Apprehension to Application: How a Family Science Night Can Support Preservice Elementary Teacher Preparation

by Kelly Feille, University of Oklahoma; & Heather Shaffery, University of Oklahoma

Abstract

Preservice elementary teachers (PSETs) often have limited opportunities to engage as teachers of science. As science-teacher educators, it is important to create experiences where PSETs can interact with science learners to facilitate authentic and engaging science learning. Using informal science learning environments is one opportunity to create positive teaching experiences for PSETs. This manuscript describes the use of a Family Science Night during an elementary science methods course where PSETs are responsible for designing and facilitating engaging science content activities with elementary students.

Introduction

The course goals listed for Teaching Science – Elementary School include creating instructional opportunities for diverse students to learn science, gaining proficiency using a variety of teaching methods and strategies within learning cycles, gaining practical experience integrating science learning with other subjects, and gaining an awareness of informal learning environments and their potential impact on student learning. However, students enrolled in this elementary science methods course (like many others) spend only two days a week on an elementary campus and through observation and student self-report we have found that their opportunities for exposure to science teaching and learning are limited at best and nonexistent at worst. In addition, many preservice elementary teachers (PSETs) bring with them negative experiences related to their own science learning (Palmer, 2002). These negative experiences combined with few opportunities to gain confidence and proficiency in science teaching may lead to a prolonged low science teaching self-efficacy in novice PSETs. Therefore, providing opportunities for PSETs to experience positive science teaching experiences has the potential to positively impact their self-efficacy (Bandura, 1986).

The use of informal science learning environments is one opportunity to create positive science teaching experiences for PSETs. Preservice learning experiences that encourage PSETs to facilitate learning in out-of-school contexts can encourage PSETs to consider teaching in a broader context beyond what they have personally experienced (Kisiel, 2012) and enhance PSET confidence for science teaching (Kelly, 2000). The advantages of “sociocultural, exciting, motivating, and free-choice learning spaces” create unique advantages for PSETs science teaching development (Avraamidou, 2015 p. 133). Family

Science Night (FSN) is one such environment where PSETs can facilitate informal science learning. Additionally, participation in Family Nights during preservice experiences can positively impact PSET's views on parental involvement (Jacobbe, Ross, & Hensberry, 2012; Uludag, 2008). While FSN that include PSET participation are often led by science educators e.g. (McDonald, 1997) or supported by scientists and science centers e.g. (Harlow, 2012), the FSN we describe is completely designed and facilitated by PSETs. The problem solving involved in planning an outreach event such as a FSN engages PSETs in not only components of informal science teaching but issues of family engagement and participation as well.

The goal of this manuscript is to describe a Family Science Night (FSN) designed and facilitated by PSETs at a local elementary school. We describe our limited role and resources used in guiding elementary science methods students through the process of planning for the FSN and provide evidence of the success of the experience relating to PSET confidence to teach science, gains in pedagogical experience, and perceptions of family involvement.

Context

Students enrolled in Science Teaching – Elementary School concurrently take methods courses in literacy, mathematics, and social studies. Each of the four methods courses meet once a week for a three-hour course credit. In addition, these students are enrolled in a pre-internship practicum (PIP) course where they spend two full days a week in an elementary classroom. Within the science methods course, PSETs construct one integrated instructional sequences utilizing three-dimensional instruction and NGSS-based state standards (NGSS Lead States, 2013) as well as two daily lesson plans that may be implemented in their field placement.

Each semester, we partner with a local elementary school to host the FSN. PSETs are responsible for every component of the FSN from start to finish. As a course assignment, PSETs work in groups of three or four to plan individual stations for the FSN. Our responsibilities (as course instructors) lie primarily in facilitating the school partnership and transporting materials. The size of our program allows us to partner with one elementary school each semester to host the FSN. These sites are selected through existing partnerships with school leadership, meaning often we have students placed at these locations for field placement during practicum and/or internship semesters. Working with school administration and staff, we identify where stations will be set-up and construct a campus map to help families navigate to areas of interest on the night of the event. We encourage leadership to involve teachers and students in publicizing the event to their campus community.

Science Night

Planning

Beginning in week two of the semester, PSETs are assigned the Science Night Activity Planning Sheet. In this planning stage, PSETs must identify whether their activity is geared towards students in early-elementary (K-2), upper-elementary (3-5) or all elementary grades (K-5). Next, PSETs describe the topic and content focus of the activity. Because our state standards are based on the NGSS, we ask students to support their development of 3-dimensional teaching by identifying included Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Cross Cutting Concepts (CCCs). After referring to the state standards or NGSS, PSETs describe what students in grades Kindergarten through fifth should know about their focus topic and DCI(s) charting a simplified learning progression of the topic.

