

Mathematics and Science Partnership Projects

July 2016 – June 2017

The Vermont Mathematics Initiative (VMI)

Project Director: Judi Laird

The VMI embodies a two phase model. Phase I, begun in 1999, is a 3-year Master's Degree program that builds school and district mathematics leadership capacity. Phase II brings VMI systematically into a district (or region) with core mathematics and pedagogical content distilled from the Phase I curriculum. To date, including Phase I, Phase II and non-credit bearing in-service variants of Phase II (Common Core training, for example), it is estimated that VMI has directly reached more than 1500 teachers. Through these teachers, VMI has an impact on tens of thousands of Vermont students.

In this proposal, we continue the progression of VMI toward its goal of reaching all educators in Vermont by developing, piloting and implementing a course specifically for educators of special populations. Through their professional expertise and their experience over several years interacting with VMI participants who teach mathematics to special populations (e.g. refugee students, special needs students, struggling learners, English language learners), VMI faculty are perfectly situated to develop an effective, challenging and engaging course. The course will be a combination of ideas from VMI's signature course *Mathematics as a Second Language (MSL)* and Dr. John Tapper's book *Solving for Why: Understanding, Assessing, and Teaching Students Who Struggle with Math, Grades K-8* and will utilize the expertise of VMI Graduates, Dr. Katherine Shepherd of UVM's College of Education, Dr. John Tapper of the University of Hartford, and VMI mathematics educators.

This proposal also allows VMI to further develop the Phase I program in areas associated with formative assessment and technology. As the *Digital Library* comes online, and more assessment data is produced from the annual Smarter Balanced Assessments, VMI participants will benefit from experience using various technological tools as a way to effectively analyze assessment data. These tools include freely available software as well as software available to VMI students through the University of Vermont. These statistical tools are especially useful during a participants Statistics II course, as they analyze school data. Additionally, *The Digital Library* will be introduced to VMI participants through program development associated with this proposal. *The Digital Library* will serve multiple purposes in the VMI curriculum—from supporting the emphasis on formative instruction, to supporting the Statistics II class (focus on the statistics associated with assessment), to creating opportunities for VMI trained teacher leaders to work with their peers.

In addition to the new development proposed in this project, VMI will continue to admit cohorts of teachers into Phase I, offer Phase II regionally and in districts, support individual school systems via faculty expertise, and generally support statewide mathematics efforts through active involvement with the Agency of Education and school systems across Vermont.

Vermont Science Initiative (VSI): Partnerships to Build NGSS Capacity in Vermont

Project Director: Alan Giese

Vision: The Vermont Science Initiative (VSI) is an established leader of science, technology, engineering and math (STEM) professional development (PD) in Vermont. In recent years our programs have emphasized PD that balances and integrates the four STEM areas. Through authentic science and engineering challenges teachers in our programs build new knowledge of core ideas and crosscutting concepts while practicing scientific thinking and the engineering design process. Math is applied through pattern description and predictive analysis. Technology is both a means (e.g. using technology to gather data) and an end (e.g. creating a technology to solve a problem). The degree of alignment between our programs and the *Next Generation Science Standards* (NGSS) has and continues to be high. While we are proud of our accomplishments, there is more that needs to be done. The vision of our proposed programs is to (1) expand and balance our statewide impact, and (2) position Vermont at the national vanguard of science education

Goals: The proposed programs will have the following outcomes:

- Participants will have enhanced science content knowledge.
- Participants will have expanded pedagogical content knowledge, skill and confidence.
- Participants will develop reflective practice and assessment skills.
- Participants will become part of professional learning communities (PLCs).
- Participants will understand the NGSS and the *Framework for Science Education K-12*.
- Participants in the NGSX program will develop the skills needed to facilitate web-based professional development modules.
- Districts statewide will build capacity for site-based STEM PD.
- Vermont will have a cadre of science teacher leaders who will continue to train other teachers.
- Vermont will be one of a group of states at the vanguard of science professional development.

