Infusing Technology and Algebra Grant Proposal

by

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A Grant Proposal Project Report
Submitted in Partial Fulfillment of the
Requirements for the
Master of Science Degree
in

Education

Approved: 2 Semester Credits

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ABSTRACT

Chippewa Falls Senior High School is working to provide our students for the workforce they will enter. Through the use of technology in the mathematics classroom, students will be prepared to enter the world of technology awaiting them. Such technology will be used in Algebra I and Algebra II classrooms to help students gain a deeper understanding of mathematical concepts and skills relevant for business in the future. By creating a stronger workforce in mathematics, the nation can move forward in the global economy.

The National Science Foundation is helping schools prepare students for technology based careers through their Innovative Technology Experiences for Students and Teachers (ITEST). By submitting this proposal, and obtaining the necessary funds, students will engage regularly with technology and mathematics. Data obtained through pre and post surveys will be disseminated to math teachers in the Chippewa Falls School District, Cesa #10, and perhaps statewide.

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Chapter I: Introduction

Project Overview

Students taught today will be the workforce of tomorrow. For employers to stay competitive, they must implement use of technology in all aspects of their operation (Vockley, 2007). Schools are responsible to create employable members of society. The Chippewa Falls School District Mission is as follows "The Chippewa Falls Area Unified School District, in partnership with the community, is committed to excellence, empowering and challenging all students to learn while preparing them for an ever-changing global society" (Chippewa Falls School District, 2009). For today's students, this means the ability to use Interactive communication technology(ICT) to demonstrate their mathematic abilities.

When looking at 55 of the United States industry sectors, education is the least technology intensive. In order to create a 21st century education system, there needs to be an intensive use of technology (Vockley, 2007). Through the strategic use of technology in a balanced mathematics program, students learning will be enhanced (NCTM, 2008).The use of technology in the mathematics classroom is one step toward improving students mathematical understanding and ability to apply mathematics effectively. When teachers teach using technology, they shift their classroom from teacher-centered to student centered (Skaw, 1997 & Way & Webb, 2006). Through this constructivist approach, students will succeed in the mathematics classroom and have the experience and problem solving skills to be successful in the world.

The Infusing Technology with Algebra Project will allow Chippewa Falls Senior High School students in grades 9-12 to interact and gain skills in using ICT through the use of graphing calculators connected to an interactive whiteboard. Students will be given

the opportunity to become familiar with ICT which is becoming increasingly present in the work force. Students will learn how to use technology to their advantage, how technology can enhance lives, and how mathematics can be applied in real world situations. Through the combination of knowledge and skills the students will gain through the use of graphing calculators connected to an interactive whiteboard, students will become sought after members of the workforce.

Project Goals and Objectives

1. Increase students engagement with mathematics
    i. Apply real world applications of mathematics
    ii. Demonstrate mathematical concepts with different approaches
    iii. Students analyzing each others work
2. Increase students engagement with information and communication technology
    i. Use graphing calculators in the classroom
    ii. Use interactive white boards in the mathematics classrooms
    iii. Use computer technology in the classroom
3. Assess of increased technology awareness
    i. Pre-Survey
    ii. Post-Survey

Methodology

Chapter two is a literature review of the implementation of interactive whiteboards, TI-Nspire graphing calculators, and TI-Navigator system into the classroom. It addresses how to properly intertwine these items to be the most effective in a mathematics classroom. Chapter three addresses the goals and objectives of the grant proposal, which focuses on increasing students' knowledge of mathematics and

technology. Chapter four describes the project methodology and includes a project timeline, personnel involved, evaluation plan, budget, dissemination plan, and sustainability plan.

Chapter II: Literature Review

This chapter focuses on the use on technology in mathematic classrooms. First addressed is the need for technology in the classroom followed by how technology can be implemented. The discussion of a connected classroom, involving an interactive whiteboard, TI-Nspire calculators, and a TI-Navigator system, is also presented.

