

**New Hampshire NCLB Title II-D
Regular Funds for Round 9
Competitive Grants – February 2011**

Step 2: Application Narrative for Classroom Mini-Grants Program

(Please be sure to complete Step 1 online at: www.nheon.org/oet/nclb)

District:	Winnacunnet Cooperative School District	Date:	2/10/11
Project Manager:	Stephen Latvis		
Position Title:	Mathematics Teacher		
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Phone:	603-686-1088		

BE SURE TO READ ALL OF THE FOLLOWING STATEMENTS.

ASSURANCES

I hereby certify that:

1. To the best of my knowledge, the information contained in this application is correct, and the school board of the district named above has authorized me as its representative to submit this application.
2. The District has submitted to the New Hampshire Department of Education (NHDOE) a General Assurances signature page for the current year.
3. The District has consulted with the appropriate non-public schools during the design and development of this Ed Tech project prior to all decisions that affect the opportunities of private school children to participate in the program.
4. All funding for this project will be obligated and reported no later than the quarterly report ending **6/30/2012** and expended and reported no later than quarterly report ending **9/30/2012**.
5. The grant funds expended will supplement, not supplant, funds from non-federal sources.
6. The District will keep records and provide information to the NHDOE as may be required for program evaluation, consistent with responsibilities under NCLB Title II-D as outlined within the Grant Application Guidance (e.g., annual tech survey, case study report).
7. The schools to be funded by this program are compliant with the Children's Internet Protection Act (CIPA) because the district employs a filtering mechanism for student access or because Ed Tech funds referenced in this application will NOT be used to purchase computers used to access the Internet or pay for direct costs associated with accessing the Internet.

Superintendents: When you submit your final grant application in the online grants management system, you will be certifying the above assurances.

Application Form for Classroom Tech Mini-Grant

Applicant: Stephen Latvis, Winnacunnet High School

Criteria	Applicants: <i>Criteria used to review each grant application are listed in the left column. Please do not delete the criteria column. By using this right column to describe how your project proposes to meet the criteria, you can increase the likelihood that you won't leave out important information. There is no page limit, but please be as clear and concise as possible.</i>
Project Abstract (10 points) A clear and concise abstract (100-150 word limit) outlines the mini grant project and overall goals, along with the process for implementing it in the classroom.	
1. Describes the project, including grade level(s) and content area(s), indicates how this project fits into school/district curriculum, indicates process for implementation and assessment, as well as how it would advance the achievement of students.	<p>Mathematics is currently a core subject in our schools that is desperate need of an image overhaul. With high stakes testing results falling far below expectations, mathematics often receives a bad reputation. It is the goal of this project to develop appropriate activities and explorations in algebra, geometry, algebra II and advanced mathematics across all levels of mathematics learning that connect to other core subjects in the sciences (physical science, biology, chemistry, and physics).</p> <p>These activities will use mathematical modeling to investigate real-world applications and problems. Through this problem or project based learning approach students will be given or select a scenario to analyze using appropriate technologies. It is the goal of this project to help all students make their mathematical learning real and authentic and to motivate students to seek out the tools necessary for higher-order mathematical thinking and analysis.</p> <p>This project will assess the efficacy of using graphic interfaces (provided by software and electronic models) to stimulate student motivation and deeper learning in math and science. The project team and other participants will use a series of common formative assessment probes to assess student learning in mathematics. The development and analysis of the outcomes of these probes will be guided by Dr. Karen Graham (UNH Mathematics Education). Additionally, Dr. Michael Middleton (UNH Dept. of Education) will assist in the development of a short electronic survey to solicit student feedback on motivation. A graduate student will further this effort by leading selected focus groups with students in the math classes involved in this project. All teacher professional development opportunities will be assessed using exit surveys with open-ended segments that will inform continued professional support and dialogue.</p>
2. Abstract includes an essential question, connected to the state frameworks, which probes for deeper meaning and broader understanding of the framework content addressed by this project, fostering the development of higher order thinking and problem solving.	<p>This project is based on the essential question: "How can mathematical modeling tools and software be used to analyze real world situations and make better decisions?" We propose to develop high quality and engaging modeling activities for high school mathematics courses. These activities will increase students' familiarity and expertise in using technological tools and software to investigate quantitative relationships and solve problems in the sciences and other core areas so that mathematical learning will be relevant, rigorous and embedded. Through project-based learning challenges, teachers and students will work together with experienced trainers in the development of mathematical models. Computer-based sensors will assist data acquisition, while modeling software (Excel & STELLA) and graphing calculators are used to analyze relationships and assist in decision-making. These higher order thinking skills are inherent to all of the core area standards.</p>

Project Description (50 points)

Describes project in general terms and indicates whether it is a replicated project or an original project. Projects which can directly impact more than one classroom are preferred.

If project is replicated, proposal describes the intended changes to the project idea and how they will improve the project in order to be appropriate for the situation. Includes specific goals and objectives that relate to the essential question, and explains how those goals will be achieved by the project. Include a rationale for any changes made to the original project.

If your project is original, proposal describes how the project is appropriate for current situation. Includes specific goals and objectives that relate to the essential question, and explain how those goals will be achieved by the project.

1. Proposal generally discusses how implementing this project will improve technology integration within classrooms and in the core content areas. Indicates the need for technology integration in school or district. Describes the determination of need for this project and includes one or more examples of data that support the rationale of need for the project, such as NECAP assessment or other data. This explains to the reviewer why the project is worthy of funding as it relates to student achievement.