Activities and Key Features: In the *VSI Science and Engineering Academy* teams of K-8 teachers will attend a summer institute plus three follow-up sessions dispersed across the school year. Year 1 will feature life-science instruction focused on the use of technology, math and engineering to solve environmental problems. Teachers will develop and implement a science/engineering unit in their classroom. Use of the NSTA's online **learning center and PLCs will foster collaborative learning, build a system of support, and promote reflective practice. Content will change in Years 2 and 3.**

In the *NGSS Teacher Leader Program*, teams of K-12 teachers will attend a summer institute, then return to their districts and facilitate the training of 5-15 additional teachers. The summer institute will utilize the newly developed NGSS Exemplar System (NGSX). Year 1 will focus on leading participants in our Pilot Program (currently underway) through facilitation at their home districts. In collaboration with the NGSX developers, lessons learned from the Pilot Program will be applied to full implementation in Years 2 and 3.

Evaluation of the program will be based on pre and post content assessments, and pre and post self-report surveys. Comfort with and employment of the project's targeted instructional knowledge, practices, and dispositions will be assessed. A quasi-experimental design will be used

to measure student gains in science practices and understanding using assessments developed by PEER Associates and other valid and reliable tools.

Partners include districts or supervisory unions, Lyndon State College, Tidemark Institute, and Clark University.

The Vermont STEM Leadership Institute (VSTEM Leads)

Project Director: Regina Toolin

The Vermont STEM Leadership Institute (VSTEM Leads) seeks to address urgent issues, questions and deficiencies in STEM education and achievement through the establishment of a 3-year STEM Leadership Program for K-12 teachers in Vermont. VSTEM Leads will provide ongoing STEM professional learning and leadership experiences for teachers to enhance the STEM knowledge, practices and pedagogical skills necessary to teach and prepare students for STEM achievement and college and career readiness, and to serve as STEM leaders within their schools and supervisory districts.

VSTEM Leads comprises a 5-day summer STEM leadership program for twenty K-12 teachers conducted at UVM with follow-up professional learning experiences during the academic year at UVM and the partner schools. The primary goal of VSTEM-Leads is for teachers to actively engage in and reflect upon STEM content, practices, pedagogy and leadership models aligned with the NGSS, CCSS Math/ELA and Transferable Skills Standards so they may transform their schools into dynamic and exciting places of authentic and interdisciplinary STEM inquiry and learning for K-12 students. Coupled with these professional learning experiences are opportunities for teacher leaders to reflect upon meaningful ways to engage and mentor their peers in the principles and methods of project-based, place-based and proficiency-based experiences through the exploration of the principles and practices of scientific and engineering design.

VSTEM professional learning experiences will emphasize three primary learning objectives:

1. Teachers will demonstrate an understanding of STEM knowledge and concepts necessary to respond to the learning needs of all students. This includes a deep understanding of:

- NGSS core knowledge and practices and VT Transferable Skills Proficiencies;
- Common misconceptions that children hold in regards to fundamental science concepts;
- Science as a way of thinking by engaging in Science and Engineering Practices;
- Engineering is the practical application of mathematics and science;
- Ways to integrate the knowledge of content, instruction, assessment and technology;
- Ways to integrate CC Math and Literacy into meaningful science learning opportunities.

2. Teachers will demonstrate improved teaching skill and effectiveness with a focus on project, place, and proficiency-based teaching and learning.

3. Teachers will develop leadership skills that include an understanding of the effective use of resources and tools to support the implementation of NGSS.

As part of VSTEM Leads program outcomes and requirements, participating teachers will:

- Develop a project that includes an instructional sequence with appropriate performance assessments aligned to NGSS, CCSS and Transferable Skills standards.
- Develop a poster of project implementation back at their school site to be presented at the VSTEM Leads Conference in the Spring.
- Participate in a lesson study (3 in total) at a partner school site followed by a critical friends' reflection and discussion.
- Draft and enact a plan for conducting a NGSS PLC about implementation at their school with an online reporting/discussion board of the success/challenges during the academic year.