

Positioning Universities to Recruit and Train STEM Teachers Who Stay in Rural Schools: A Collaborative Approach

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One half of U.S. school districts are rural, and 20% of U.S. students are educated in schools classified as rural (Showalter et al., 2019). There are many reasons to teach in rural schools. From smaller class sizes to smaller communities, they offer the potential for teachers to foster ties with students and families (Barley & Brigham, 2008; Monk, 2007). Rural teachers often teach students for multiple classes, teach siblings in the same families, or play multiple roles—getting to know students as coach of the Science Olympiad or volleyball team or in out-of-school settings as part of the community. Smaller schools can give teachers opportunities to teach a variety of subjects rather than just rolling through the same course six times a day (Goodpaster et al., 2015; Monk, 2007; Sutcher et al., 2016). Rural schools can offer leadership opportunities in ways that large urban and suburban districts may not (Goodpaster et al., 2015). New teachers can quickly become (or start out as) heads of their department or lead teachers, playing important roles in developing curriculum. Rural schools also offer opportunities for rich and lasting place-based teaching and learning. Local natural environments, local industries from agriculture to nature-based tourism to mining, and local challenges from global warming and fracking—all offer real world contexts for a place-focused curriculum that builds to state and national standards and engages students (Benner et al., 2021).

Rural schools can be great places for new STEM teachers to work, but these advantages are not well known, and it continues to be challenging to recruit new teachers to teach science and mathematics in rural classrooms (Goodpaster et al., 2015; Monk, 2007; Sutcher et al., 2016). Moreover, many of the potential benefits listed above could also present challenges. Teaching multiple subjects means additional preparatory work. Living in a small community where “everyone knows each other” can be a double-edged sword. Rural science and mathematics teachers may be the only teacher in their discipline and may not have colleagues teaching the same subject. Having colleagues or mentors who teach the same or similar subjects can support professional learning (Azano et al., 2021). Rural schools often lack necessary resources, which has an outsized effect in the sciences by limiting materials for investigations (Donachie, 2017). Something as basic as an acid titration experiment requires glassware, chemicals, safety equipment, and an acid cabinet, along with disposal costs. Also, the lack of replacements and the physical distance to professional development opportunities can serve as a barrier.

Relatively few resources have been allocated toward the improvement of STEM teacher preparation and support for rural places, while extensive resources have been devoted to addressing the needs of preparing teachers for urban schools (Azano et al., 2019; Goodpaster et al., 2015; Barley & Brigham, 2008). Additional research is needed to more fully understand and address the teacher workforce challenges that exist in staffing rural science and mathematics classrooms. Educators and researchers should be working to describe important features of disciplinary instruction in rural contexts, and additional ways science and mathematics courses can connect to rural communities (Tran et al., 2018).

Establishing a Collaborative Research Project

We set out to build a collaborative group of researchers to better understand the unique approaches, challenges, and opportunities of training rural STEM teachers. We began our work, now funded by the National Science Foundation as a Noyce Track 4 Research project (DUE #[2050108](#) and #[2050099](#)), by reaching out to around 100 universities whose educator preparation programs (EPP) serve prospective rural STEM teachers. Fourteen of those institutions were able to commit to a four-year project to (1) better understand which EPP features correlate with teachers going to, and staying in, rural places and (2) collect and design curricular strategies that attend to place and collaboratively disseminate those materials.

This blog will focus on the **collaboration** behind our research efforts. Most of the rural-serving universities involved in our study are small (below 20,000 students) and largely teaching-focused. The process of extensive survey design, understanding what types of data are needed, finding that data across different institutional structures, obtaining IRB approvals in different institutional settings, then getting good survey response rates over time have all been significant challenges. A common theme has guided our work: collaboration is critical. For each of the items mentioned above, we begin by discussing problems and potential solutions within the research leadership team and then with the 14-institution team. This is accomplished through weekly Zoom meetings of the leadership team, bimonthly Zoom meetings of the 14-institution team, and annual full group face-to-face meetings. A part of the success of the project has also centered on the Principal Investigator and Project Manager attending to the most pressing issues, keeping clear tasks for each meeting, and following-up with the right people to ensure actions are being taken.