Mathematics is currently a core subject in our schools that is desperate need of an image overhaul. With high stakes testing results falling far below expectations, mathematics often receives a bad reputation. It is the goal of this project to use technology in developing appropriate activities and explorations in Algebra, Geometry, Algebra II and advanced mathematics across all levels of mathematics learning that connect to other core subjects in the sciences (Physical Science, Biology, Chemistry, and Physics). These activities will use mathematical modeling to investigate real-world application problems. Through this problem based learning approach students will be given a scenario to analyze using appropriate technologies. It is the goal of this project to help all students make their mathematical learning real and authentic and to motivate students to seek out the tools necessary for higher-order mathematical thinking and analysis. This project will also assist in providing visual representations (models) that can be used by a variety of learners to understand quantified relationships. This project is an **original project** that improves the understanding of modeling in mathematics, the value of modeling as a learning strategy, and extends modeling to connect and enhance other subject areas within any school's curriculum.

The Winnacunnet Cooperative School district (also known as WHS) **qualifies as a "high-need district"** for this project using the following current statistics:

- Winnacunnet's mathematics NECAP mean scaled scores of 1134 being slightly below the state mean scaled score of 1136;
- Winnacunnet's science NECAP mean scaled scores of 1133 being slightly below the state mean scaled score of 1133;
- This is the second year that Winnacunnet did not meet AYP across all subgroups.

The goal of the project is to use technology to increase student engagement in learning and to improve student achievement in mathematics. Through mathematical modeling scenarios using the technology tools that currently exist at Winnacunnet (and other middle schools), including:

- Logger Pro software and Vernier probes (see list included later),
- Geometer's Sketchpad, and
- Microsoft Excel

This project will leverage already existing technologies through the addition of new technology and software, including:

- STELLA mathematical modeling software,
- TI-Nspire graphing calculators, and
- TI-Nspire Lab Cradles (coming out in April 2011)

We hypothesize that the combination of technological tools will increase student engagement in learning. These tools will expedite information and data gathering to analyze and solve problems using mathematical modeling. This will increase the relevance of mathematical challenges and provide graphical representations of problems that will lead to increased student achievement and success in mathematics and in state NECAP tests.

Research studies conducted on the use of TI-Nspire technology has resulted in the following validated results (extracted from Texas Instruments Website http://education.ti.com/educationportal/sites/US/nonProductMulti/research_nspire.html):

- Algebra 1 students taught with TI-Nspire outperformed the group using TI-84's in all assessments except the state test;
- Students using TI-Nspire handhelds have demonstrated deeper understanding and greater abilities in drawing inferences, with greatest gains by low-achieving students;
- Teaching with TI-Nspire CAS may improve motivation to use algebraic representations, confidence, and diversity of tasks selected by students;
- Appropriate use of TI-Nspire technology can facilitate use of shared resources for collaborative learning, high student engagement, and a novel, integrated format for instructional units. Beliefs that the calculator is an aid to learning mathematics (not just an efficiency device);
- Classroom use of TI-Nspire™ can enhance student engagement, collaboration and learning;
- TI-Nspire facilitated mathematical modeling and meaningful introduction to the use of symbols

2. Project is focused on one or more content areas, with the proposal indicating which content area and associated standards are the main focus. Proposal indicates how the project will address ICT literacy skills without focusing solely on the acquisition of ICT literacy skills devoid of core content learning.

The content areas that are the focus of this project are those in high school mathematics (Algebra 1, Geometry, Algebra 2, Pre-Calculus, and Calculus) and high school sciences (Physical Science, Biology, Chemistry, and Physics).

The current Grade-Span expectations in Mathematics that are used by the state of New Hampshire highlight the following about mathematical modeling and use of technology in the following content strands:

- Geometry and Measurement: *In both areas, geometry and measurement, students need to investigate, experiment, and explore geometric properties using both technology and hands-on materials.*
- Data, Statistics, and Probability: *Collecting, organizing, and displaying data, as well as interpreting and analyzing the information to make decisions and predictions, have become very important in our society. Technology should be used as a tool throughout the investigation process.*
- Functions and Algebra: *Students at all grade-levels should recognize, describe, and generalize patterns and build mathematical models to describe, interpret, and predict the behavior of real-world phenomenon.*

The new Common Core Standards in High School Mathematics have the following highlights:

- The high school standards call on students to *practice applying mathematical ways of thinking to real world issues and challenges*; they prepare students to think and reason mathematically.
- The high school standards set a *rigorous definition of college and career readiness*, by helping students develop a depth of understanding and ability to apply mathematics to novel situations, as college students and employees regularly do.
- The high school standards *emphasize mathematical modeling*, the use of mathematics and statistics to analyze empirical situations, understand them better, and improve decisions. For example, the draft standards state: "Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. It is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data."

The basic mathematical modeling cycle listed on the common core standards for mathematics website is summarized in the following six steps. It involves:

- (1) identifying variables in the situation and selecting those that represent essential features,
- (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables,
- (3) analyzing and performing operations on these relationships to draw conclusions,
- (4) interpreting the results of the mathematics in terms of the original situation,
- (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable,
- (6) reporting on the conclusions and the reasoning behind them.

The above standards are extracted from the common-core standards website (<http://www.corestandards.org/the-standards/mathematics/high-school-modeling/introduction/>).

This project supports all five of the ICT standards by:

- Using technology tools responsibly to provide knowledge for decision-making,
- Becoming proficient in using these 21st century tools in mathematics and other core subject areas,
- Using the tools for cognitive proficiency in problem solving and decision making,
- Gaining a proficiency in the use of hardware and software, and
- Adding to digital portfolios.

3. Proposal describes in detail the project based learning unit(s) that will encompass the project, and project features support acquisition of digital and media literacy skills. Project based learning (or problem based learning) with a constructivist approach and essential questions are the heart of these projects. Team projects must show evidence that these pedagogies are clearly understood and applied.

