

PROJECT PROPOSAL

Many middle school students in the United States move through their daily school curriculum without connecting classroom concepts with real world experiences (Sawyer, 2006). Teachers have limited time to implement learning activities that engage students in authentic activities. Based on the work of the National Research Council, the National Science Education Standards state: “Students at all grade levels and in every domain of science should have the opportunity to use scientific inquiry and develop the ability to think and act in ways associated with inquiry...” (National Research Council, 1996, p. 105). This project will address the need for developing creative and critical thinking skills that students need to transfer scientific and mathematical concepts to help address existing socially relevant problems in their communities, as well as to improve self-efficacy related to the study of science and mathematics. “Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance...” (Bandura, 1994, p. 71).

For the proposed 3-year cycle we will engage students in a quest for energy sustainability. We propose to design, implement, and evaluate a collaborative partnership, *Kids for Change*, between Virginia Tech and Montgomery County Schools. This study will serve a significant number of low income, female, and students with learning disabilities in grades 6-8. Research indicates middle school students are a pivotal population for the development of complex reasoning in science (Songer, 2006; Schmidt, McKinight & Raizen, 1996; Linn et al, 2000). In order for this study to be successfully implemented, we need cooperation from the middle school faculty participants. The U.S. Department of Education (1996) defines professional development as “the rigorous and relevant content, strategies, and organizational supports that ensure the preparation and career-long development of teachers and others whose competence, expectations, and actions influence the teaching and learning environment” (p. 1). Professional development related to this study will be provided and stipends and release time will be awarded to participants. “Professional development serves as the bridge between where prospective and experienced educators are now and where they will need to be to meet the new challenges of guiding all students in achieving to higher standards of learning and development” (U.S. Department of Education, 2001).

Our goal is to encourage middle school students to build knowledge by thinking critically, developing observation skills, and negotiating solutions based on their understanding of scientific and mathematical principles. “The use of case studies promotes lifelong learning by engaging students in reflecting on alternative solutions, monitoring their own progress, and developing personal practices that involve sorting out ideas” (Linn, 2006). To achieve this goal, we pursue the following objectives: 1) Develop a set of learning materials, a model case study, and procedures that link scientific and mathematical concepts to the everyday lives and communities of middle school students; 2) Introduce students to emerging information technology, such as content development and syndication, authoring and design tools, and social software, that allows them to create their own online narratives of issues experienced in their lives and communities; 3) Build a reusable archive of student developed artifacts (case studies) in a virtual environment; 4) Build an instructional design model to be replicated in middle schools at state and national scales. Students will collaborate with each other and with subject-matter experts (SMEs) across the world in both virtual and face-to-face environments. In 6th grade students will explore the meaning of global footprints and develop a better understanding of their roles in sustainability. In 7th Grade, students will explore the Off-the-shelf game SPORE. After playing SPORE, groups will discuss interactions with species, their successes and failures, and devise life science explanations for varying results. In 8th grade, using case scenarios, students will collaborate with team members and SMEs in a virtual world (Second Life) to identify environmental problems and brainstorm possible solutions. Inspired by the popular Discovery Channel program, MythBusters, Kids for Change will lead students on a mission to debunk common misconceptions of scientific and mathematical principles related to sustainable energy. Based on the work of Carver (2006), we have chosen to “use a tiered research approach to iteratively refine the definition of deep understanding, the instructional and assessment methods, and the research designs yield progressively deeper explanations of effective teaching/learning processes” (p. 206).

Intellectual Merit: The proposed research has the potential to make significant contributions to the following intellectual domains: 1) educational psychology – understanding what interests and motivates middle school children to participate in STEM/ICT domains; 2) instructional design and technology – understanding how to design and implement a range of emerging and advanced multimedia and ICTs; 3) learning sciences – understanding the collaborative aspects of learning *with* and *through* disciplines and technologies; 4) human-computer interaction – design and use of social software systems and the forms of interaction and civic engagement that are possible with these ICTs; and 5) English and technical communication – understanding the complexity of multimedia narratives generated by diverse participants.

Broader Impacts: A focus on **sustainability and energy security** is critical to STEM-related educational, workforce, and national security issues. Focus will be on development of programs, technological infrastructure, and inter-institutional partnerships.