Due to the lack of state or district adopted curriculum materials in elementary science, we have found that our students often struggle to identify content-rich science learning experiences. They then rely on those found in cursory internet searches and fail to critically examine the content piece of the learning experience. Rather than restrict such activities from inclusion, we encourage our students to freely explore science activities they find through Google searches or online inspiration tools such as Pinterest, but challenge them avoid becoming distracted by the “fun factor” and instead focus on the scientific accuracy of the content their activity presents. Focusing on science content encourages PSETs to dig deeper into their identified science activities when they construct the progression of learning for their topic and describe, in detail, what students should be expected to learn through participating in their station. It is this part of the process that forces PSETs to abandon content-negative activities or those that promote alternative conceptions for learners such as shaving cream rain clouds or Oreo cookie moon phases. Additionally, the feedback process helps to identify common content misconceptions held by our PSETs and serves as our own formative assessment as we navigate the remainder of the semester course.

PSETs provide a detailed listing of what students will be expected to do at their station and what PSET group-members will do at the station to facilitate student learning. Although it is not expected that PSETs develop a detailed lesson plan of sorts, they should identify procedural steps they will need to guide students through. In addition, PSETs should pre-determine examples of probing and scaffolding questions that can be used during the facilitation of the activity to guide student understanding of the science content addressed in the activity at multiple grade levels and allow PSETs to formatively assess student learning. As a part of this stage, PSETs identify what students will learn from completing the activity, describe how they will know that students are learning (e.g. student responses to questions, completion of a task, or drawings of observations), and address safety considerations.

As a final organizational step to the planning process, PSETs estimate how many students they believe they could facilitate at one time, the type of table that would be preferred, and a shopping list of materials and supplies needed (see Resource). Although some students perceive this planning process as tedious, many of them attribute the success of their station to the rigorous planning expectations.

> When we were working on our lesson plans in the classroom, I felt as though the entire process was more in depth than it needed to be. Until actively engaging with the students during science night, I did not understand why we had to be as thorough as the expectation mandated us to be. (PSET Science Night Reflection)

We encourage PSETs to consider their activity along the lines of *kitchen science* relying on readily available, low-cost materials. Due to safety and allergy concerns, we prohibit the use of edible-science activities. We then assess PSETs' Science Night Activity Planning Sheets using a Yes-Partially-No checklist (see Resource) ensuring that activities are content and ability-level appropriate, unique (meaning there are no duplications of stations), and materials and supplies are reasonable. After assessment, PSETs must provide corrections and edits to their Planning Sheet prior to implementation.

Preparation

One to two weeks prior to the FSN, PSET groups gather their found (or purchased) materials and host a FSN trial run during their science methods class. We use this opportunity to remind PSETs of the importance of trying-before-teaching. This allows them to identify design flaws in their activities as well as areas where students may need scaffolding or support. This step in itself provides a significant learning opportunity for the PSETs. As they realize where their plan is flawed, or their estimations of time or material demands are skewed, it becomes a moment of realization of the implications for their future classroom.

PSET groups create color-coded posters to advertise their station. As a means to guide parent and student attendees at the FSN, colors are assigned to stations by activity content or topic focus (i.e. physical science, earth-space science, life science, or integrated STEM). Finally, groups compile their materials, signage, and handouts (as desired) to be transported to the FSN.

Presentation

As support for the FSN, we ask that our elementary campus partners have tables and areas set-up prior to the FSN start time. PSETs arrive 30 minutes early to arrange their materials and hang their signs. Volunteers are then staged at entry points to distribute campus maps and lists of stations.

This is where we find our PSETs shine. The low-stakes environment of the FSN eases the fear that often accompanies science instruction. Groups divide-and-conquer as students and their families engage in interactive, student-centered science activities. Trios and foursomes of PSETs quickly fall into a routine of engaging students as they approach their tables. Immediately, they ask students questions about the materials and encourage predictions with prompts such as, "What do you think will happen?" Learning as they go, PSETs adapt their scaffolds for the various levels of learners they encounter and can frequently be seen engaging both early-childhood and upper-elementary learners simultaneously.

As the night bears on, PSET confidence increases as supplies run low. At the close of the night while families trickle out, PSET groups work to break down their stations and clean up the inevitable mess. Although their exhaustion is apparent, so is their joy. The night has been deemed a success by students, parents, campus volunteers and staff, and primarily the PSETs.

Reflection

Immediately following the FSN, we ask PSETs to reflect on their experiences. We prompt students by asking them a) What moments stand out as memorable? Did anything surprise you? Did anything frustrate or disappoint you? b) Did students learn from your activity? How do you know? and c) How do you feel this experience shaped you as a science teacher? Reflections should be between two and four double-spaced pages.

Evidence of Success

The PSETs' reflections following the FSN provide a great deal of evidence relating to the success of the event in meeting the goals of the Teaching Science – Elementary School. Approaching science night as students who generally felt unprepared to teach science, apprehension was the most accurate description of the PSETs feelings towards the experience. "When first going into science night, I was not excited. If I am being honest, I thought that the whole thing was going to be a poor turn out and that we would be sitting there for no reason." (PSET Science Night Reflection) By all accounts, that apprehension quickly turned into excitement and appreciation. In their reflections, PSETs reported finding an increased confidence to teach science, gaining skills in facilitating authentic science learning, and being pleased and inspired by the amount of family and community support.

