Teaching Outside the Box: A Collaborative Field Experience of Formal and Nonformal Educators

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Abstract

This paper describes a collaborative project in which elementary education (ELED) majors partnered with recreation majors (RM) to develop and implement science lessons in the outdoors. ELED and RM students both need experiential learning to accomplish respective skill sets in multiple settings. The purpose of this project was to provide both undergraduate groups with “real-life” experiences related to their respective fields and in doing so, to promote science learning in natural spaces. ELED and RM students co-constructed inquiry-based lessons and related recreational activities for implementation with 5th grade students. The researchers provide an overview of the project and describe the actions, benefits and outcomes of this university partnership.

Introduction

As science teacher educators, most methods courses include coverage of content and pedagogical practices essential to effective science instruction. For the elementary teaching candidate, this includes the development of science instructional plans for use with school-aged learners. A common problem encountered with this expectation centers on the aspect of curriculum implementation– the where, what, and when of science teaching and learning. The Common Core Standards have directly impacted science learning at the elementary level in states that have adopted them (National Governors Association Center, 2016). The majority of the day is dedicated to literacy and mathematics, leaving science, social studies, and health as extracurricular content areas rotated throughout the school year. This not only impacts our teaching candidates’ opportunities to observe science teaching and learning, but also limits their chances to implement lessons with school-aged children.

Many science educators have been innovative and creative in their efforts to provide preservice candidates with science teaching opportunities. At the elementary level, candidates have provided instruction at family science night (Gunning & Mensah, 2000), Saturday science clubs (McLaughlin, 2015), discovery centers (Jarrett, 1999), environmental education centers (Bennett & Heafner, 2004; Carrier, 2009; Moseley, Reinke, & Bookout, 2002), in school gardens (Carrier, 2009; Carrier-Martin, 2003; Cronin-Jones, 2000), and at local museums (Kisiel, 2013). The literature also reveals how interdisciplinary partnerships between faculty in teacher education programs (Shin, Lee, & McKenna, 2016; Maheady, Magiera, & Simmons, 2016; McClanahan & Buly, 2009) and among university faculty and local institutions (VanSickle & Schaumleffel, 2016; Bainer, Cantrell, & Barron, 2000) benefit undergraduates as well as the local community. Engagement in service-learning, faculty research and collaborative projects promote authentic, meaningful contexts for learning and have a lasting impression on the teaching candidate (Lederman 1999; Tilgner 1990).

In our teacher education program, elementary candidates have one science methods course. The course covers the elementary science curriculum, essential science content, processes, methods, and inquiry-based planning and assessment. And while all of these elements are vital to science planning and teaching, a recurring challenge centers on the instructional context for application. We want elementary candidates to have one science teaching/learning experience to be powerful and meaningful, encompassing candidates' knowledge of content, children, inquiry and school curriculum (Wilson, Shulman, & Richert, 1987). In this article, we describe a unique project developed for the field experience. Through an interdisciplinary approach, elementary education majors were paired with recreation managers to develop and implement inquiry-based learning activities surrounding a fifth grade science standard.

By thinking outside the box, an unconventional partnership between formal and nonformal educators was initiated. The goal was for these future professionals to collaborate, share expertise and promote science learning in natural spaces.

Project Inception and Preliminary Work

We have degrees in outdoor education, though our professional pursuits have led us to different programs of study. One of us has spent decades in public education as an elementary teacher and outreach educator, while the other has spent years in national parks and has facilitated a number of environmental education programs. Our involvement on university committees, as well as our participation in local service activities, presented us with many opportunities to converse about our work. In time, we recognized a shared frustration with the practicum component of our methods courses. As interns, both elementary education and recreation manager students were to engage in designated field placements where knowledge and strategies were practiced. However, our course evaluations suggested that the practicum had little value beyond an assigned space for completing required coursework. This limitation prompted us to propose and develop an interdisciplinary field experience in which our students worked together to plan and teach science to school aged learners.