This project will improve the technology integration within our mathematics and science classrooms by promoting student inquiry and analysis of real-world problems. Students will be gradually challenged to use a modeling software program known as STELLA[®]. STELLA[®] offers a practical way to dynamically visualize and communicate how complex systems and ideas really work. Whether they are first-time or experienced modelers, teachers, students, and researchers use STELLA to explore and answer questions of relevance to math, science, economics, social studies, history, etc. Please see their website for more information (<http://www.iseesystems.com/software/Education/StellaSoftware.aspx>).

Computer-based sensors (Vernier probes and LoggerPro software) have been used for more than 2 decades in the sciences. There has been some use of motion detectors in the math classes and graphing calculators, but other than games or tutorials, mathematics teachers have not strayed far from the formula driven strategies that yield correct answers. Our schools struggle to help students gain algebraic understanding which enables them to advance to college level work beyond Algebra II. Two thirds of New Hampshire schools are considered "in need of improvement" and lower-leveled algebra courses can take up to 3 years for students to pass. There must be a better way!

Daniel Pink's work suggests that highly skilled 21st Century learners must be functional in both logic and creativity. His right brain and left brain studies have demonstrated how successful individuals can be, even those with learning disabilities.

We hypothesize in this project that graphics driven modeling software that can be used to describe and predict quantitative relationships can improve student learning in mathematics, and by using real-world relationships that students can investigate mathematically will improve student motivation and success in mathematics.

Mathematical modeling is used in almost every sphere to make predictions and improve decisions. It predicts our weather, global warming, and economic outcomes. We use it every day to make decisions, yet it does not currently have a place in K-12 academics. There are pockets of success from Concord-Carlisle High School in Massachusetts to Seattle, Washington public schools. Thomas Jefferson Magnet High School outside of Washington DC has used STELLA for many years to emphasize relationships in the sciences. In this project, Mathematical Modeling will be used to engage learners through the following content area courses:

- Algebra 1 with connections to Physical Science and Biology
- Geometry with connections to Biology and Chemistry
- Algebra 2 with connections to Chemistry and Physics
- Advanced Mathematics and Calculus with connections to Advanced Physics

Students can use STELLA to see a visual representation of how variables interact by creating a picture for students to visualize the relationships and to experiment with different models to make predictions on outcomes. Other technologies that students will make use of will include Texas Instruments graphing calculators, Vernier science probes and Logger Pro software. The aim of this multi-approach analysis will be for students to see how different technologies can be used to analyze the problems presented to them and to choose appropriate tools and modeling software to study the situation.

Example mathematical modeling activities that connect technology in this project include the following:

- Challenging students to creating a successful business accounting plan for selling t-shirts using STELLA software (balancing overhead with material and labor costs to achieve a profit)
- Quantifying the physical phenomena of a bouncing ball using Logger pro software
- Analyzing data collected for water contamination using Excel software
- Investigating and optimizing the geometry of cell phone tower locations using Geometer's Sketchpad software

All students at Winnacunnet High School are creating digital portfolios that include artifacts and reflections. In this project students will complete a digital model with a written reflections about their work in response to a particular challenge or prompt. The digital media literacy standards met by this proposed project are in the areas of media (including software, equipment, video, and digital portfolios) and using technology as a research tool, a communication tool, and a productivity tool.

The digital media literacy standards are met by this proposed project in the areas of media (including software, equipment, video, and digital portfolios) and using technology as a research tool, a communication tool, and a productivity tool.

<p>4. Proposal identifies and explains at least three specific learning goals the team needs to address in its professional development activities and how the proposed professional development will address these.</p>	<p>The focus of the professional development activities for this project will include learning how to use the following technologies and how to increase student learning through the creation of authentic problem-based learning activities:</p> <ul style="list-style-type: none"> • STELLA modeling software • TI-Nspire calculators • Vernier probes • Logger Pro software <p>Professional development will also focus around learning current methodologies in mathematical modeling. Greta Mills, the 2010 recipient of the Christa McAuliffe Sabbatical Award, has agreed to mentor us and facilitate our professional development over the summer in mathematical modeling. Her sabbatical focus has been on bringing mathematical modeling to as many students in New Hampshire as possible. Greta originally trained with the New Hampshire Computational Science Team as the only math teacher with 3 other science teachers. This team was organized by our current Assistant Superintendent Barbara Hopkins and worked with modeling experts at NASA, super-computing facilities at San Diego and Champagne, IL with funding from the National Science Foundation. We are honored to have Greta mentor our team. Greta has already given a 3 hour workshop to the team as well as other teachers from the sending schools of SAU 21. She shared her work to date in mathematical modeling and the projects she has been developing. She is an expert in the use of STELLA software; Logger Pro/Vernier software, Microsoft Excel, and Geometer's Sketchpad, all current technologies that help connect real-world mathematical concepts to mathematical models. Her project title is 'Students as mathematicians: making real-world applications truly realistic,' and she has been working to develop activities in modeling with mathematics for all secondary levels, including middle schools. Our activities will focus on identifying interesting and open-ended problems which students would explore and resolve in collaborative groups.</p> <p>To assist in identifying interesting and challenging problems, we will hire two of high school students to work with our teachers. This will enable us to get authentic feedback from current learners and to be able to reflect with them on other curricular areas that might be re-energized or deepened with the use of modeling. These students will be selected to work with the team and each will receive a modest compensation for their time and efforts.</p>
<p>5. Proposal indicates that support has been obtained from the superintendent AND the principal, preferably by attaching letters of support within the grant application pages (not as separate files). Such support acknowledges that he/she has read the RFP, understands the requirements, and will allow the applying team to fulfill the requirements, if they are awarded the grant.</p>	<p>All letters of support for the grant are attached at the end of this grant. The Superintendent of SAU 21, Mr. Robert Sullivan, Ed. D, Assistant Superintendent, Barbara A. Hopkins, C.A.G.S. and the Principal of the Winnacunnet Cooperative School District, Mr. William McGowan, have all:</p> <ul style="list-style-type: none"> • Read the RFP and this application, • Understand the requirements, and • Will allow the applying team to fulfill the requirements, if we are awarded the grant. <p>All letters of support for the grant are attached to this WORD version of the grant and will be sent as attachments when the grant is emailed to Dr. Cathy Higgins.</p>
<p>6. Proposal supports schools, teams, or districts that haven't participated in mini-grants previously or partners with such entities.</p>	<p>The team will be the first interdisciplinary team of mathematics and science teachers that is applying for this type of grant from Winnacunnet High School. Participants from some of the sending districts' middle schools cannot apply for min-grants but will benefit from the professional development and collegial sharing of Algebra 1 models and challenges for learning.</p>

