

Emerging Technology Pilot Grant Proposal

I. Cover Sheet

Project Title:	Developing elementary pre-service teachers' TPACK in division of fractions by integrating SmartBoard, Mathematical Habits of Mind, and content knowledge in the design of instruction.
For fiscal year:	2009-2010
Principal Investigator:	Hsing-Wen Hu
UW Campus:	River Falls
Campus LTDC Rep:	Mary-Alice Muraski
Date:	12/07/09

II. Abstract

In this age of digital technology, developing an overarching construct for mathematical teaching has become a critical issue in mathematics education. Mathematics Teacher TPACK Standards, created by AMTE's Technology Committee, offers guidelines for thinking about this construct. TPACK has been proposed as the interconnection of technology, pedagogy, and content knowledge for mathematics educators to develop an instructional model. This proposal plans to assist pre-service teachers in developing strategies that will teach the concept, 'division of fractions' using the TPACK framework. This involves teaching the interaction of Mathematical Habits of the Mind (pedagogical knowledge) using interactive whiteboard (technology knowledge) to actively learn about the division of fractions (content knowledge). After participating in this module, participants' knowledge in division of fractions will be assessed by using an achievement test. In addition, a five-stage developmental process (recognizing, accepting, adapting, exploring, and advancing) will be used to evaluate pre-service teachers' progress in learning to integrate a particular technology in teaching mathematics. The project is not only useful for pre-service teachers to assess their mathematics TPACK, but is also helpful in guiding teacher educators to evaluate and plan the technology preparation of their pre-service teachers.

III. Project Narrative.

Statement of Need/Problem:

Teaching and learning fractions has traditionally been one of the most problematic areas in elementary school mathematics, especially division with fractions. Children's success rates on various tasks related to such division are usually very low. The traditional algorithm for division of fractions continues to be included in the curricula of elementary schools without teaching meanings or adequate teaching strategies and materials. Therefore, they might not be able to help students learn effectively.

In order to improve students' learning in this area, they need to look beyond the algorithmic procedures and develop a conceptual understanding of division of fractions. One way children will be able to retain these mathematical reasoning skills is to offer them Mathematical Habits of Mind. Applying Mathematical Habits of Mind in the content of division of fractions may help students see interconnections in the thinking process and may help students become more flexible in applying the reasoning they learn. Through the practice of mathematics, the following habits of mind are developed: patterning, experimenting, describing, tinkering, inventing, visualizing, conjecturing, and guessing.

Besides using Mathematical Habits of Mind to help students to conceptualize the concepts of division of fractions, many studies find incorporating technology into content area produce positive results. Based on these studies, the TPACK was developed for satisfying the current needs in math education. The TPACK requires integrating technology, pedagogy, and content knowledge where teachers design their instruction in order to help elementary students think and learn mathematics using digital technologies. When classroom environment and context change (such as new teaching strategies, alternative assessment for learning outcomes, and technology usage), TPACK provides a dynamic framework for examining a teacher's knowledge necessary for the design of curriculum and instruction focused on the preparation of their students to think and learn mathematics with technology.

In order to develop elementary pre-service teachers' knowledge in division of fractions, this study is going to use the TPACK framework which was created by AMTE's Technology Committee. Figure 1 (see Appendix A) portrays levels in which pre-service teachers engage as they develop their knowledge and understandings in ways that combine multiple knowledge bases — technology (interactive whiteboard), content (division of fractions), and pedagogy (Mathematical Habits of Mind). On the left side of the graphic, the figure highlights PCK as the intersection of pedagogy and content. Then, when knowledge of technology expands and begins to intersect with pedagogical and content

knowledge, the pre-service teacher knowledge base that appears is the knowledge described as TPACK – where pre-service teachers actively engage in guiding student learning of mathematics with appropriate technologies.

The TPACK framework provides a lens for considering the actions of pre-service teachers who have an integrated knowledge of technology, content, and pedagogy. As they develop their TPACK, the recognition of the levels of thinking and understanding will apply to technique and method courses for elementary mathematics such as TED 315 and TED 720. About sixty pre-service teachers will receive the benefits of this project every semester. In addition, the project also supplies a discursing opportunity for mathematics educators between UW system campuses.

Activities & Work Plan:

Four major themes frame the pre-service teachers' TPACK development Model: Curriculum and Assessment, Learning, Teaching, and Access. The detailed descriptions of these four themes, participants' roles, project timeline, individual's responsibility and other steps are included in the table (see Appendix B).