After gaining approval from our respective departments, the first step required that we compare course goals and expected student outcomes. As the instructors, we shared general beliefs about science teaching and learning, but had to distinguish formal from informal learning (Kisiel, 2010; Tal & Steiner, 2006). In teacher education, we often refer to *informal* learning as experiences that take place outside the classroom (such as field trips or afterschool programs), but recreation managers who often provide outreach education, refer to outdoor learning experiences as *nonformal*. Therefore, we defined formal learning as pedagogically-based and typically associated with structured learning environments and identified nonformal learning experiences as structured activities that promote participants' skills (orienteering, climbing, boating) or knowledge (map reading, rock formations, tides and currents) typically aligned with recreational choices or environmental advocacy. This distinction was necessary for distinguishing the roles (and expertise) of the Elementary Education (ELED) and Recreation Management (RM) faculty and students participating in this venture.

Next, we examined the typical student population enrolled in our methods courses. At the time, an average of 22-24 first semester seniors was enrolled in each section of the elementary science methods course. The majority of ELED candidates were Caucasian females, with 50% growing up in suburban areas and 25% indicating rural or urban areas of upbringing. RM students were traditionally second semester sophomores or juniors, 65% male and 35% female. Though a bit more ethnically diverse, the majority of RM students were Caucasian and identified their area of upbringing as 50% suburban, 35% urban and 15% rural. Though the ELED candidates were further along in their program and had more pedagogical training, RM students had a range of leadership and/or risk management courses that included outdoor education.

With learning domains identified and student background experiences in mind, we focused our attention on the shared course assignments completed during the practicum component of our respective courses. In the science methods course, elementary candidates constructed a three-day instructional sequence formatted to the 5E learning cycle (Bybee, 2015). At least one lesson was to be taught to a group of elementary students under the supervision of a licensed practitioner. Analysis of assessment data, teacher feedback, and candidate reflection were subcomponents of the instructional design. In the recreation management methods course, the practicum setting included municipal, state, or federal parks, and outreach assignments aligned with the core competencies of recreation and parks systems. The practicum work focused on leadership, management, programming, and administration skills (Barcelona, Hurd, & Bruggeman, 2011). To ensure common course requirements were met, we integrated the 5E instructional plan with the RM students' outreach education assignment, resulting in a shared instructional plan for implementation.

In drafting the guidelines for the assignment, we selected four science curricular strands from the North Carolina Standard Course of Study (NCSCOS). Each plan was to include repeated practice of an identified process skill. Students from both programs would be randomly assigned a partner, a curricular strand and practicum date. ELED candidates would propose the "exploration" and "explanation" portions of the inquiry to the RM partner and together, they would determine an appropriate 'engagement' activity. RM students would be responsible for contributing activities for the "elaboration" portion of the 5E plan. As the curriculum experts, ELED candidates drafted the plan and shared essential science background content; the RM students contributed nature knowledge and addressed group management. The responsibility of “evaluation” was intentionally kept separate, with the ELED candidate responsible for a formative science assessment and their RM partner focused on program evaluation.

Supporting the Venture

After drafting an overview of the shared curriculum design project for implementation outdoors, we sought support from our university and community partners. For the ELED candidates, it was important that the science teaching involved students from a local public school. For the RM students, we needed a local agency that provided outreach education. Since the practicum would take place outdoors, the agency selected had to be within a reasonable distance to the local school site. The university needed to support this interdisciplinary effort as well, resulting in an internal grant ($5,000) for travel and resources over the academic year. In this section, we share the actions taken to bridge the partnership with our local constituents. We refer to these identified groups as *investors*, for, without their support, this project would not have been possible.

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Investors of the Project

District (school)

With the end of the school year quickly approaching, it was important to contact teachers from existing school partnerships. One school had a departmentalized fifth grade and the science teacher on this team had been in the first author’s graduate class. We approached her (and the team) about an outdoor learning experience that included four field excursions to a neighboring federal park at no cost to the school. We outlined the planning and implementation process, highlighting how the experience would provide 5th graders with an opportunity to observe change in the natural world over time. The mathematics teacher had ideas for integrating geometry and the language arts teacher felt the opportunity would lend itself to her unit on poetry and informational writing. The team's immediate concerns, however, related to district field trip mandates and transportation costs. Even with a budget to support transportation, the group was less than optimistic that the project would occur.

