Noyce Master Teaching Fellowship Program
2018 – 2023
(NSF award # 1758243)

Preparing Digitally-Rich STEM Master Teachers for Digital Conversion in K-12 Schools
Warner Graduate School of Education
University of Rochester

Program Description

Program Rationale:

Improvement in student academic achievement in several school districts nationwide has been attributed to digital conversion of teaching methods and learning behaviors in those same districts. Despite this success, conversion to digital teaching and learning has not been universally adopted for a variety of reasons. Our proposed Track 3 Master Teaching Fellowship (MTF) will focus on preparing a cadre of 20 math and science teachers to:

- Leverage technology for enhanced student engagement and learning in K-12 area schools
- Increase understanding of how technology can be used to create new and more effective STEM teaching modalities to improve math and science instruction
- Lead their districts in digital conversion efforts
- Promote digital conversion while offering STEM learning opportunities promoted by the Common Core Program and the New Generation of Science Standards

This program is preceded by two MTF projects at the University of Rochester involving 39 fellows. However, this new program differs in that there is additional focus on digital conversion and on developing a regional model best serving small school districts outside of major metropolitan areas. Given the emphasis on leveraging digital technologies for STEM learning, fellows will be involved in extensive and innovative learning experiences via synchronous and asynchronous online experiences.

The MTF program supports the National Science Foundation (NSF) Strategic Plan of 2014-2018 and the Noyce central doctrine by integrating education and research to create a diverse STEM workforce. Development of a strong STEM workforce will be enhanced by:

- MTF fellows assuming leadership positions in district-wide digital conversion efforts
- The creation of a secondary STEM workforce pathway through K-12 student engagement and competency with digital learning
- Utilization of technologic equipment previously purchased by many districts using financial incentives provided by New York State (SMART Schools Bond Act-2015)

This MTF program will capitalize on the following competitive advantages:

- Ongoing collaboration between the University of Rochester and the high-needs small suburban district, East Irondequoit Central School District, resulting in successful digital

conversion over the past 4 years (recently recognized by the National School Board Association (NSBA) as a nation-wide model)

- New York State's recent implementation of new math and science standards, consistent with Common Core and New Generation Science Standards at the national level
- Infrastructure provided by the Western New York Digital Conversion Consortium recently launched by the Warner School and East Irondequoit School District
- The newly created Advanced Certificate in Digitally-Rich Teaching in K-12 Schools, approved and registered by the New York State Education Department
- Warner School's experience in designing and offering a variety of online courses
- Preliminary results from a concurrent NSF funded grant designed to leverage synchronous online learning for professional development of math teachers in rural schools
- Previous collaboration of the Warner School, the University of Rochester Colleges of Arts and Sciences and Engineering and the Rochester Museum and Science Center involving two prior MTF projects

Program Overview:

The proposed MTF aims to recruit 20 math and science teachers from 6 small high-needs school districts, including 3 from rural districts, which are members of the Western New York Digital Conversion Consortium. Each MTF fellow will commit to completing a 5-year tuition-free program, accruing 41 credit hours of graduate coursework plus mentored experiences. The program requires a 5-year service commitment to high-needs schools including teaching, mentoring colleagues and providing professional development. Upon program completion, participants will receive an Advanced Certificate in Digitally-Rich Teaching in K-12 Schools. Interested fellows will be eligible to apply for a full scholarship designed to support the pursuit of New York State certification as a School Building Leader and School District Leader in preparation for district administrative positions.

Each fellow will receive a stipend of $10,000 per year for 5 years with the requirement to remit 50% of the stipend received, on a pro rata basis, should the 5-year commitment not be met. At least 60% of grant funds are to be used for tuition and stipends and the commitment requires 50% matching funds of which at least half must be cash contributions.