Confidence to Teach

PSETs reported that their confidence to teach science increased in multiple ways. They felt more comfortable asking questions of students given the repeated nature of the experience. They felt safe to try out their ideas and were able to learn from how students responded to improve their strategies and therefore adapt their practices as the night went on to better meet the needs of their learners. The fear or apprehension they brought into the course was alleviated through the positive interactions they had with the elementary students. "Throughout this experience, I realized that just because my science background wasn't ideal, doesn't mean that I won't be a good teacher of science. I really think that my confidence grew throughout this experience and I see now that I can teach science and be successful." (PSET Science Night Reflection) As PSETs engaged with elementary students (and their parents) at multiple levels of science content knowledge, they could experiment with questions, pedagogical approaches, and levels of scaffolding that students required. So, rather than a one-and-done attempt at a lesson in their field placement classroom, the repeated trials afforded by the FSN allowed PSET confidence to grow from apprehension to proficiency.

Facilitation of Learning

Prior to the FSN, PSETs have very little experience facilitating learning of science with students. They have reflected on their own learning experiences in science and begun to consider how they see themselves as a science teacher, but have not been able to try out their vision. “This science night really made me reflect on myself as a science teacher and the kind of teacher I will want to be. Throughout college, I have always known how important it is to make science engaging and hands-on, however, I have never seen the impact it truly has on students for myself. After the science night, I had made up my mind that I will commit to making science engaging and meaningful even if it is a little bit more work- because it is totally worth it.” (PSET Science Night Reflection) We find that as they see young students make complex connections through engagement and questioning, their self-efficacy and outcome expectancy improves.

Community Support

PSETs reported being most surprised by the parental support demonstrated at the FSN. “The reaction from the parents was more than I could have ever expected. Multiple parents verbally expressed their gratitude for our efforts and attendance at the science night. They explained that they rarely have the opportunity to see their student’s education in action. They noted that the science night allows them to better understand their child as a student and understand how he or she learns in an academic environment.” (PSET Science Night Reflection) As future elementary teachers, seeing parents and the school community as part of the educational team is paramount. The FSN provided an excellent opportunity for PSETs and the school community to engage collaboratively in an interactive and low-stakes manner.

Lessons Learned

As course instructors, there have been some important lessons learned regarding facilitating a FSN with PSETs. First, thorough and thoughtful feedback is absolutely necessary in regards to the Planning Sheet. As this is generally one of our PSETs first experience facilitating science learning, they often struggle in making accurate content connections at grade-appropriate levels. Requiring PSETs to respond to feedback and make corrections strengthens their FSN activity plan and better prepares them to engage with elementary students. However, we have found it is just as important to not over-scaffold this process. Allowing PSETs to learn as they go was part of what PSETs describe as making the experience so meaningful.

Second, the setting makes a difference. Our two current school settings are very different architecturally speaking. When families were able to easily see and find each of the stations, the experience for our PSETs was more positive. When families were required to weave through a complex school building, some stations saw very little foot traffic and therefore their experience was diminished due to lack of student interaction.

Third, our PSETs felt most confident when they were left to interact with students on their own without classroom teachers present. When stations were placed inside of classrooms, we found that most teachers preferred to be present as their room was used for the FSN. As understanding as we are about this, we found that our PSETs were more reserved in their interactions with students and parents and seemed to rely on engagement from the classroom teacher rather than take charge themselves.

Finally, practice makes better. As much as we tell our PSETs that they must try before they teach, we have found that providing them the time and space to run their FSN activity during our methods course class time is the only way to ensure a trial run. For some groups, if we had not insisted on this their FSN activity would have been a flop – providing a valuable learning experience no doubt, but with the stakes of missing the FSN completely. We find that due to the pressure of failing in front of their peers, allowing the trial run (with successes and failures) to happen during class is just as valuable a learning experience as it would be with elementary students but without the higher stakes.

Conclusion

The incorporation of opportunities to teach in informal settings for preservice science education supports the growth and development of PSETs confidence to teach science and their consideration of science teaching beyond the scope of the formal classroom setting. To combat the negative science learning experiences PSETs bring, they need repeated and positive episodes of science teaching. A Family Science Night can provide just that. When PSETs can practice their craft in engaging and exciting, yet low-stakes, environments they are likely to find an increased confidence in their ability to facilitate authentic science learning. Their new-found positive orientation to science teaching can lead to an appreciation and even passion for finding the means to meaningfully include science in their future elementary classrooms and beyond. “Science Night helped show me that I can teach science to any grade, not just to my [pre-intern practicum] class. I was excited to share the activity with students of all ages and found that I was able to keep their attention and engage them all by asking questions and sharing my enthusiasm with them. I am thrilled to be able to do this for the rest of my working life.” (PSET Science Night Reflection)

Supplemental Files

Resource.docx

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