The proposed project was then shared with the school principal. While concerned about budgetary aspects, she felt this opportunity would be a great experience for the 5th grade students and the teaching team. She consented to the additional field trips, but only if: 1) transportation costs were covered and, 2) the superintendent approved the project. In an effort to move forward, we identified potential dates for the trips using the recently approved school calendar. Field excursions were scheduled about 4-5 weeks apart to allow ample planning time and seasonal variation at the park. Trips were tentatively planned for early October, November, March and late April.

The principal arranged for a meeting with the superintendent. Perhaps serendipitous, the district superintendent had curricular roots in outdoor learning. Her enthusiasm for the project extended beyond the science opportunities for the elementary students and included an expressed interest in forging stronger relations with both the university and the federal park. She felt the partnership was not only innovative in regard to science learning, but provided a large population of at-risk students an opportunity to interact with college students over time. In her letter of support, she approved the tentative calendar, waived the district field trip mandate, and offered two activity buses for transportation of the elementary students.

Federal park

The choice of a local federal park (managed by the United States Army Corps of Engineers) was intentional. The chosen site was a source of near-by nature, only four miles from the school and a familiar source of recreation to the local community. Just days before contacting the park superintendent, an interpretive ranger had crafted a partnership memorandum for the chair of the Recreation Management program at our university. In his attempt to strengthen ties with the university, we were invited to the park to discuss the project. We described how ELED candidates and their RM partners would co-construct a science lesson and implement it with 5th graders at the park. The ranger agreed that, upon approval from the park superintendent, one campground area near the lake would be designated to our project and reserved for the four field excursions. The ranger also referred us to the 'Friends of the Lake' group that was in the midst of converting a space at the site into an Environmental Education Center.

We met with the park superintendent and a representative from the Friends of the Lake group in late June. Again, we described our intentions and received support. As a partner in this endeavor, the superintendent waived site fees, granted access to facilities (even during "off" season when closed to the general public), and designated an interpretative ranger to assist us on the days of the field excursions. The Friends' group offered us an inaugural visit to the Environmental Education Center upon its opening in the spring. With letters of agreement from the school district and the federal park, it was time to put words into action.

Project in Motion

As faculty, we identified two topics from course syllabi that would serve as the "common knowledge" shared by both ELED and RM students: 1) Learning in Nature and 2) Comfort in Nature through Environmental Socialization. Since one aspect of the collaboration required science teaching in an outdoor setting, it was necessary for both groups to understand the importance of children's interaction with nature as it influences intellectual development (Brown, 2009; Burdette & Whitaker, 2005; Dadvand et al., 2015; Gray, 2011; Kahn & Kellert, 2002). We wanted students to understand how direct and regular access to the natural world has the potential to sharpen an individual's "breadth of awareness, facility of reasoning, acuity of observation and associative skills" (Pyle, 2002, p. 315). It was also important that they recognize nature's potential to build confidence, develop identity, and supplement learning for elementary students (Anderson, Lawson, & Mayer-Smith, 2006; Ewert, Place, & Sibhthorp, 2005; Proshanksy & Fabian, 1978). Whether a formal or nonformal educator, the value of nature strand was not only the context for science teaching and learning but also the means for emphasizing the value of nature experiences during the formative childhood years.