<p>7. Proposal indicates partnerships which involve NH teacher preparation program faculty.</p>	<p>Additionally, with the current national interests for STEM education and teachers in mind, we have two different teacher-preparatory professors from the University of New Hampshire who are interested in our project. They will serve as advisors and assist in the evaluation of the project.</p> <p>Dr. Karen Graham is a mathematics education expert and also the director of the UNH Leitzel Center for mathematics, Science, and Engineering Education. Karen has agreed to advise us on specific assessments in algebra where we can gather information on student learning in both the short and longer terms. Since not all students will be using these activities, we have the opportunity for a controlled research study. We plan short formative and summative evaluations that will give feedback to teachers, students, and the researchers.</p> <p>Dr. Graham's support letter includes the following statement: "I am willing to serve as an advisor to the project. In that role I will work with you to develop appropriate assessments and meet with you and other project members at least 3 times per year to plan the project evaluation, review preliminary results, and provide formative feedback to the project."</p> <p>Dr. Michael Middleton from the UNH Education Department is an expert on student motivation. Dr. Middleton will assist us with some short surveys that we can administer electronically to students to gauge their interest levels and desire to pursue more mathematical learning (motivations to persist in problem-solving).</p> <p>Dr. Middleton's letter of commitment includes: "I understand that my role on the project will be to lend my expertise in the area of student motivation to the design, implementation and evaluation of the project. I further understand that serving in a consulting role will include meeting with the project personnel to review progress and research findings, and making suggestions aimed at improving the overall design of the learning system, as well as the outcomes for the students who participate. From my perspective, this project is important given the current press for data-driven decision making related to policy, curriculum and instruction. Participants will benefit from using technology to promote deeper learning of the content and dispositions favorable toward a practical approach the practice of classroom assessment."</p>
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<p>8. Proposal indicates thoughtful inclusion of students with special needs and uses appropriate technology to assist those learners in order to promote the achievement of all students.</p>	<p>The mathematics classes that are taught by the teachers on the team include students that range in mathematics ability and learning styles, as well as students with special needs. Approximately 15% of the students in these classes have IEPs due to learning disabilities. Classes that have been taught by teachers on the team include:</p> <ul style="list-style-type: none"> • Algebra 1 Preparatory, Algebra Recovery, Geometry Preparatory (with many students with various learning disabilities), and Algebra 2 Preparatory • Geometry College Preparatory, Advanced Functions College Preparatory, Finite Mathematics College Preparatory and Calculus Running Start/College Preparatory; • Geometry Honors, Algebra 2 Honors, and Advanced Functions Honors; • Physics College Preparatory, Physics Honors, and Physics Advanced Placement <p>Winnacunnet High School follows a full inclusion model of students in mathematics education and allows all students, regardless of their special education needs, to fully participate in an appropriate mathematics program of study. The range of courses and ability levels of mathematics students are well represented by the teachers on the team. Participating middle school teachers have between 15 and 20% students with disabilities. Seabrook in particular is a school in need of improvement for mathematics and will benefit from this project.</p> <p>Special educators that are currently partnered with the mathematics department currently and work specifically in the area of mathematics and learning disabled students. These teachers will be provided with the opportunity to participate in the professional development activities of this project to be utilized in this project.</p> <p>The nature of the technologies and software products that this project will utilize will more adequately address the needs of students with special needs in the area of mathematics learning. This will promote increases in mathematics achievement to students with special needs as well as all students.</p>
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<p>9. Proposal indicates plans for dissemination of the project to other schools and districts throughout the state, including presentations at 2 or more venues.</p>	<p>Members of the team will present to the following groups in order to disseminate information about the project not only to Winnacunnet but to other schools and districts through the state:</p> <ul style="list-style-type: none"> • To the teachers in the Winnacunnet High School Mathematics and Science Departments in an effort to foster other ideas for project based learning that can occur between the mathematics and science teachers of the school. • To the mathematics teachers of the sending districts in SAU 21 of Hampton, Seabrook, Hampton Falls, North Hampton, and South Hampton via the SAU 21 mathematics vertical team that currently exists. In addition these teachers will be invited to send members from their respective mathematics programs to participate in the professional development activities this grant will provide. It is also a goal of the team to develop activities in mathematics modeling that can be able to be used in the pre-algebra and algebra programs at the sending schools. The Algebra teacher from Sacred Heart (a local parochial school that also sends students to WHS) will also be invited to the training sessions. • To the member schools of the Tri-State Mathematics League which includes the following schools from New Hampshire: Exeter High School, Timberlane Regional High School, Pinkerton Academy, Londonderry High School, Oyster River High School, Dover High School, Portsmouth High School, Spaulding High School, and Somersworth High School. This meeting will be facilitated by Stephen Latvis, the lead teacher on the team that is also the current president of the Tri-State Mathematics League. <p>The team will also look to participate in various conferences throughout the year as the opportunity presents. Such conferences will include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • New Hampshire Teachers of Mathematics (NHTM) spring of 2012/fall of 2012 conference (date and location TBD) • Teachers as Researchers Conference held each May at UNH Manchester. • New Hampshire Science Teachers Association Conference held each March. • The 2012 Christa McAuliffe Technology Conference (date and location TBD)
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<p>10. Proposal indicates specific plans for video production training as needed and an outline for the promotional video that describes the various stages of design and implementation of the project.</p>	<p>The team has several identified experts in the field of video production at Winnacunnet High School. Derek Roberts, a teacher at the high school who specializes in video production and helps to produce the student-run “WHTV,” a weekly school televised production, will be contacted to assist in the production of the video. The team is also aware of the training sessions that are available and will have a member of the team participate in the training sessions as the need presents itself. It is the belief of the team, however, that there is enough expertise at the high school currently that this component of the project will be easily addressed and fulfilled.</p> <p>Derek would be paid a maximum of \$200 for his time and efforts assisting the team with the video production.</p> <p>The video that Derek produced for the grant team of Michael Handwork, John Croteau and Dot Grazier for their project can be viewed at the following link: http://www.youtube.com/watch?v=NZvfaAwWpME</p> <p>The outline for the video would follow the various stages of work done by the team, which would be the following stages:</p> <ul style="list-style-type: none"> • Professional Development work over the summer with Greta Mills • Design of the project-based learning activities and piloting them over the summer with a few students to work out any problems • Classroom based videos while the projects were being worked on by the students • Follow-up video would include explanations of the various stages of the project from the members of the team <p>How the implementation of the project enhanced the teaching in the classroom and the experiences had by the students</p>
<p>Capacity for Success (35 points) Describes the capacity of each team member to achieve meaningful success at achieving the goals of the Tech Mini-Grant Program in the school or district. Clearly articulates the program and policies in place that will support success in terms of professional development, technology leadership, and how this program would meet specific achievement needs of the students.</p>	
<p>1. Proposal demonstrates capacity for success by providing strong evidence that school/district and the individual team members are willing and able to conduct the scope of work involved in implementing this project.</p>	<p>All team members are experienced teachers who have the time, enthusiasm and dedication for using modeling to improve learning and achievement in mathematics. They are supported in this effort by university experts, the administration at both the SAU, high school and sending middle school levels.</p> <p>Greta Mills, Christa McAuliffe Sabbatical Awardee and Hanover High School Mathematics Teacher, has given a commitment to work with the team over the summer with professional development activities to support mathematical modeling. This will include mathematics teachers from the sending schools. All members of the team and sending school math teachers recently participated in a 3 hour workshop given by Greta Mills on the topic of mathematics teaching and mathematical modeling through project-based learning scenarios. Her workshop presentation was enthusiastically received and has further motivated the team to engage in learning how mathematical modeling can raise student achievement. Greta’s gift for making mathematical modeling real, relevant, and student-centered was evident in the numerous projects she presented and the various technologies she used; all of which we are looking to develop and implement.</p> <p>The Curriculum Coordinator of Winnacunnet was present at the workshop and equally excited by mathematical modeling. She knows what the multiple representations of models can pose for the learning and achievement of all students in mathematics. The Assistant Principals that oversee the mathematics and science departments and Principal McGowen (former math teacher) are also working in concert with the team to provide administrative support to ensure the project is successful. The support for the team extends to both the Assistant Superintendent and the Superintendent of the SAU, as well as the Principals of the sending schools. Everyone that is a stakeholder in the SAU and Winnacunnet wants to see this project be successful and is fully dedicated to making that success a reality. We believe this approach may provide the targeted intervention (graphical representation) that many students need for learning mathematics.</p>

