not only fosters the usage of science process skills, but also contains repeating word patterns to aid in word identification which promotes language and literacy development (Stanaway, 2006).

Lastly, through my years as a professor and classroom teacher, I have acquired a sizable closet of science materials. I have developed a "lending closet" in which students can check out materials to assist them in the implementation of their science lesson. Materials include class sets of magnifying lenses, measuring spoons and cups, safety goggles, eyedroppers, balance scales, ramps, binoculars, trays, clipboards, and children's literature. These readily available materials take away a major stress placed on the teacher candidate of not only planning and teaching a science lesson, but also providing appropriate tools and materials for students to use during the lesson.

I realize that I cannot reconfigure instruction time for all elementary schools across the nation to prioritize science. I do believe, however that I am giving my students a broader perspective of science teaching and learning. The teacher candidates successfully completing my science method course will have the tools and experiences to integrate science across the curriculum on a daily basis. In the end, I hope the next generation of students are taught not just scientific content, but also learn how to analyze, apply and transfer that knowledge into other content areas. Teaching science in an interdisciplinary way will take full advantage of the natural curiosity of young children and will provide a strong foundation for meaningful language and literacy development.

References

Banilower, E. R., Smith, P. S., Weiss, I. R., Malzahn, K. A., Campbell, K. M., & Weis, A. M. (2013). *Report of the 2012 National Survey of Science and Mathematics Education.* Chapel Hill, NC: Horizon Research, Inc.

Colker, L. J., & Koralek, D. (2006). *Spotlight on young children and science*. Washington, DC: NAEYC.

Conezio, K., & French, L. (2002). Science in the preschool classroom: Capitalizing on children's fascination with the everyday world to foster language and literacy development. *Young Children*, *57*, 12-18.

Eastman, P.D. (1960). *Are you my mother?* New York: Random House, Inc.

Harris Interactive. (2011). *Stem perceptions: Study & parent study. Parents and students weigh in on how to inspire the next generation of doctors, scientist, software developers and engineers.* Study commissioned by Microsoft Corp. Retrieved September 20, 2016, from http://www.microsoft.com/presspass/presskits/citizenship/docs/STEMPerceptionsReport.pdf

Huerta, M., & Jackson, J. (2010). Connecting literacy and science to increase achievement for English language learners. *Early Childhood Education Journal 38*, 205-211.

Lee. O., & Buxton, C. A. (2013). Integrating Science and English Proficiency for English Language Learners. *Theory into Practice*, *52*, 36-42.

Lightbown, P. M., & Spada, N. (2006). *How languages are learned*. Oxford, England: Oxford, University Press.

Nord, C., Roey, S., Perkins, S., Lyons, M., Lemanski, N., Schuknecht, J., & Brown, J. (2011).

America's high school graduates: Results of the 2009 NAEP high school transcript study. Washington, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved September 1, 2016, from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2011462

Osborne, J. (2003). Attitudes towards science. A review of the literature and its implications. *International Journal of Science Education, 25(9),* 1049-1079.

President's Council of Advisers on Science and Technology. (2012). *Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering and mathematics*. Washington, DC: Executive Office of the President. Retrieved September 20, 2016, from http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_feb.pdf

Read to Succeed Act. (2014). *Act 284. June 5, 2014*. South Carolina General Assembly.

Sackes, M., Trundle, K. C., & Flevares, L. M. (2009). Using children's literature to teach standard-based science concepts in early years. *Early Childhood Education Journal*, 36: 415-422.

Stanaway, J. (2006). *Science and children's literature*. Retrieved November 11, 2016, from https://msu.edu/~stanawa8/Science%20and%20Children's%20Literature.htm

Their, M. (2002). *The new science literacy: Using language skills to help students learn science*. Portsmouth, NH: Heinemann.

Traphagen, K. (2011). *Strengthening science education: The power of more time to deepen inquiry and engagement*. Washington, DC: National Center on Time and Learning. Retrieved September 20, 2016, from

http://www.timeandlearning.org/sites/default/files/resources/strengthening_science_education_full_report_.pdf