Technology and Mathematics

According to The National Council of Teacher of Mathematics (NCTM, 2008), technology is an essential tool for students to learn mathematics in the 21st century. As the world changes into a more technical society, students who have the ability to do mathematics will have increased opportunities for their futures (NCTM, 2000). The need for mathematics in daily life and the workplace will continue to increase as society changes. The Maryland Math Commission (2001) discussed how science, technology and engineering jobs are one of the quickest growing areas in the United States workforce. Students today will be the workforce of tomorrow, where 80% of the jobs will be technology based (Maryland Math Commission, 2001). To prepare students for this growing demand, technology must be present in the classroom for students to have ample opportunity to gain the skills they will need in the workforce (Vockley, 2007).

When a classroom has a balanced approach to mathematics, the use of technology enhances the learning and teaching of mathematics. The appropriate use allows access to mathematics for all students involved (NCTM, 2008). Using technology as a tool for mathematics education, allows teachers to teach students more mathematics at a deeper level (Maryland Math Commission, 2001). However, when technology is incorporated into mathematics, it is important that the technology does not replace a skill which is needed for deeper understanding of the topic (Goldenberg, 2000). The use of

technology in mathematics teaching is essential as it influences the mathematics taught and enhances the students learning (NCTM, 2000).

Interactive Whiteboards

Zevenbergen and Lerman (2008) stated the use of interactive whiteboards (IWBs) in the classroom has the possibility to increase students opportunities to witness mathematical representations to help develop their understanding. An IWB consists of the interactive whiteboard, a computer, and an projector to display the computer screen. The user can manipulate the computer screen by touching the whiteboard. Within the upper grades, IWBs connected to the Internet allows for use of virtual manipulatives where physical devices may not be available (Goldenberg, 2000). Use of IWBs in the classroom allows the teacher to quicken the pace of the lesson and lead discussions of mathematical concepts without being limited by students arithmetic abilities (Smith et al., 2005; Kent, 2006). The ability to create complex connections between previous learning becomes available when IWBs are involved. IWBs give the teacher the ability to easily modify the context of a lesson to either capture the students' world or engage them in a real, practical mathematics problem (Kent, 2006).

While there are many benefits to the use of IWBs in the classroom caution and care must be used in their implementation. If IWBs are used merely as a presentation tool, interaction within the classroom will not be present (Armstrong et al., 2005). IWBs allow teachers more flexibility on how material is presented, however use may create a teacher centered classroom (Ottman, 2007).

For IWBs to reach their full potential, there needs to be a shift in pedagogical style from teacher – pupil to pupil – pupil interactions. To help ensure the interactive use of the IWBs, the quality of questioning as well as the breadth of questioning need to be

fully developed to guide the mathematical thinking and cognitive processing of learners. When only one person is interacting with the IWB, the opportunity for deep mathematical understanding is compromised . Through the use of collaboration in smaller groups and the use of other tools in combination with the IWB, interaction among learners can be increased (Zevenbergen & Lerman, 2008).

Connected Classroom

A connected classroom, where calculators connected together are available to all students, expects students to participate actively in the learning occurring in the classroom (see Figure 1 below). Classrooms such as these take a student centered approach to learning (Owens et al., 2008). The use of calculators and other technology are components of a high-quality mathematics education (NCTM, 2008). The ability to create a resource and interaction rich learning environment is essential to facilitate meaningful learning for students (Liu, 2003). In other words, by using a connected classroom students become responsible for their learning and gain valuable technology skills.

(Texas Instruments Educational Technology, 2009)

Figure 1: Connected Classroom using TI-Nspire graphing calculators and TI-Navigator system

TI-Nspire and TI-Navigator

The TI-Nspire is a graphing calculator which is computer based, many of the functions mirroring those of a computer. Research shows that instructional software has positive effects on student achievement in mathematics when compared to instruction without such technology (US Department of Education, 2008). The TI-Nspire's computer-like set up will allow for usage of instructional tutorials.