<p>2. Proposal describes why participation in this effort is appropriate for district and the capacity the school or district has that will insure the success of the project.</p>	<p>The SAU-wide Mathematics Vertical Team (which consists of members from all of the sending schools, curriculum coordinators, and the SAU) will continue to provide a focus for the curriculum articulation of Math Modeling across the districts. The positive working relationships between high school and middle level teachers of Algebra 1 have been forged through this team and the multiple district School Boards expect that the Vertical Teams strive for excellence through continuity of curricula and reflection on student learning through assessments. Project-based learning or backward planning designed projects are at the forefront of this project. The Vertical Team (which meets regularly through the academic year) provides a forum for mathematics teachers and administrators to share teaching strategies, challenges, and successes. Algebra 1 is the foundational course that connects grades 8 and 9 teachers. It is imperative that the scope and rigor of student experiences are aligned for success in future high school courses. The ongoing dialogue of teachers and the project participants through the Mathematics Vertical Team will insure the continued success and reflection on outcomes for the proposed project.</p>
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3. Proposal describes any structures, policies, and/or procedures already in place in school or district that support the project and the project-based learning philosophy.

Winnacunnet Cooperative High School is willing to provide the cost of substitutes, summer support for additional people to attend the professional development by Greta Mills, and any additional print, space, time, and resources necessary to ensure the success of the project. Sending middle school administrators have been supportive of the Vertical Teams and will provide the necessary teacher support to maintain continuity in the mathematics curriculum. The modeling activities at the middle level will be initially supported by Excel and STELLA Runtime software. As the project progresses at least two of the larger middle schools have indicated that they will procure STELLA modeling software as a site license. All middle schools are advancing their work with graphing calculators and the use of electronic probes for data acquisition in the sciences and math.

This project also supports the **Common Core Standard in High School Mathematics of Modeling**.

