

Schoolyard SITES: School-community Partnership to Learn about Teaching Locally-Relevant Citizen Science

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Abstract: Schoolyard SITES is a community partnership STEM teacher professional development program and research study at University of New Hampshire. The program partners elementary teachers with UNH Extension science volunteers to bring locally-relevant citizen science projects to K-5 students. Our research study examines the community-based partnership PD model and its impact on school teachers' self-efficacy and their success in engaging students in the NGSS science practices through citizen science projects.

Introduction

Currently K-12 science instruction is changing in the United States. As described in the *Framework* (National Research Council [NRC], 2012) and outlined in the *Next Generation Science Standards* (NGSS Lead States, 2013), the national K-12 science education recommendations emphasize active learning that engages students in the science practices while learning disciplinary content. Furthermore, a fundamental principle of the *NGSS* is that K-12 students engage in science learning that is relevant to their everyday lives, hence demanding real-world, problem-based learning (NRC, 2012). Given this new vision of K-12 science education, teachers' approach to instruction is expected to significantly change. Therefore, there is an increasing demand, nationally and in New Hampshire, for professional development (PD) that builds both K-5 teachers' science content knowledge and their ability to integrate the science practices into the classroom (Osborne, 2014).

Schoolyard SITES (Schoolyard Science Investigations by Teachers, Extension Volunteers, and Students) is a community partnership STEM teacher PD program and research study at University of New Hampshire (UNH). The program partners elementary teachers with UNH Extension science volunteers to bring locally-relevant citizen science projects to their students. We designed Schoolyard SITES to address identified needs of elementary school teachers, for PD in *NGSS*. It also capitalizes on emerging trends in citizen science programs and their associated learning outcomes (National Academies of Sciences, Engineering, & Medicine, 2018).

The study focused on the following research questions: 1. What collaborative components do teachers and volunteers focus on while working on a successful interdisciplinary collaboration? 2. What are the changes that are observed in elementary school teachers' self-efficacy teaching science and ability to integrate *NGSS* science practices through a locally-relevant citizen science project?

Schoolyard SITES model & activities

The Schoolyard SITES professional development model is a 3-pronged collaboration among elementary teachers, Extension science volunteers, and professional development/citizen science professionals. This 3-way collaboration is central to building both content knowledge and teacher self-efficacy. The teachers, volunteers, and professional development specialists create a synergy of skills, expertise, and content knowledge. The Schoolyard SITES PD workshop series emphasizes a collaborative learning approach that supports the development of a partnership between teachers and project volunteers. The PD framework is structured such that elementary teachers share their knowledge of instructional planning and pedagogy, while at the same time the volunteer shares their knowledge of specific, local life or Earth science topics and their passion for the scientific enterprise. Participants learn together as a team, and gain experience with scientific investigations and content that they will use later in their classrooms. With support from the volunteer, teachers design and teach a citizen science curriculum for their students that is relevant to the school district's curriculum and elementary school site.

Methods

We used a mixed-method research approach that incorporated pre- and post surveys and interviews plus document analysis of curriculum units produced as a result of the teacher-volunteer partnership. The online surveys and interviews (face-to-face) were administered before the first workshop and after participants taught the curriculum project in the elementary classrooms. The survey and interview instruments addressed volunteers' and teachers'

process of collaboration, teachers' self-efficacy teaching science and integration of the eight NGSS science practices. The pre post surveys included the reliable and validated Science Teaching Efficacy Belief Instrument (STEBI-A)(Riggs & Enochs, 1990). Document analysis of collaboratively designed curriculum units were conducted to assess the extent to which the eight NGSS practices were represented in the projects.

Findings & analysis

Teacher-volunteer partnership

After going through the collaborative process, the teachers (100%, n=12) reported that they continue to feel that collaborating with community members is an important endeavor. All volunteers (100%, n=7) reported in their pre-surveys that collaborating with community members was an important endeavor and in the post survey most of the volunteers (86%, n=6) reported that they continue to feel that collaborating with teachers is an important activity, while one (14%, n=1) was unsure. Overall, the teachers were able to give more nuanced or very detailed explanations for each of the collaborative components after completing the Schoolyard SITES program. For example, we found that most teachers (n=11) in their pre survey suggested that listening is important part of a collaborative process but did not provide details. In the post survey most teachers (n=12) were able to illustrate with at least one example how listening is an important part of the collaborative process.

Teacher self-efficacy

The average self-efficacy score for the teachers before the Schoolyard SITES program was 50.8. Following the program, the average self-efficacy score for the teachers was 54. The change in self-efficacy for individuals differed. Some individuals demonstrated a larger change in efficacy than others. This variability among the 12 teachers attributed to the 'borderline' difference between the average pre (50.8) and post (54) scores (t-Critical two-tail = 2.20, p = 0.06, n=12) for the cohort collectively. In general, however, the majority of teachers (75%) demonstrated an increase in self-efficacy.

Integration of NGSS practices

All participating teachers (n=12) reported moderate or very improved integration of NGSS science practices after the Schoolyard SITES program. The top NGSS science practices reported were students' carrying out investigations, analyzing and interpreting data, constructing explanations, and engaging in scientific argumentation. The curriculums designed by the teacher-volunteer teams included the eight NGSS science practices. The practices of asking questions (SEP1), planning and carrying out investigations (SEP3) and data analysis (SEP4) were featured in all of the team's written curriculum units. In addition, scientific argumentation (SEP7) and communication (SEP8) were also integrated into most of the units.

Discussion

The Schoolyard SITES model emphasizes a pathway for how citizen scientist volunteers and teachers can build a sustainable partnership so as to engage elementary students in citizen science and authentic science practices. The study sheds light on how collaborative behaviors (e.g., listening, compromise) play a role in the partnership. We observe that all teachers and community volunteers understand that school-community partnerships are important, and our findings suggest that teachers increase self-efficacy and improve their integration of NGSS practices in the classroom after participating in the Schoolyard SITES community-based partnership PD model.

References

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