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In *Last Child in the Woods*, Richard Louv (2005) expressed concern about the lack of nature opportunities available to today's children. We recognized that our college students were of this generation and likely had limited outdoor nature experiences. To increase their confidence and comfort in outdoor settings, we expanded course content on human development to include the notion of environmental socialization (ES). Through ES, essential ancillary skills and competencies are developed through frequent outdoor experiences and promote the individual's conceptualization of self in terms of the environment (Bixler, Floyd, & Morris, 2002; James, Bixler, & Vadala, 2010). This tied in well with the value of nature content because it highlighted how repeated and frequent experiences in the outdoors inform the individual's practical knowledge of the physical world. During the first week of the course, students in both classes responded to a survey that included 35 Environmental Socialization items, 10 science teaching efficacy items from the STEBI-B (Bleicher, 2004), 5 items specific to college science coursework and environmental education training, and two open-ended items about comfort in the outdoors and teaching science. Demographic information included area of upbringing, gender, and year of birth. The ES measures provided information about recollected childhood experiences and were used to explain and emphasize the significance of these experiences in their own life trajectories in class. We hoped this would further substantiate the rationale for the collaboration and shared practicum experience. A primary goal was for both groups to understand how these formative experiences have the potential to impact future interest, comfort and confidence in science learning for children. The efficacy items were used as pre/post data for the project, providing comparison measures between the formal and nonformal groups.

By early August, both methods courses had been modified to align with our interdisciplinary approach to the shared field experience. Both groups of students met for a general orientation about the joint project/partnership the third week of classes and were randomly assigned partners and curriculum topics at that time. The following week, ELED and RM candidates traveled to the federal park site and met with the ranger. During this visit, the teams selected their designated area, and examined surfaces (grass, forest, open field, parking lot), resources (lake, beach, and playground) and proximity to covered area (amphitheater, pavilion) in case of inclement weather. RM students assessed feasibility of designated teaching areas by evaluating logistics and timing of rotation stations. ELED candidates identified essential materials to the inquiry and modified the 5E plan to fit the selected space. As a part of the shared instructional assignment, an out-of-class meeting between ELED and RM students was required to develop and finalize the instructional plan. By the end of the fifth week, teams had to submit a projected budget and materials list. Each team had the experience of working with limited funds and resources, a reality they would face in their future professions.

In finalizing lessons, teams were encouraged to practice the lessons multiple times. The goal was to implement the engage, explore and explanation portions of the plan in 45 minutes. Instructional pacing was important, especially since each team had to be able to informally assess 5th graders' learning before they rotated to the next station. For each 5th grade field excursion, ELED and RM students arrived to the park site 1.5 hours in advance (around 6:45 a.m.). Teams were given time to set up their station, organize materials, and quickly run through lessons. The last 15 minutes were spent determining the rotation circuit based on selected sites. During this time, teams designated who would escort students to the next station and who would set up for the next group. When the school buses arrived (at 8:15 a.m.), 5th graders were greeted, assigned to a station group, and escorted to that designated area.

At each station, 5^{th} grade students engaged in a preliminary activity or question that led to the planned exploration. Explorations averaged 25-30 minutes and included data collection in provided science journals. The explanation portion of the lesson was directed toward the 5^{th} graders questions and experiences. The remaining time was spent reinforcing key terms, skills and concepts through the RM activity. After the 5^{th} graders rotated through four stations, a final whole group culminating activity was led by the second author, providing an opportunity for participants to share a favorite moment or experience from the day. The 5^{th} graders were then bussed back to school where the teaching team would spend another 2-3 days reinforcing these learning experiences through writing, math, and science instruction.

In Retrospect: The Project

Close to 100 Appalachian State University students participated in this field experience over the academic year. A final product from the partnership included a curriculum guide with a dozen 5E lesson plans aligned to the NC State Science Standards. In addition, over eighty 5th grade students from a local elementary school engaged in multiple outdoor science learning experiences facilitated by future educators at a neighboring federal park. The district superintendent and principal attended the final field excursion, celebrating the partnership in local newsletters and district correspondence. In addition, the authors were asked to provide inservice to 5^{th} grade teachers in the district using the federal park as the venue for future field trips. The park superintendent and Friends of the Lake group requested copies of the curriculum guide and continue to utilize the materials with visitors to the Environmental Education Center. Though recognized by the investors, our primary focus had been to impact the science teaching/learning experience through a shared practicum. Therefore in this final section, we highlight key findings about the collaboration.

