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BOARD # 469: WIP: Partnering to Prepare STEM Master Teachers for Michigan's Middle Schools - A National Science Foundation Robert Noyce Teacher Scholarship Program

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WIP: Partnering to Prepare STEM Master Teachers for Michigan's Middle Schools - A National Science Foundation Robert Noyce Teacher Scholarship Program

Abstract

Michigan Technological University (MTU) and Northern Michigan University (NMU), with NSF funding, are training 30 experienced middle school science teachers as STEM education leaders through the Master Teachers Program. Participants will develop and implement participatory action research (PAR) projects in their classrooms and disseminate their findings. They will also receive training in leadership, the Next Generation Science Standards, student-centered science instruction, and professional learning community facilitation. The program aims to address Michigan's critical teacher shortage and improve science learning outcomes by developing teacher leaders who can mentor novice teachers and drive improvements in STEM education.

Over 90 applications were received for the 30 available spots. The program began in January 2025, with amaster's-seeking cohort beginning online coursework and a master's-holding cohort beginning professional development activities. The project's impact on leadership development and teaching practices will be evaluated through surveys, interviews, observations, and analysis of PAR projects and classroom artifacts. Twenty teachers with existing master's degrees will receive a $10,000 annual stipend for five years. Ten teachers without master's degrees will have tuition fully covered for a two-year online Master or Arts in Educational Instruction Pedagogy (jointly offered by MTU and NMU), followed by a $10,000 stipend upon degree completion and $10,000 annual stipends for the subsequent four years.

Background

Science learning outcomes across the U.S., including in Michigan, need improvement [1]. Teachers are crucial for student success, but Michigan faces a severe teacher shortage, exacerbated by the COVID-19 pandemic [2-4]. This shortage has led to increased reliance on experienced teachers as mentors and professional development providers [5], often without adequate resources and support, leading to frustration and potential attrition.

The Michigan Master Teachers Program (MTP) aims to address the teacher shortages by partnering with districts to identify and develop experienced and effective teachers as science teacher leaders. MTP Fellows will receive leadership training to become effective mentors prepared to drive improvements in science teaching and learning. They will learn evidence-based approaches to address current and future challenges. MTP's success could serve as a model for other states, ultimately improving students' STEM performance and interest in STEM careers by empowering teacher leaders to enhance their own and their colleagues' effectiveness.

Faculty and staff at MTU and NMU are collaborating for MTP to enact long-standing plans for collaboration to improve teaching and learning in Michigan schools. The partnership between NMU and MTU leverages NMU's strengths in teacher education in pedagogy and praxis and MTU's strengths in STEM. The project is managed by the PI team at MTU in coordination with representatives from NMU and an external evaluator from Western Michigan University.

Program Objectives

Twenty teachers with master's degrees are supported as a cohort in their development as teacher-leaders. Years 1-2 of the teacher leadership programming will include training on leadership standards, leadership portfolios, individual development plans, Next Generation Science Standards, effective professional learning communities (PLCs), professional learning community facilitation, and participatory action research (PAR). PAR acknowledges the lived expertise of individuals by engaging them as co-researchers and knowledge creators [6,7]. As living experts in the experience of learners, students can identify areas for improvement in educational settings [8] and are ripe for involvement as PAR co-researchers. The teachers will develop and implement PAR projects in their classrooms and disseminate their results at a relevant conference. Years 3-5 will include local and state-wide teacher-led PLCs on topics chosen by the teachers and developed with the support of program staff. These teachers will each commit 250 hours per year to the program, or approximately 5 hours per week. Over their five years in the program, the master's teachers will be compensated $10,000/year.

The master's seeking cohort includes ten teachers with a six year commitment. These teachers will earn a master's degree through NMU during their first two years in the program. Tuition is paid by the program. After they have earned their master's degrees, in years 3-6, these teachers will each commit 250 hours per year to the program. In years 3-4, these teachers will complete similar leadership programming as completed before them by the cohort of teachers who entered the program with master's degrees, including PAR projects. In years 5-6, these teachers will also lead PLCs on topics of their choice, developed with the support of program staff.

Implementation

Project team meetings in Fall 2024 involved launching an application and website to recruit and inform potential candidates, screening applicants, and planning activities for each cohort. Project partners (school administrators and educational nonprofits) were invited to a virtual meeting in the Fall to discuss the ideal qualifications of applicants, the benefits of the fellowship, and the application timeline. We also reached out to individual partner districts with program information, the application form, and a promotional flyer. Over 90 applications were received for thirty spots, and we have completed a competitive selection process to fill both cohorts. More than half of the applicants were from the Upper Peninsula of Michigan, highlighting successful outreach in that rural region. The activities for each cohort were planned collaboratively, with the degree requirements for the master's-seeking cohort determined mainly by NMU. The activities

for the cohort with master's were planned with teacher leaders from a previous Noyce award (NSF award 1758392, Michigan Master Teacher Fellows Program). These activities were adjusted from the previous grant to focus on the Michigan teacher leadership standards and development of teaching portfolios as the initial focus areas for the fellowship. Fellow and co-PI feedback in the previous project had indicated that it would be helpful to compile a teaching portfolio to provide additional coherence and intrinsic motivation for the Fellows.