By implementing the TI-Navigator system with the use of TI-Nspire calculators, students will have the opportunity to interact with technologies along with their peers. The TI-Navigator is hardware that allows the calculators to connect to hubs, which in return communicates with a router box. Figure 1 depicts the router box is connected to a computer with software and connected to a video projector (Hivon et al, 2008). Through this connection, students' activity on their calculators is available for whole-class viewing through the projector.

A high interactive classroom increases students attention and interest in learning (Liu, 2003) The TI-Navigator supports a collaborative, interactive classroom environment by enhancing student interactions, focusing attention, and providing opportunities for peer and self assessment. Students time on task along with student interaction increased with the use of the TI-Navigator. Due to the TI-Navigator, teacher have the ability to see what the students are accomplishing and in return creates high accountability on behalf of the students (Dougherty et al, 2005). The TI-navigator has several features which are used in the classroom setting: quick poll, learning check, screen capture, and activity center. Quick poll and learning check allows for the opportunity for formative assessments of students. Screen capture can be applied to

increase formative or conceptual knowledge. Finally, the activity center allows students to explore and develop conceptual knowledge (Owens et al, 2008).

TI-Nspire calculators allow students to visualize mathematics and take a hands on approach to their mathematical learning (Texas Instruments Educational Technology, 2009). Features of the TI-Nspire include: multiple representations of a problem on a single page, ability to grab a graphed function and move it, create, save, and review work in electronic documents, and manipulate one aspect of a problem and immediately see that result on other representations (Texas Instruments Educational Technology, 2009).

Conclusion

Overall, there is a need to emphasize students understanding of mathematics and the technology available to them. When available technology is used appropriately, students learn more mathematics and engage with the mathematics more thoroughly (Maryland Math Commission, 2001). To give students an advantage in the workforce, they must be able to apply their mathematical knowledge and technology skills simultaneously. Through the use of IWBs and graphing calculators, educators can create a classroom environment where mathematics is learned though the use of technology. Students can be held accountable for performance using technology and acquire mathematical knowledge and skills. The technology must enhance delivery of math content and encourage a student-centered approach for successful integration into the learning environment.

Chapter III: Project Goals and Objectives

The Infusing Technology and Algebra Project is important in increasing students engagement with mathematics and technology at Chippewa Falls Senior High School, in Chippewa Falls, Wisconsin. Through the use of the TI-Nspire graphing calculators and TI-Navigator system, students will be able to engage with mathematics at a deeper level. The interaction with technology will allow students to be better prepared for future jobs and higher education.

Goal 1:Increase Students Engagement with Mathematics

Student will engage with graphing calculators and interactive whiteboards to obtain the following objectives. Through the use of lesson planning, students will apply real world applications of mathematics. Students will also demonstrate mathematical concepts with different approaches. Finally, students will analyze peer work by viewing mathematical representations of classmates using the TI-Navigator.

Goal 2: Increase Students Engagement with Information and Communication Technology

Students will use the topic of mathematics to interact with technology to obtain the following objectives. Ability to use graphing calculators in the classroom. Use of interactive white boards in the mathematics classroom. Use of computer technology in the classroom.

Goal 3: Assessment of increase in technology awareness

To assess the students in their knowledge of and comfort levels using technology, a Pre-Survey and Post-Survey will be conducted with the students.

Chapter IV. Project Methodology

Project Description and Timeline

Chippewa Falls High School students will increase their interaction with mathematics and technology through the use of interactive technology and graphing calculators in the classroom. Technology will be used in the math classrooms to help students gain a deeper understanding of mathematical concepts and skills relevant for business in the future.

