A Systematic and Supportive Approach to Place-Based Student Research Projects

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Introduction

As far as the eye can see, an abundance of academic research posters adorn the elementary and secondary hallways of Roscoe Collegiate ISD, a small public school district in rural west Texas. The district is in its 5th year of an annual research tradition. All students in grades 3-12 complete place-based, or locally relevant, student research projects (SRP), a majority of which focus on regional agricultural issues, resulting in the production of research posters, and, for juniors and seniors, capstone manuscripts. Students, teachers, Extension workers, volunteers, and administrators in the district work synergistically to enable and support the districtwide initiative. The overarching purpose of this local requirement is to provide experience, support, and self-efficacy in conducting formal scientific research to improve the accessibility of and success in higher education—including graduate school—to rural, economically disadvantaged students. As long-term concrete experience in research is acquired, potential graduate students may not only be more confident in the face of such expectations (Hadré & Pan, 2017; Kolb, 1984; Podolak, 2016), but also more interested in enrolling in science-based majors in college (Krapp & Prenzel, 2011; Murray, Napieralski, Luera, Thomas-Brown, & Reynolds-Keefer, 2012; Smith & Sobel, 2010). Although K-12 research project contest opportunities are available through programs like FFA and 4-H, participation is voluntary and requires resources which not all homes and schools can provide. Such inexperience and inaccessibility are the problems addressed in this rural district's initiative to raise a generation of researchers through its systematic and supportive student research project (SRP) program.

How it works

Students progress from implementing pre-designed, group experimental projects in elementary and middle school to developing individual topics and designs for their junior and senior year capstone projects through a scaffolded approach. To set the stage, instructional coaches, partnering university representatives, and regional public education employees guide faculty and staff on project-based learning, technical writing, APA style, and research processes. Administrators work to set deadlines and budgets, coordinate training and serve in a leadership role to solve problems that arise. Next, an on-site 4-H Extension specialist assists with research problem identification, designs and methodologies, procurement of resources, and general oversight. Research designs incorporate local, agricultural problems, school themes, and Texas Essential Knowledge and Skills (TEKS) in the particular grade's science, technology, engineering, agriculture, and math (STEAM) courses. Templates for posters, timelines, articles for review, and project designs are posted on a web-based platform for teachers to access.

Research investigations, papers, and posters are developed in a cross-curricular manner throughout 3-6 weeks with each subject class contributing in the following way:

- STEAM courses: conducting the literature review, writing materials and methods sections, and conducting the investigation
- Math courses: analyzing data, creating appropriate tables, graphs, and charts
- ELA courses: revising and editing
- College readiness course (AVID®): writing the literature review, writing the introduction and conclusions sections

Junior and senior year students design and conduct their own research investigations with the help of a designated teacher in a STEAM class and/or an assigned teacher mentor. Finally, the Extension specialist and administrators arrange local project fairs for the elementary school, middle school, and high school at which students present and defend their research for a panel of community judges. The judges determine winners in each grade, and winners continue to present and defend their research projects at various events and meetings in the community, particularly those related to the place-based issues addressed in the projects.

Results

Programmatic efforts to support underrepresented groups into the sciences show promise (Summers & Hrabowski, 2006). The district conducts two internal evaluative actions to assess its annual research projects program, one a survey item on a senior exit instrument. The senior exit item reads: Q6. *My STEM research project experience makes me feel more confident in conducting research again in college or at a job.* The second evaluative action is the administration of a pretest and posttest instrument given by the onsite research specialist. Comparisons reveal gains in knowledge, research process vocabulary, and academic area vocabulary. The district has attracted formal external evaluators due to its transformative efforts, one of which is a graduate student conducting an evaluation on the districtwide research projects program. Other outcomes include an increased sense of community engagement and awareness development of local agricultural issues through place-based research learning.

Over the past five years, over two dozen students have participated in 4-H or FFA regional or state research poster competitions. Five advanced to the state level. Four have advanced to the national FFA Agriscience Fair. In 2018, a student from this district won first place overall at the national level.

Advice to others

As with any program planning initiative, conducting a needs assessment and establishing a clear purpose are critical first steps. Choosing project topics that fit within the timeframe can be challenging for those charged with doing so (Podolak, 2016) which is why early collaboration is quintessential. A specialized staff of Extension specialists and instructional coaches is recommended but not necessary. Training appropriate faculty and staff on basic research methods is highly recommended. Efficient use of available financial resources can get the job done in varying capacities. Inclusive teamwork, open communication, process feedback loops, and culture with grit are indispensable. Students in the same grade level in differing STEAM classes may create scheduling and coordination problems. A solution is to scaffold student self-efficacy by reducing cross-curricular support in early secondary grades.

Resources and costs

Listed annual costs are based on 318 students in grades 3-12.

- 4-H Extension contacts for project topic and design consultation
- Project materials budget: $2,000
- Staffing and training in cross-curricular project-based learning and research: $5,000
- Printing posters (cost varies depending on school's printing capabilities): $500
- Judging of poster presentations: $500

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