Warner School Commitments:

- Design and implement the training program, using input and support from all partners
- Coordinate fellow recruitment and selection process
- Monitor execution and completion of the program and service requirement
- Execute the external evaluation for NSF reporting
- Manage distribution of stipends and collection of remitted funds if necessary
- Offer a 50% tuition waiver
- Contribute additional in-kind resources to satisfy most of the matching funds requirement

College of Arts, Sciences and Engineering Commitments:

- Identify a faculty member who will act as a Co-Principal Investigator (Co-PI) and liaison for the program and who can engage other STEM faculty to participate in Noyce fellow experiences
- STEM faculty co-PI to participate in the fellow selection process
- Provide expert consulting on STEM content
- Offer guest lectures, lab experiences and support to Noyce fellows
- Provide on-going feedback and suggestions for program improvement
- Contribute information for program evaluation and reporting of results
- Contribute a portion of the STEM faculty co-PI's time in-kind

District Partner Commitments:

- Assume a leadership role in recruiting and selecting fellows from their district
- Ensure selected fellows are available to conduct required training activities
- Provide opportunities for fellows to effect improvement of STEM teaching practices and advance digital conversion efforts
- Contribute information for program evaluation and reporting of results
- Contribute in-kind resources such as administrator time, space, etc.

Fellow Commitments:

- Participate in all 5-year training program activities
- Provide services such as mentoring and professional development in support of district efforts to improve STEM teaching practices
- Support district efforts towards digital conversion
- Comply with the 5-year service requirement in high-needs schools by staying in the same district for the full 5 years
- If the above 5-year requirement is not fulfilled in the same district, the fellow must provide documentation of completion of the service requirement in another high-needs district or remit a portion of the stipend

Program Specifics:

The MTF training program begins by focusing on digitally rich math and science practice for the first 2 years. During subsequent years fellows will engage in more complex roles as "master teachers" (coaches, mentors, providers of professional development and agents of change). The program is comprised of 3 complementary and interrelated components:

- Customized 3-credit Warner graduate courses tailored to the specific goals of the MTF program and offered hybrid online
- Mentored field experiences including design and implementation of summer programs for Museum and Science Center students, creation of professional development

opportunities for STEM teachers and participation in digital conversion efforts in their district in collaboration with an assigned mentor from the program leadership team

- Leadership seminars comprised of half-day monthly meetings for fellows and mentors facilitated by the PI and members of the project leadership team aimed at developing fellow leadership roles as digitally rich STEM master teachers

Years 1 and 2: Focus on digitally rich STEM teaching

For the first 18 months, fellows will focus on teaching practice, creating math and science experiences for their students consistent with state and national standards. Understanding by Design (UbD) and Universal Design are educational planning approaches that will be incorporated into the instructional design process. Fellows will complete a sequence of 3 semester-long courses, meeting requirements necessary to earn the Advanced Certificate in Digitally-Rich Teaching in K-12 Schools. All courses will be offered in hybrid-online format and in-person meetings will occur every other week. A combination of synchronous online sessions and asynchronous online activities will be required as well. During this period, fellows will take advantage of strategies developed by the SYNCON project while participating in practice demonstration lessons offered by expert digitally rich teachers such as those at East Irondequoit. Fellows will also engage in innovative digitally rich STEM scaffolded experiences in the classroom and in non-traditional settings such as summer camps, after-school programs and museum activities.

Year 3: Focus on STEM coaching

In the third year, fellows will begin coaching and mentoring student teachers and colleagues. Topics covered in course offerings include Communication and counseling skills, content-based coaching and distance coaching. Concurrently, fellows will engage in mentored practices, in person and remotely, such as review of innovative instructional materials with colleagues, collaborative STEM lesson planning and student teacher mentoring.

Year 4: Focus on STEM professional development

During this year, fellows will begin to provide professional development to teachers from local schools and University of Rochester pre-service teachers. Coursework required includes offerings in design and facilitation of STEM professional development, focusing on digitally rich math and science teaching online and in person. Mentored experiences are associated with course offerings. To prepare for program requirements in year five, fellows will complete a course in Leadership and Organizational Dynamics offered in the spring semester.