Table 1

Project Timeline

Month	Activity
March 2010 - May2010	• Inform School Board of Grant Application/Award • Order classroom set of TI-Nspire • Order TI-Navigator System • Attend training on TI Technology
June 2010 – August 2010	• Complete online tutorials of TI-Nspire • Teacher development/revision of lesson plans • Installation of equipment
September 2010	• Survey students on technology knowledge and use • Train/inform peer teachers in using calculators • Teacher development of TI-Nspire lesson plans • Implementation of TI-Nspire lesson plans in Algebra I and Algebra II
October 2010 – December 2010	• Invite parents to experience the interactive whiteboard and calculators

	• Development/revision of TI-Nspire lesson plans in Algebra I and Algebra II • Implementation of TI-Nspire lesson plans
January 2011	• Analyze and compare current semester final test results with other teachers • Attend more training on TI Technology • Development of TI-Nspire lesson plans • Implementation of TI-Nspire lesson plans
February 2011- April 2011	• Discuss Semester Final findings with students, parents, teachers and administration • Development/revision of TI-Nspire lesson plans • Implementation of TI-Nspire lesson plans in Algebra I and Algebra II
May 2011	• Post survey of students use and knowledge of the technology • Development of TI-Nspire lesson plans • Implementation of TI-Nspire lesson plans
June 2011	• Compare current Semester Final test results with other teachers

Personnel Qualification

The person responsible for implementing the project is Janelle Yeakey a Secondary Mathematics Teacher whose earned her Bachelors Degree: Secondary Mathematics Education from UW Eau Claire in May 2006 and a Master of Science in Education Degree: Professional Development from UW Stout in December 2009.

Anticipated Results

Through the use of graphing calculators, students will gain a deeper understanding of mathematical topics and their applications to careers and post secondary education. Students will also become aware and comfortable with the technology they will use in their future careers and post secondary education.

Evaluation Plan and Tools

Students involved with the technology integration will complete surveys prior to using technology and after the completion of an Algebra I or Algebra II course. There will be approximately 60 students, 30 in Algebra I and 30 in Algebra II, working with the technology. The students in Algebra I will range in grades 9 to 12, with around 95% of them being in grade 9. The students in Algebra II will range in grades 9 to 12 with around 95% in grades 10 and 11. In addition to the surveys, semester grades of students using the technology and those not using the technology will be assessed.

Table 2

Pre-Survey

1. Gender(circle one): Male Female
2. Age (circle one): 14 15 16 17 18
3. Grade Level (circle one): 9^{th} 10^{th} 11^{th} 12^{th}
4. Current mathematics class: Algebra Algebra II
5. The number of mathematics courses I have taken that have involved technology other than calculators(circle one): 0 1 2 3 4 5 or more
6. I have access to the following technology outside of the school building (check all that apply): _____ Calculator (standard) _____ Calculator (scientific)

_____ Calculator (graphing) _____ Computer _____ Internet _____ Other (specify)_____										
Rate the following on a scale of 1 to 10 (1- extremely low, 5- average, 10- advanced)										
7. I would rate my level of mathematical ability is:	1	2	3	4	5	6	7	8	9	10
8. My confidence level with using technology for mathematical purposes is:	1	2	3	4	5	6	7	8	9	10
9. My understanding of how mathematics is used in real world context.	1	2	3	4	5	6	7	8	9	10
10. When solving a math problem, I can easily apply more than one strategy to solve the problem.	1	2	3	4	5	6	7	8	9	10
11. My confidence level with interactive white boards is:	1	2	3	4	5	6	7	8	9	10
12. My confidence level with graphing calculators is:	1	2	3	4	5	6	7	8	9	10

Table 3

Post – Survey

1. Over the course of the semester, I missed the following number of classes (circle one): 0 1-3 4-6 7-9 10+

2. The number of times I came in outside of class to receive help from the teacher (circle one): 0 1-3 4-6 7-9 10+										
Rate the following on a scale of 1 to 10 (1- extremely low, 5- average, 10- advanced)										
3. I would rate my level of mathematical ability is:	1	2	3	4	5	6	7	8	9	10
4. My confidence level with using technology for mathematical purposes is:	1	2	3	4	5	6	7	8	9	10
5. My understanding of how mathematics is used in real world context.	1	2	3	4	5	6	7	8	9	10
6. When solving a math problem, I can easily apply more than one strategy to solve the problem.	1	2	3	4	5	6	7	8	9	10
7. My confidence level with interactive white boards is:	1	2	3	4	5	6	7	8	9	10
8. My confidence level with graphing calculators is:	1	2	3	4	5	6	7	8	9	10