Project Outcomes and Evaluation:

Upon conclusion of this module, participants will be assessed to determine the learning results. First of all, this project wants to determine if students can learn division of fractions effectively by using TPACK model. The achievement test will be conducted at the end of module. In addition, pre-service teachers' integration-decision process will be evaluated by using a five-stage sequential method. It includes:

1. Recognizing (knowledge)— pre-service teachers become aware of integrating SmartBoard with learning mathematics and have some idea of how it functions
2. Accepting (persuasion)— pre-service teachers form a favorable or unfavorable attitude toward teaching and learning mathematics with SmartBoard technology
3. Adapting (decision)— pre-service teachers engage in activities that lead to a choice to adopt or reject teaching and learning mathematics with SmartBoard technology
4. Exploring (implementation)— pre-service teachers actively integrate teaching and learning mathematics with SmartBoard technology
5. Advancing (confirmation)— pre-service teachers evaluate the results of the decision to integrate teaching and learning mathematics with SmartBoard technology

IV. Dissemination:

- The project results will be published on the Web and to disseminate project results on UWRF campus and across the UW System.
- The report of project outcomes will be submitted to the LTDC and Office of Learning and Information Technology on May 20, 2009.
- The research papers will be presented at Wisconsin Mathematics Council 2010 Conference and National Council of Teachers Mathematics 2010 Conference.

V. Budget and Budget Narrative:

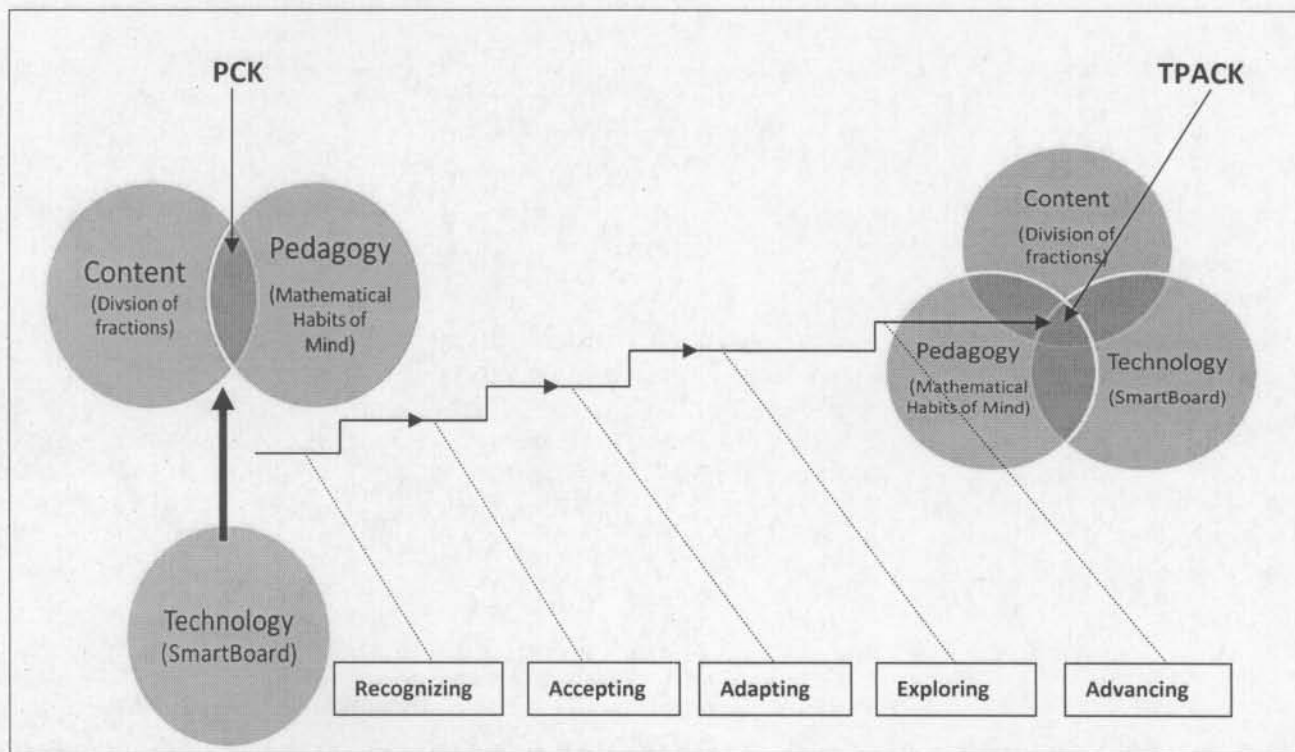
Budget summary:

<i>Personnel Salary</i>	
Research assistant (100 hrs. total @ 8.00)	\$ 800
<i>Supplies and Expenses</i>	
SMART Notebook Math Tools Software (10 computers)	\$ 900
SmartBoard (Matching with other grants)	\$ 1500
Travel expense: <ul style="list-style-type: none">• Wisconsin Mathematics Council conference: \$ 600 (May, 2010)• National Council of Teachers Mathematics conference: \$700 (April, 2010)	\$ 1300
Mileage (meetings and workshops)	\$ 300
Others (photocopies, papers, manipulatives...)	\$ 200
<i>Total requested</i> (\$5000 maximum)	\$ 5000

Request for funding support:

The proposer seeks funding to help support fractional photocopies for handouts, data collection & analysis, interpretation, writing and editing the research article, and dissemination of information gained from the study. Transportation funding is requested for the researcher and research assistants to attend the WMC 2010 conference and NCTM conference to present this work. The two student assistants will assist with creating and monitoring the project, and they will be paid minimum wages from this funding.

Appendix A: Teacher levels as their thinking and understanding interconnected and integrated manner identify by TPACK



Resource:

Niess, M. L., Ronau, R. N., Shafer, K. G., Driskell, S. O., Harper S. R., Johnston, C., Browning, C., Özgün-Koca, S. A., & Kersaint, G. (2009). Mathematics teacher TPACK standards and development model. *Contemporary Issues in Technology and Teacher Education*, 9(1), 4-24.

Appendix B: Activities and work plan

PI: Principle Investigator PA: Project Assistant

Activities	Descriptors	Leaders or facilitators	Timeline
Project preparation			
<i>Make pre-assessment and survey items</i>	Items (problems) include: <ul style="list-style-type: none"> • Conceptual understanding • Procedural fluency • Applying word problems • Pedagogical Tech knowledge 	PI & PA	01/01-01/08/10
<i>Design TPACK curriculum</i>	The curriculum includes: <ul style="list-style-type: none"> • Technological knowledge (<i>SmartBoard</i>) • Pedagogical Knowledge (<i>Mathematical Habits of Mind</i>) • Content knowledge (<i>Division of fractions</i>) IRB Application	PI & PA	01/11-01/22/10
Project body			
<i>Curriculum and Assessment</i>	<ul style="list-style-type: none"> • Pre-assessment-- assessing pre-service teachers' understandings • Curriculum--the treatment of the content • Post -assessment--assessing the pre-service teachers' understandings 	PI & PA	01/25-01/29/10
		PI	02/22-03/26/10
		PA	03/29-04/01/10
<i>Learning</i>	<ul style="list-style-type: none"> • Focus on the concepts of division of fraction • Demonstration of conceptions of how students learn (<i>development of students' thinking skills</i>) 	PI	02/01-02/05/10
<i>Teaching</i>	<ul style="list-style-type: none"> • Focus on the concepts of division of fraction • Instructional approaches 	PI	
		PI & PA	02/08-02/19/10
<i>Access</i>	<ul style="list-style-type: none"> • Usage (<i>supply opportunities to use SmartBoard</i>) • Barriers (<i>help pre-service teacher to address barriers to SmartBoard integration</i>) • Availability (<i>Use SmartBoard to enhance pre-service teachers' participation and correspond to their leaning styles</i>) 	PI & PA	02/01-03/26/10
Project conclusion			
<i>Write final report</i>	Follow final report template to write report	PI & PA	04/05-04/30/10
<i>Submit final report</i>	Submit report to OLIT & LTDC	PI	05/05/10

Revised Emerging Technology Pilot Grant Proposal

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Date:	12/07/09, Revised 1/25/2010

Revised Emerging Technology Pilot Grant Proposal

We are proposing revising the fund request to include \$1000 for licensing of mathematics curriculum software from Houghton Mifflin Harcourt Publishing Company and \$450 to cover the costs of an additional student with technology skills to assist the PI with integrating the technology into the instruction. This student would work approximately 30 hours @ \$15.00.

These were not included in the original proposal due to the fact we were attempting to remain under \$5000. We were seeking additional funds for licensing the curriculum from the Teacher Education Department and College of Education and Professional Studies. We were also looking for technology assistance from the Division of Technology Services and the Teaching & Learning Technologies team and its students. These three areas are support the \$4500 cost of the Smartboard. In addition, Division of Technology Services is taking this opportunity to redesign the technology within the classroom to reduce the usage complexity of the equipment for an additional \$5000.

V. Budget and Budget Narrative: Revised – additions in bold

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