Year 5: Focus on STEM reform and digital conversion

In the final year, fellows will focus explicitly on successfully effecting systemic reform in assigned districts with emphasis on digital conversion and its implications for the teaching of math and science. Fellows will transition to the role of independent agents of change in their district, engaging with influential educators and participating in activities in the pursuit of digital conversion.

Table 1: MTF Program at a Glance

Year. Focus	*Course (semester - # credits)*	*Mentored practice*
1&2. Digitally-rich STEM teaching	• *LS: Implementing digitally-rich STEM Teaching* (yearlong+ summers-7) • *Foundations in Teaching & learning STEM* (Spring Y1-5) • *Digitally-rich Teaching* (Fall Y2- 3) • *Integrating Technology in Math & Science Teaching* (Spring Y2-3)	• Observations of digitally-rich "demonstration classes" • Innovative digitally-rich STEM teaching in informal settings (in supporting/primary roles) • Innovative digitally-rich STEM teaching in own class • Analysis of own videotaped lessons (including some personal experience of being coached online)
3. STEM coaching	• **LS: Implementing STEM Coaching* (yearlong+summer-4) • *Counseling & communication skills* (FY3- 3) • *STEM Coaching* (SpY3-3)	• Innovative digitally-rich STEM teaching in own class and/or informal settings • Offer demonstration classes • Mentoring/supervising a student teacher • Working with colleagues on digitally-rich STEM innovations for their classes • Participating in high quality STEM PD in a supportive role
4. STEM PD	• *LS: Implementing STEM PD* (yearlong-4) • *Designing STEM PD* (FY4-3) • *Leadership & organizational dynamics* (SpY4-3)	• Innovative STEM teaching; demonstration classes • Mentoring student teachers/colleagues • Guest speaker in methods courses • Co-facilitating STEM PD
5. STEM reform & Digital Conversion	• *LS: Implementing systemic reform* (yearlong-4)	• Innovative STEM teaching; demonstration classes • Mentoring student teachers/colleagues • Designing and facilitating STEM PD • Working on STEM innovations and digital conversion at the school & district level

Advanced Credentials Option:

Fellows may wish to pursue additional New York State certification as a School Building Leader and/or School District Leader to ensure opportunities for advanced positions in school administration (department chair or curriculum coordinator) and become more impactful agents of change. Certification requirements include completion of 6-7 additional courses and an administrative internship. All requirements may be satisfied during the regular five-year program. Grant funds are available to cover 50% of costs for eight scholarships with in-kind contributions for the remainder provided by the Warner School as a tuition waiver.

Fellow Recruitment and Selection:

Recruitment:
The first semester of the grant will be devoted to the recruitment and selection of fellows. The opportunity to apply for a fellowship will be offered to all math and science teachers in partner districts. In addition, the Warner School will proactively request nominations of candidates from

school principals, other administrators in each partner district and regional STEM educators. In order to attract a committed and diverse pool of applicants, our recruiting process includes the following components:

- A required, free digitally rich STEM teaching workshop
- Shared experiences from Phase I and Phase II grant recipients
- Review and evaluation of classroom teaching videos submitted by applicants using the Reformed Teaching Observation Protocol (RTOP)
- Extension of the recruitment period by beginning the training program in January

Selection:
District math and science teachers interested in applying to the fellowship program will be required to submit the following documentation for review:

- Cover letter stating the reasons for the applicant's interest in and commitment to the program
- Curriculum Vitae or Resume
- Copies of transcripts and test scores including the New York State Content Specialization Test results
- Artifacts illustrating the applicant's teaching style with student outcomes
- List of references and letters of recommendation
- Video of applicant teaching a full class period (if requested)

Applications and supporting documents will be reviewed by the leadership team and a representative from each district partner. Reviewers will generate a short list of promising candidates from each district based on the following:

- A completed master's degree
- Strength of prior transcripts and test scores
- Evidence of innovative teaching practices, including use of technology, and positive impact on STEM learning
- Past involvement and performance in STEM and technology professional development and reform efforts
- Evidence of high-quality STEM teaching and leadership potential
- Commitment to participate in all program activities and maintain their district employment

Applicants chosen for inclusion in the final short list will be interviewed by leadership team members, observed by evaluators using the RTOP and a final selection of candidates will be made.