Budget

Table 4

I. Personnel & Professional Development

Description	*Quantity and Cost*	*Budget Requested*
TI-Nspire Training	1 @ $180.00	$180.00
Travel	1 @ $390.00	$390.00
Lodging	3 nights @ $205.85	$617.55
Substitute Teacher	2 days @ $100.00 per day	$200.00

Table 5

II. Equipment

Description	*Quantity and Cost*	*Budget Requested*
TI-Nspire Wireless Navigator 30 User System	1 @ $4,000.00	$4,000.00
TI-Nspire (Inspire) Class Pack	1 @ $3,835.50	$3,835.50
TI-Nspire Teacher Bundle with emulator software	1 @ $203.85	$203.85
Book: Exploring Algebra 1 with TI-Spire	1 @ $39.95	$39.95
Algebra I with TI-Nspire: Semester I	1 @ $19.95	$19.95
Algebra I with TI-Nspire: Semester II	1 @ $19.95	$19.95

Table 6

Total Requested Budget	$9,506.95

Budget Narrative

I. Personnel & Professional Development

The Ti-Nspire training is a 3-Day training provided by Texas Instruments at their International Conference March 5-7, 2010 in Atlanta, Georgia. Janelle Yeakey, Chippewa Falls High School Mathematics Teacher and grant proposer, will attend the conference and during the three days she will learn how to use both the TI-Nspire and TI-Navigator appropriately in the classroom. The allocated budget will fund air travel and lodging from Eau Claire, Wisconsin to Atlanta, Georgia for the three day conference.

II. Equipment

The budget allocations for equipment include the TI-Navigator and classroom set of TI-Nspire, including guide books of activities.

Dissemination Plan

The proposer will present research data collected and findings to the Chippewa Falls school administration, school staff, and school board. The results will also be disseminated to Cesa #10, and perhaps statewide. The results from the surveys along with the lesson plans incorporating the technology will be available to all staff in the Chippewa Falls School District through the use of a shared file. The lesson plans will also be posted the Texas Instruments activities exchange website giving educators from around the world accessibility.

Sustainability Plan

Following the completion of the first year, high school students who are enrolled in Algebra I or Algebra II will continue to use the TI-Nspire Calculators. Materials can be updated by using the Texas Instruments technology rewards program. The Texas Instruments technology rewards program allows educators to collect points from purchased Texas Instrument products. Students who purchased TI products will be asked to turn in their points to their teacher so that the points can be redeemed for future TI products.

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Appendix A: Letter of Intent

December 22, 2009

National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

The Chippewa Falls Senior High School is delighted to submit a proposal to the National Science Foundation ITEST Strategies Grant with a goal of enhancing high school students' ability to use technology to enhance their mathematics ability.

The Infusing Technology and Algebra Funding Program will be used to purchase TI-Nspire graphing calculators, TI-Navigator for students in grades 9-12 to be able to explore mathematics using technology with a goal of gaining a deeper understanding of mathematic concepts and applications. This project aims to combine the use of technology and teaching of mathematics so students will see how mathematics will apply to their future jobs and post secondary education.

Sincerely,

Janelle Yeakey
Chippewa Falls Mathematics Teacher
735 Terrill St
Chippewa Falls, WI 54729

Appendix B: National Science Foundation Proposal Request

Innovative Technology Experiences for Students and Teachers (ITEST)

ITEST Learning Resource Center

The ITEST Learning Resource Center homepage contains information on ITEST projects in 38 states, as well as related publications and resources:
http://www2.edc.org/itestlrc/default.asp

CONTACTS

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Address questions to	DRLITEST@nsf.gov	(703) 292-8628	

PROGRAM GUIDELINES

Solicitation 09-506
Please be advised that the NSF Proposal & Award Policies & Procedures Guide (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: Grant Proposal Guide Chapter II for further information about the implementation of this new requirement).