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Undergraduates

From survey data collected the first week of class, we noted that ELED and RM students conveyed uncertainty or discomfort with science content knowledge (Udo, Ramsey, & Mallow, 2004). Specific to ELED candidates, we observed increased anxiety once curricular topics were assigned (Gunning & Mensah, 2011). Yet as the semester progressed, ELED candidates' discomfort shifted from understanding of science content to managing groups and materials in an unstructured (unfamiliar) setting. The RM students' comfort with facilitating groups in outdoor settings, as well as their expertise with risk management, helped mediate their partners' anxieties and reduce stresses related to the unexpected. Similar to the recommendations of McLaughlin (2015) and Kelly (2000) we believed that this experience, when combined with our students' growing expertise in formal and nonformal settings, positively impacted their confidence in the teaching of science.

Unique to this project, was the opportunity for ELED candidates to assume a mentoring role during the instructional planning process. Prior to this project, RM students perceived lesson planning and implementation as requiring little work or effort. However, after working with ELED candidates and the 5th graders, they were more likely to recognize how purposeful planning and preparation impacted the learning experience for the 5th graders. Though RM students expressed an increased appreciation for the instructional planning of the formal educator, ELED candidates' reflections consistently indicated an increased confidence in planning and teaching science.

The rotation arrangement provided both groups with multiple opportunities to adjust, modify, and practice their instructional approaches (Bennett & Hefner, 2004). Activities observed during the latter rotations included better pacing, more direct questioning, and improved management of materials and resources. With each repetition, candidates expanded upon their understanding of science concepts and vocabulary (McLaughlin, 2015) and exhibited more comfort and confidence in teaching the lessons as the day progressed. Both ELED and RM students indicated the benefit of this type of arrangement during debriefings and in teaching reflections. The majority of ELED candidates and RM students referred to the students' engagement and excitement for science learning as a worthwhile outcome of their efforts.

Finally, this collaboration demonstrated the need for public land managers to partner with local schools to promote advocacy for natural spaces. Both groups had the opportunity to work with various constituents that can provide support and enhance their professional roles. In this project, nonformal and formal realms were fused to create a shared learning domain, a place in which the expertise and knowledge of its members contributed to the growth and development of the participants. ELED candidates utilized the outdoor environment as a natural space for science teaching/learning, and RM students recognized the importance of their role in advocating for public lands and supporting public school teachers through outreach.

Instructors

There are many aspects of this interdisciplinary project that contributed to our growth as instructors and learners. In retrospect, a great deal of time and energy had been devoted to the practicum experience for our students. Course evaluations confirmed the effort was worthwhile. Prior to this partnership, student comments tended to focus on our teaching style or the organization of the course. Comments during this project were centered more on the value of experiences or assignments related to the partnership.

ELED: “Planning the 5E with Jim (pseudonym) had its challenges, but I enjoyed how authentic the experience was. I felt like a real teacher working with someone who wanted the students to learn science.” (Course Evaluation)

RM: “Presents materials in real-life situations that we would encounter; projects helped us explore many parts of recreation so we fully understand what it takes to be a recreation major and what we need to be successful in the field” (Course Evaluation)

Course evaluations also revealed quantitative gains in the areas of teacher effectiveness, appropriateness of course assignments, and overall course ratings. While these unexpected outcomes were meaningful and provided baseline data for future work, we were unable to replicate the program without funding for transportation. Currently, ELED candidates continue to construct and implement lessons in the outdoors, but without the recreation majors for support.

Conclusion

In this section, we present four shared outcomes that made this teaching outside the box collaboration a worthwhile endeavor. These outcomes motivate us in our ongoing efforts to seek funding sources that promote university partnerships with local agencies and enhance the field experiences of candidates in our respective programs.