This project supports the following **NH Frameworks for Sciences**: *Students will understand the meaning of models, their appropriate use and limitations, and how models can help them in understanding the natural world.*

This project supports the following **NH Frameworks of Social Sciences/Economics**: *Students will demonstrate the ability and willingness to apply economic concepts in the examination and resolution of problems and issues in educational, occupational, civic, and everyday settings.*

This project supports the **Winnacunnet High School Performance Expectations** of:

- I-1: Find and collect information from a variety of print and non-print materials, electronic databases, multimedia, or other sources.
- I-3: Demonstrate the skills to work collaboratively.
- C-1: Define key problems and/or concepts
- C-3: Generate a variety of possible solutions, theories, and/or other appropriate responses to complex questions or problems.
- A-1: Communicate an understanding of issues facing local, national, and global communities.
- E-5: Present information or ideas using visual, artistic, and/or technological mediums.

The following technology, hardware, and software are already being used at Winnacunnet and will help to support the project's success as it will be used in concert with the hardware and software that will be funded by this project

- Several class sets of mobile laptop carts for use in classrooms
- Several desktop computer labs are available for use by students and teachers
- Each team member has his or her own laptop computer
- A classroom set of iPads will be available for use starting with the 2011-2012 school year
- Geometer's Sketchpad site license and extensive use and training by mathematics teachers already in place
- Logger Pro/Vernier software site license and extensive use and training by the science teachers is already in place
- The following Vernier probes are available from the science department for data acquisition. They will be used by the Mathematics teachers for special projects and connecting them with TI-NSpire calculators through the lab-cradle interface.
 - 8 motion detectors
 - 12 photogates and smart pulley set ups
 - 6 dual range force probes
 - 1 force plate
 - 6 magnetic field sensor
 - 1 three axis accelerometer
 - 6 microphones
 - 1 temp probe
 - 6 LabPro interfaces
- 12 Texas Instruments CBR Motion Detectors currently used by the Math Department.

4. Proposal discusses the abilities and expertise of the individual team members with respect to their ability to collaborate, organize, schedule, and deliver a successful project to their students.

- **Stephen Latvis** (15 years of teaching experience, all at Winnacunnet) has taught the following courses in recent years: Geometry Preparatory (with many students with various learning disabilities), Geometry College Preparatory, Advanced Functions Honors, and Calculus College Preparatory;
- **Christine Karmen** (19 years teaching experience and 7 years teaching experience at Winnacunnet) has recently taught: Geometry Preparatory and College Preparatory and Honors, Algebra Recovery (with many students with learning disabilities and motivation challenges), Algebra II Preparatory and Finite Mathematics;
- **Jay Miller** (9.5 years teaching experience and 7 years teaching experience at Winnacunnet) is the current lead mathematics teacher at Winnacunnet High School) has recently taught: Algebra 1 Preparatory, Algebra 2 Honors, and Advanced Functions College Preparatory
- **Adam Edgar** (15 years of teaching experience and 11 years teaching experience at Winnacunnet) is a teacher of science and physics classes (including honors and AP physics). He is an expert in the use of Vernier probes and Logger Pro software. Adam's area of expertise with these technologies will be an invaluable in-house resource and he is very enthusiastic about working as part of the team since mathematical modeling or computational science is also relevant to all areas of science.

This team of mathematics teachers with one science teacher includes teachers of every traditional high school math courses (Algebra 1 to Calculus), Physics and Physical Science, with learning ranges from preparatory to honors and Advanced Placement. This year about 15% of the students that the mathematics teachers on the team worked with received special education services of some kind.

All members of the team are highly familiar with each other and respect their various teaching styles. This variation will provide greater diversity in the strategies implemented with the modeling activities and increases the potential for innovation. Furthermore, each team member brings varied experiences in working together with additional disciplines such as social studies, physical education and the arts which can further bridge interdisciplinary work.

Stephen, the team leader, is also the current president of the Tri-State Mathematics League that holds mathematics contests throughout the year at local schools (see the list of schools in previous sections). He has thus been responsible for organizing and holding meets throughout the seacoast area of New Hampshire, Massachusetts, and Maine. He is very adept at scheduling and coordinating meetings via e-mail and to get people to reach consensus on issues (whether they agree or disagree on something). He is also accustomed to making the tough decisions necessary for things to run smoothly, effectively, and efficiently. Stephen has worked with each of the team members and is confident that this team will meet the challenges of the project. All team members have been active on the SAU-wide Vertical Articulation Teams for math and science and have developed relationships with 7th and 8th grade teachers from the sending districts.