Using Data to Encourage Collaboration

Our first goal was to identify all the STEM certification pathways at our 14 partner institutions along with their most basic features. For instance, Morehead State University's *Middle Grades Science* certification is an undergraduate pathway housed in a college of science with one semester of student teaching; while Clarkson University's *Masters of Arts in Education* is housed in a college of education with a two-semester teaching residency. The next step was to collect syllabi for all education courses in each of these degree plans. From there we interviewed department heads, Noyce program coordinators, and supervisors of field placements to investigate how programs attend to place and prepare teachers for potentially rural assignments. Faculty professional development, as well as issues of equity and diversity, were themes in these conversations.

We seek to connect the EPP inputs to the outcomes of the graduates over time, so three surveys were designed: a *Teacher Intention Survey (TIS)* completed in students' final year of teacher preparation, an *Initial Employment Survey (IES)* completed in their first year after graduation, and a *Teacher Follow-up Survey (TFS)* in their second year after graduation. We have administered the *TIS* three times and the *IES* once. (These surveys will be shared broadly once they are validated.) Understandably, our results are very preliminary but point to a substantial fraction of students being uncertain about where they would like to teach and changing course during their teacher preparation experience.

The results from the EPP student surveys are used to engage the stakeholders in discussion and collaboration. We ask each other this question: What effects are your courses and programs having on your students? Many programs either do not run follow-up career surveys with their graduates, or do not

share those results with teaching faculty. Our data provide a rare window into the sentiments of prospective STEM teachers and experiences of recent graduates.

One example of the use of our data can be seen in a cross-tabulation from our Teaching Intention Survey. We compared prospective teachers' "initial intention" upon EPP entry with their "current intention" in the last semester of their EPP. Table 1 depicts these results across all institutions.

		As of now, in the current stage of my teacher preparation program, I intend to teach in a school where the geographic area is classified as....			
		I had not decided where I want to teach	rural or small town	urban or suburban	Total
When I first entered the teacher preparation program, I intended to teach in a school where the geographic area is classified as....	I had not decided where I want to teach	13	4	8	25
		52.00%	16.00%	32.00%	100.00%
	rural/small town	2	24	4	30
		6.70%	80.00%	13.30%	100.00%
	urban/suburban	4	5	43	52
		7.70%	9.60%	82.70%	100.00%
Total Count		19	33	55	107
Total Percent		17.80%	30.80%	51.40%	100.00%

Table 1: Cross-tabulation of intentions before entering EPP and in final semester of EPP.

During our first whole-group face-to-face meeting, each institution's *individual* outcomes for this cross-tabulation was shared. We first discussed the potential implications in table groups and then factors that had affected the students' change in intentions as a full group. As we connect these findings to longitudinal results after these prospective teachers enter the classroom, we hope to foster a sustained reflective discussion on what causes some students to become *more* interested in a career in a rural place, and other students to become *less* interested in a career in a rural place.

As an example of our qualitative research leading to reflection and collaboration, when the instructor interviews from each institution were coded within the Context-Curriculum-Conveyance framework formulated by Azano, et al. (2019), one of the factors that stood out were "formal assignments explicitly pertaining to rurality." Three of the 14 institutions had assignments that fit into this category, and one institution had assignments from three different EPP courses fitting this description. The core leadership team discussed these features and invited the institution leading the curricular innovation to coauthor a paper highlighting these strategies (Outlaw et al., to appear). Our intention is to use joint publication efforts to inform and sustain our collaborative's discussion of curriculum that attends to place.

The Path Forward

We believe that sustaining (and growing!) these discussions about recruiting, training, and keeping up with rural STEM educators is vital. As we collect and design curricular strategies, they will only be as useful as the number of programs and faculty that engage with them and then adopt or build on them.

The path forward to growing and strengthening our rural STEM teaching force is undoubtedly to work together!

Collaboration is central, both to understanding and improving the rural STEM teacher pipeline. Our project seeks to document and understand a variety of rural-serving STEM EPPs, understand those programs' graduates over time, and use that information to improve practice across the rural STEM education community. The fact that rural education definitionally takes place in smaller groups makes it imperative that we collaborate to identify best practices, design effective curricula, and communicate well so that we can support each other across the rural STEM education community.

Join Us

Perhaps you have been reading this post and thinking that you would be interested in curriculum for helping EPP students to consider and possibly prepare for teaching in a rural place. Perhaps you would like to share materials or experiences that you use to support potential rural teachers. We invite you to join us. To hear updates on the project, receive materials, or share some of your own, please contact our Program Manager, [Dr. Diana Outlaw](#).

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