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Outcome 1: This project promoted the idea that science teaching and learning is a shared responsibility that extends beyond the walls of the classroom and includes local and community partners (Kisiel, 2013). Recent declines in elementary science instructional time, limited childhood play in the outdoors, and lack of access or resources to participate in environmental education programs provide sufficient evidence that the formative science experiences of our nation's youth are lacking. With frequent experiences in outdoor learning and participation in environmental education, the value of the natural world and recognition of it as an appropriate context for promoting an individual's interest, curiosity and science knowledge is reinforced.

Outcome 2: Individuals need to reconnect with their natural surroundings. In the past decade, diminished interest and participation in nature-based activities have been reported (Hofferth, 2009). Parental fears of safety, lack of access to nature, and the emergence of digital technologies are but a few of the reasons cited for this waning interest in outdoor activity (Chawla, 1998; Louv, 2005). We noted that many of our undergraduates, as well as the 5th graders, had limited opportunities playing in the outdoors (Duerden & Witt, 2010; Miller, 2005; Pyle 1993). Evidence of outdoor experiences were limited to organized and/or group activities. Survey data revealed that both ELED and RM students were not comfortable teaching science content and that ELED candidates were more likely to indicate discomfort teaching in the outdoors. Educators, whether formal or nonformal, must feel comfortable in nature, and feel competent to carry out science learning in natural spaces.

Significant life and environmental socialization literature suggests frequent and enduring experiences with nature help develop comfort and skills in outdoor natural settings (Chawla, 1998; James, Bixler, & Vadala, 2010); Rios & Brewer, 2014; Tanner, 1980). Throughout the project, both ELED and RM students had ample opportunities to plan, apply, and practice effective strategies and approaches in an outdoor setting. Not only were the impact of these efforts rewarded by the 5th graders engagement, but resulted in a positive science teaching experience in the outdoors for the teaching candidates (Carrier, 2009).

Outcome 3: Elementary students can benefit from participation in innovative programs or projects that situate science learning in meaningful, appropriate contexts. As noted by Bingaman and Bradley-Eitel (2010), frequent outdoor experiences can contribute to increased science content knowledge and problem solving skills over time. We believe that the four "seasonal" field excursions had a positive impact on the 5th graders' engagement and this influenced content knowledge specific to the curricular strands selected for the project. Using items from an end-of-grades (EOG) practice test as pre/post data, 5th graders correct responses to the identified landforms, weather/climate and interdependence items increased on average by four points.

In addition, we draw upon two additional occurrences that highlight the impact of our endeavor. First, we were informed by classroom teachers that the North Carolina End of Grades (EOG) science scores for the 5th graders increased from below district average to at district average, a significant change from the previous year. Because the school has such a transient student population, this was an incredible accomplishment whether impacted by the project or not. In addition, residential camp staff recognized and praised the students' comfort in, and knowledge about, the outdoors. Having worked with many local schools over the academic year, the camp leaders were struck by the students' enthusiasm during a 2-night overnight excursion.

Outcome 4: By promoting and supporting interdisciplinary teaching and learning projects at the university level, undergraduates have unique opportunities to engage in real-life experiences in professional contexts, further preparing them for future roles and responsibilities. This project resulted from ongoing discussions between two faculty members, in two different departments, in two different colleges at one state university. Yet, the partnership's success can be credited to all the stakeholders: undergraduate students, elementary school students, classroom teachers, district and park superintendents, park rangers and a friends of park group.

Promoting relations, developing partnerships, supporting interdisciplinary projects—all common practices of professionals in the public sector (Smith & Trexler, 2006). However, elementary teaching candidates have limited social networks or resources early on, leaving them exposed and without support upon graduation. As science educators, we must critically examine and question whether our methods courses are preparing candidates for successful "real-life" science teaching. We questioned how competency and confidence in teaching science could occur without observing science teaching in practicum classrooms or without access to essential resources or materials. In answering these questions, we developed an experience for our candidates that utilized the natural world as a resource, as a classroom, and as an interdisciplinary venue for learning (Carrier-Martin, 2003; Duerden & Witt, 2010).

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