<p>5. Proposal indicates team member and district/administrative support with respect to:</p> <ul style="list-style-type: none"> • implementing the project in classrooms, • supporting the professional development opportunities necessary to successfully participate in the Mini-Grant program, • participating in required mini-grant meetings, • producing the 3 minute documentary video for presentation, • preparing the lesson plans and materials necessary for sharing with other, • attending the Mini-Grant celebration day, • presenting the project within the district and at a regional or state venue, and • participating in post-project evaluations for program improvement. 	<p>The team members, the curriculum coordinator, the assistant principals that oversee both the mathematics and science departments, the assistant superintendent of the SAU and the superintendent of the SAU are all in support of the proposal with respect to:</p> <ul style="list-style-type: none"> • implementing the project in classrooms (at the high school and sending schools for Algebra 1), • supporting the professional development opportunities necessary to successfully participate in the Mini-Grant program (mini-grant team and participating 7th and 8th grade math teachers), • participating in required mini-grant meetings (project team), • producing the 3 minute documentary video for presentation (project team with some sending districts participation), • preparing the lesson plans and materials necessary for sharing with others (all participants), • attending the Mini-Grant celebration day (project team), • presenting the project within the district and at a regional or state venue (project team), and • participating in post-project evaluations for program improvement (all participants including assessments of mathematical learning and motivation developed under the guidance of UNH Education Professors Graham and Middleton).
<p>6. Proposal discusses the Extent of Impact within the School – indicates the anticipated number of staff that will be directly and indirectly impacted by the project, as well as the number of students that will be directly and indirectly impacted, along with supporting explanations for each.</p>	<p>The team has made a commitment to present to the teachers in the Winnacunnet High School Mathematics and Science Departments in an effort to foster other ideas for project based learning and the use of technology that can occur between the mathematics and science teachers of the school. Each team member is also committed to helping promote mathematical modeling activities and development of this pedagogy within the mathematics and science departments. This would directly impact 15 mathematics teachers and 14 science teachers and 300 students while indirectly impacting 900 students over the next school year (every student at Winnacunnet is generally taking either a mathematics or science course each year).</p> <p>Both the mathematics and science common core standards have mathematical modeling as a central focus and both core subject areas will be looking to implement these fully in the upcoming years to meet the new standards and resulting statewide testing. As engagement in mathematical modeling leads to motivated students and increases in achievement it is the pledge of this team to help develop mathematical modeling practices in all areas of these core content areas. It is also the hope of the team that future mathematical modeling partnerships could be forged with the social studies department, especially in the study of economics, history and social change.</p>

<p>7. Proposal discusses the Extent of Impact to Other Schools – Describes how the project will involve or include outreach to multiple schools, or multiple districts, in order to increase the impact of the project.</p>	<p>The team has made a commitment to work with the mathematics teachers of the sending districts in SAU 21 of Hampton, Seabrook, Hampton Falls, North Hampton, and South Hampton via the SAU 21 mathematics vertical team that currently exists. In addition, these teachers will be invited to send members from their respective mathematics programs to participate in the professional development activities this grant will provide. The Sacred Heart School Mathematics teachers will also be invited as many of their students continue at WHS. One goal of the team to develop activities in mathematics modeling that will be able to be used in the pre-algebra and algebra programs at the sending schools. Most of the schools are advancing in their use of graphing calculators and the use of technology in teaching. STELLA runtime is a free download; which provides access for their students to developed models. This would directly impact dozens of teachers in SAU 21 and the newly formed SAU 90 and thus indirectly impact several thousands of the SAUs’ students. This will also affect a teacher and students attending the private and parochial Sacred Heart School.</p> <p>The team has made a commitment to present the project to the member schools of the Tri-State Mathematics League which includes the following schools from New Hampshire: Exeter High School, Timberlane Regional High School, Pinkerton Academy, Londonderry High School, Oyster River High School, Dover High School, Portsmouth High School, Spaulding High School, and Somersworth High School. This meeting will be facilitated by Stephen Latvis, the lead teacher on the team that is also the current president of the Tri-State Mathematics League. This would directly impact about 14 teachers and indirectly impact the several hundred students these teachers work with.</p> <p>The team has also committed to looking into and participating in various conferences throughout the year as the opportunity presents. Such conferences will provide extended impacts to many teachers and students statewide and nationally. As possible we will share the assessment and research part of our project through articles published in professional journals. This is especially important for teaching with Common Core Standards and the project’s potential to help all mathematics’ students become successful as well as to improve mathematical achievement.</p>
<p>Budget (5 points) Budget contains a narrative and justification of expenses regarding equipment, supplies, travel, and professional development expenses appropriate to carry out the proposed project. The total for professional development is at least 25% of the total budget requested. Include \$100 per team member for each teacher to attend the spring 2012 celebration event.</p>	<p><i>See budget below</i></p>

Budget is formatted with the narrative in left column and total amounts in right column. Within the narrative, proposal describes a logical connection to district goals and shows how costs were calculated. Proposal includes \$100 per teacher for attendance at celebration event.

Budget	TOTAL
Hardware: <ul style="list-style-type: none"> • Set of 10 TI-NSpire calculators @ \$1848 (\$21 S/H estimated) • Set of 5 TI-NSpire Lab Cradles @ \$725 (\$18 S/H estimated) 	\$2612
Software: <ul style="list-style-type: none"> • STELLA site license @ \$989 	\$989
Supplies: n/a	\$0
Professional Development Activities (must be at least \$2,500) <ul style="list-style-type: none"> • Training in Modeling @ \$1500 • Project Celebration @ \$500 • Model and Curriculum Development and evaluation time @ \$3100 (124 hours and \$25 an hour) + benefits = \$3338 • Graduate Student Evaluator @ \$100 (4 hours at \$25 an hour) • Videographer to produce supporting videos @ \$200 (8 hours @ \$25 an hour) + benefits = \$216 • Student Workers @ \$200 (10 hours for 2 students @ \$10 an hour) • UNH Advisory @ \$250 (5 hours at \$50 an hour) 	\$6104
Indirect Cost @ 2.3% (per 2010-11 district rates posted at http://www.ed.state.nh.us/education/data/misc.htm)	\$223.21
Total	\$9928.21

School Administrative Unit No. 21

Winnacunnet, South Hampton, Seabrook, North Hampton, Hampton Falls, Hampton

Ms. Cathy Higgins
NCLB Title II-D Program Manager
Office of Educational Technology, Division of Instruction
New Hampshire Department of Education
101 Pleasant Street
Concord, NH 03301

Dear Ms. Higgins:

This letter is to support and affirm the Mathematical Modeling proposal submitted to the Title IID program from Winnacunnet Cooperative High School. Winnacunnet receives freshmen from minimally five different sending schools and districts. On February 8th (delayed due to snow) they held a workshop on Mathematical Modeling that was attended by 18 teachers representing all of the sending schools. Modeling has been in study by the teachers (especially Winnacunnet and Seabrook) since November as the Common Core Standards were announced. Mathematical Modeling is part of those standards and is the area least familiar to teachers across the nation.