DUE DATES

Letter of Intent Deadline Date: January 19, 2010

ITEST

Full Proposal Deadline Date: February 12, 2010

ITEST

Full Proposal Deadline Date: April 7, 2010

Innovation through Institutional Integration (I^3)

SYNOPSIS

The ITEST program responds to current concerns and projections about the growing demand for professionals and information technology workers in the U.S. and seeks

solutions to help ensure the breadth and depth of the STEM workforce. ITEST supports research studies to address questions about how to find solutions. It also supports the development, implementation, testing, and scale-up of implementation models. A large variety of possible approaches to improving the STEM workforce and to building students' capacity to participate in it may be implemented and studied. ITEST projects may include students or teachers, kindergarten through high school age, and any area of the STEM workforce. Projects that explore cyberlearning, specifically learning with cyberinfrastructure tools such as networked computing and communications technologies in K-12 settings, are of special interest.

This program is interested in addressing such questions as: What does it take to effectively interest and prepare students to participate in the science, technology, engineering, and mathematics (STEM) workforce of the future? What are the knowledge, skills, and dispositions that students need in order to participate productively in the changing STEM workforce and be innovators, particularly in STEM-related networked computing and information and communication technology (ICT) areas? How do they acquire them? How can the Nation's burgeoning cyberinfrastructure be harnessed as a tool for STEM learning in classrooms and informal learning environments? What will ensure that the nation has the capacity it needs to participate in transformative, innovative STEM advances? How can we assess and predict inclination to participate in the STEM fields and how can we measure and study impact of various models to encourage that participation?

Four types of projects are invited:

Research projects enrich the understanding of issues related to enlarging the STEM workforce. Research projects may conduct efficacy and effectiveness studies of intervention models, conduct longitudinal studies of efforts to engage students in the STEM areas, develop instruments to assess engagement, persistence, and other relevant constructs of student motivation, or conduct studies to identify predictors of student inclination to pursue STEM career trajectories. The program is especially interested in projects that target students from groups that are underserved and underrepresented in STEM and ICT-intensive careers, including those residing in rural and economically disadvantaged communities.

Strategies projects design, implement, and evaluate models for classroom, after-school, summer, virtual, and/or year-round learning experiences for students and/or teachers. The strategies are intended to encourage students' readiness for, and their interest and participation in, the STEM workforce of the future. Strategies project proposals must describe the anticipated contribution to the research knowledge base about STEM career preparation in addition to immediate impacts on participants.

Scale-up projects implement and test models to prepare students for information technology or the STEM workforce of the future in a large-scale setting such as at state or national level. A scale-up project must be based on evidence of demonstrated success from an existing strategy for students or teachers.

Conferences and Workshops target STEM educators (from both the formal and informal education communities), educational researchers, and evaluators. The proposed conferences would be expected to contribute to the development of a research agenda on K-12 STEM workforce preparation and development issues, workforce participation, and cyberlearning. Conferences or workshops must be designed to bring together individuals with expertise in technology and STEM education, career development, cognitive science, sociology, anthropology, science fields, and other communities that are invested in STEM workforce careers. Evaluation approaches for innovative STEM and ICT workforce motivation, preparation, and development models are also sought.

Innovation through Institutional Integration (I^3) projects enable faculty, administrators, and others in institutions to think and act strategically about the creative integration of NSF-funded awards, with particular emphasis on awards managed through programs in the Directorate for Education and Human Resources (EHR), but not limited to those awards. For Fiscal Year 2010, proposals are being solicited in nine EHR programs that advance I^3 goals: CREST, GSE, HBCU-UP, ITEST, LSAMP, MSP, Noyce, RDE, and TCUP.

EDUCATIONAL OPPORTUNITY

This program provides educational opportunities for K-12 Educators . This program provides indirect funding for students at this level or focuses on educational developments for this group such as curricula development, training or retention. To inquire about possible funding opportunities not directly from NSF, please look at the active awards for this program.