Accepted master's-seeking Fellows applied to NMU's Master of Arts in Education (MAE) Instruction in Pedagogy as graduate degree-seeking students. Applications were reviewed to ensure they met the required 3.0 GPA for acceptance to the graduate program. Each accepted applicant was assigned one primary NMU advisor to assist in navigating the plan of study, graduate school requirements, and expectations for graduation. All applicants understand that the MTU and NMU faculty are working as a team to leverage their areas of expertise and achieve the Noyce award goals connected to coursework and clinical experiences.

In the first summer of the program, non-master's seeking Fellows will complete a non-credit bearing course hosted on MTU's Global Campus to introduce them to the practice of PAR. Through the course, Fellows will envision PAR projects to complete with their students the following school year. They will be supported by their PLC's through implementation of their PAR projects, ultimately resulting in their write up and presentation of their projects and findings at a regional or national conference. Master's-seeking Fellows will complete this course after graduation.

Evaluation

Project evaluation is focused on determining the impacts of project activities on Fellows' leadership development and teaching practices. MTP is focused on developing Fellows' leadership skills in alignment with the Michigan Teacher Leader Preparation Standards [9]. The project also seeks to align Fellows' teaching practices with the Next Generation Science Standards [10]. Evaluation data sources will include annual leadership knowledge/self-efficacy [11]; NGSS teaching practice surveys [12]; and annual interviews focused on leadership opportunities, program experiences, program strengths, and areas for improvement. Additionally, micro-teaching observations will be conducted and Fellows' participatory action research projects and classroom artifacts will be collected and assessed using rubrics. These data will help triangulate the survey data to determine the extent that Fellows are growing in teacher leadership and NGSS aligned teaching. Project evaluation questions are shown in Table 1.

Evaluation questions	*Measures*	*Analysis*
• To what degree does the project enhance teacher knowledge/implementation of NGSS pedagogical practices? • What evidence is there of student engagement?	• Surveys, teacher lesson plans, observation of micro-teaching episodes • Classroom/school attendance data	• Descriptive statistics • Rubrics • Qualitative analyses
• To what degree does the project enhance teacher knowledge and self-efficacy related to teacher leadership? • What evidence is there that teachers are implementing teacher leadership practices?	• Surveys of teacher leadership • Interviews • Assessment of teacher-led PAR projects using rubrics • Documentation of PLCs	Descriptive statistics Qualitative analyses
• To what extent does the project meet its targets for recruiting, supporting and retaining teachers?	• Participation data, surveys	• Frequencies
• To what degree do teachers and school administrators see an ongoing alignment between the project and their own priorities? • What (if any) implementation barriers exist? • What elements of the project model can be sustained beyond the funding period?	• Surveys, interviews, documentation of dissemination efforts	• Descriptive statistics • Qualitative analyses

Table 1. Project Evaluation

Outcomes And Current Activities

Thirty teachers began the fellowship in January 2025, including representation from 22 school districts in 14 intermediate school districts throughout Michigan: Alpena-Montmorency-Alcona ESD, Bay Arenac ISD. Berrien RESA, Clare-Gladwin RESD, Crawford-Oscoda-Ogemaw-Roscommon ISD, Copper Country ISD, Delta-Schoolcraft ISD, Ingham ISD, Kalamazoo RESA, Marquette-Alger RESA, Midland County ESA, and Oakland Schools. Traverse Bay Area ISD, and Wayne RESA. The ten Fellows seeking master's degrees have begun asynchronous online coursework for their Master's in Educational Curriculum Instruction through NMU, in partnership with MTU. They will complete four credits in Spring 2025: a three-credit course on Next Generation Science Standards and a one-credit course on Student-Centered Science. Both courses are hosted at MTU's Global Campus. In the summer, they will complete five credits: three credits in Educational Research and two credits in Integrated Science. The research course will be hosted at NMU and the integrated science course at MTU. The Fellows with master's degrees have begun their Fellowship activities, starting with professional development on the Michigan Teacher Leadership Standards . Following their completion of this course, the Fellows with master's will receive training on building a teaching portfolio, which they will develop throughout the spring to progressively highlight their achievements. Their initial portfolio will include written reflections on areas of leadership they would like to pursue or develop throughout the fellowship. The course instructors and co-PIs will meet monthly through the spring with the Fellows with master's to provide opportunity for face-to-face reflection and collaboration.

Conclusion

The Noyce project, “Partnering to Prepare STEM Master Teachers for Michigan's Middle Schools” at MTU and NMU will directly address the shortage of middle school STEM teachers in Michigan by developing and retaining teacher leaders within the state. By integrating PAR projects into their classrooms, the project will have the secondary effect of inspiring the next generation of STEM scholars in Michigan.

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