There are several reasons why this proposal is important state-wide:

- Math Modeling will need to be understood by math teachers across the nation and sample lessons, challenges, and teaching strategies will be paramount.
- Relevance to real-world scenarios has been a classic criticism of mathematics teaching and is inherent to student motivation; this project focuses on both areas.
- Mathematics Education has struggled throughout the century to equip all students with learning strengths that are quantitative; beginning with real-world challenges that can be described graphically (with modeling software such as STELLA) and may provide insight to a teaching methodology that truly provides mathematical learning opportunities to all students.
- Should this project generate a successful model, this project may provide the basis for a state-wide consortium project since the STELLA runtime software is a free download, produced by a New Hampshire company. That's a "win-win!"

It is our hope that you will fund this project. Steve Latvis has the energy and the statewide reputation to take this project far and wide. It is unusual to find such depth and determination in a mathematics teacher who also thoughtfully employs technology for gains in student learning. He and Greta Mills have already demonstrated impact with teachers and in other academic areas. We will provide the administrative support and guidance for them to take it to the next level and involve the middle school mathematics teachers from North Hampton, Hampton, South Hampton, Hampton Falls, and Seabrook. Please contact our office should you have any questions.

Sincerely,



Robert M. Sullivan, Ed.D.
Superintendent of Schools



Barbara A. Hopkins, C.A.G.S.
Assistant Superintendent of Schools

2 Alumni Drive, Hampton, New Hampshire 03842-2282
Telephone 603 926-8992 - Fax 603 926-5157

Winnacunnet High School



Dr. Cathy Higgins SEABROOK — HAMPTON — HAMPTON FALLS — NORTH HAMPTON
NCLB Title II-D Program Manager
Office of Educational Technology, Division of Instruction
New Hampshire Department of Education
101 Pleasant Street
Concord, NH 03301

February 25, 2011

Dear Dr. Higgins:

This letter is in support of the Mathematical Modeling proposal submitted to the Title IID program. The Winnacunnet Cooperative High School teachers and administrators have been working on this since the first webinar on the Title IID Programs. As a former mathematics teacher, I am very supportive of the team's efforts and will provide the release time and support they require for a successful project. As we have continuously strived for improved grades and scores by our math students; this has turned into a greater collaboration that is not only embraced by our math teachers, but also by science and the 7th and 8th grade math teachers from our sending schools. For those that are doing well in math; they see the increased depth of understanding and the opportunity for more project-based learning that builds student autonomy in learning. For those struggling to meet AYP in mathematics; they see the powerful graphics that assist students in understanding relationships first qualitatively and then quantitatively. This is a very thoughtful and articulated project that will transcend the investment as a systemic initiative across 6 districts. It is also timely with the Common Core Standards for Mathematics taking stride in our state.

I currently lead the Mathematics Vertical Team, and it is clear that this project will provide joint ownership in mathematics education for all students, but especially for the foundational course of Algebra 1. The teacher-to-teacher dialogue will have a regular platform through our SAU-wide team and the assessment results of mathematical understanding and motivation for learning can be examined and further disseminated to all teachers and the community.

Thank-you for considering this project and I do hope the proposal gains a favorable outcome. It has certainly generated continued discussions and excitement amongst our staff! Please contact me should you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "William F. McGowan".

William F. McGowan
Principal

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School Website: www.winnacunnet.org



UNIVERSITY *of* NEW HAMPSHIRE

February 25, 2011

Stephen Latvis, Mathematics
Winnacunnet Cooperative High School
1 Alumni Drive
Hampton, NH 03842

Dear Stephen:

I am pleased to write in support of your proposal *Motivating Mathematics Through Modeling = M3*. The goal of your project "to develop high quality and engaging modeling activities for mathematics courses (focusing on high school Algebra) that improve students' ability to use technological tools and software to connect to the sciences and other core areas" represents a critical need and will make an important contribution to the field.

I am willing to serve as an advisor to the project. In that role I will work with you to develop appropriate assessments and meet with you and other project members at least 3 times per year to plan the project evaluation, review preliminary results, and provide formative feedback to the project.

I look forward to working with you on this project.

Best Regards:

Karen J. Graham, Ph.D.
Professor, Mathematics and Statistics
Director, Joan and James Leitzel Center
University of New Hampshire
Durham, NH 03824
karen.graham@unh.edu



UNIVERSITY of NEW HAMPSHIRE

February 23, 2011

Stephen Latvis, Mathematics
Winnacunnet Cooperative High School
1 Alumni Drive
Hampton, NH 03842

Dear Mr Latvis,

I am writing to indicate my agreement to serve as consultant associated with the proposal being submitted: "How can students use mathematical modeling tools and software to analyze real world situations and make better decisions?" I understand that my role on the project will be to lend my expertise in the area of student motivation to the design, implementation and evaluation of the project. I further understand that serving in a consulting role will include meeting with the project personnel to review progress and research findings, and making suggestions aimed at improving the overall design of the learning system, as well as the outcomes for the students who participate. From my perspective, this project is important given the current press for data-driven decision making related to policy, curriculum and instruction. Participants will benefit from using technology to promote deeper learning of the content and dispositions favorable toward a practical approach the practice of classroom assessment.

My own experience in research includes 10 years as a faculty member at The University of New Hampshire, Department of Education. My research focus, broadly defined is the relation of classroom environment and student motivation. Given my experience in this field, I believe I can offer some valuable insights and advice regarding both the design of the system, as well as the ways to assess student level outcomes.

Sincerely,

Michael Middleton
Associate Professor