University of Rochester Key Program Personnel:

Dr. Cynthia Callard, Executive Director of the Center for Professional Development and Education Reform at the Warner School of Education (Center hereafter), will direct and oversee all project activities as the **PI**, a role she has played since 2012 in Phase I and II MTF projects. An experienced math teacher and professional development provider, and also the co-PI of the NSF-funded DRK-12 SYNCON project, Callard will be the lead facilitator of all the Leadership

Seminars, co-teach the first course on STEM Teaching & Learning (as she did in Phase II), and be ultimately responsible for education components of the project and reporting to NSF.

Dr. Dave Miller, Assistant Professor at Warner, will be a co-PI and **project coordinator**. Dr. Miller has prior experience with instructional technology as the PI of three SBIR grants awarded by the U.S. Department of Education, which focused on designing and leveraging a learning management in K-12 settings system. Dr. Miller has also participated as a consultant in the Digital Conversion Tem that launched digital conversion at East Irondequoit, has been a leading member of the team of faculty that designed and has been teaching the sequence of courses to prepare online instructors at Warner, and contributed to launch the Western New York Digital Conversion Consortium. Dr. Miller will be teaching or co-teaching the courses related to digitally-rich teaching and digital conversion, providing support to both the leadership team and partner districts on issues related to digital conversion, and serving as the main liaison with the partner districts.

Dr. Mike Daley currently splits his time as an Associate Professor of Environmental Science at LeSalle College in Boston, where he teaches online science undergraduate courses, and as Assistant Professor in the Center for Professional Development and Education Reform at Warner, where he is involved in professional development and coaching of K-12 science teachers. As one of the STEM **co-PI**s for the project, Daley will be responsible for all science education components of the project, as well as co-teach the new technology-rich STEM teaching course and serve as mentor for about half of the science Fellows.

Dr. Raffaella Borasi, Professor and currently the Dean of the Warner School of Education but returning to a faculty position by the start of this project, and a mathematics educator with extensive experience in directing NSF-funded projects, will be another **co-PI** – a role she already played in Phase I and II. She will co-teach the first course on digitally-rich teaching (as she did in Phase II) and serve as a mentor for a few of the math Fellows. Her previous role as dean puts her in a unique position to coordinate the complex staffing and cost-sharing required for this project.

Dr. John Kessler, Associate Professor in the Earth and Environmental Science Department at the UR, will also serve as **co-PI**. Dr. Kessler has been the PI of prior NSF grants, and has research and outreach interests that well complement the rest of the project leadership team. He will serve on the project's leadership team, acting as liaison with the College of Arts, Sciences and Engineering – which will include participating in the selection process, providing direct support in the design and/or implementation of specific aspects of the training programing, proactively identifying other STEM faculty in the College that could enrich the Noyce Scholars' experience and connecting them with the project's leadership team as needed.

*Michael Occhino, a former 22-year veteran science teacher in the Rochester City School District and currently the Director of Science Education Outreach in the Center, will also be a member of the project leadership team, and will co-facilitate the Leadership Seminars (a role he played in Phase II), co-teach some of the courses, serve as mentor for about half of the science Fellows, and support the project in other capacities.

*Stephanie Martin, a former teacher for 14 years and current Director of Math Education Outreach in the Center and a member of the SYNCON team with Callard, will also be a member of the project leadership team, and will co-facilitate the Leadership Seminar (a role she played in Phase II), co-teach some of the courses, serve as mentor for the math Fellow working in middle school and support the project in other capacities.