Fostering Interest in Information Technology (FI$^3$T): Critical Framework

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Abstract: This paper describes the “Community of Designers” concept that is being utilized as the critical framework for the Fostering Interest in Information Technology (FI$^3$T) project funded by the National Science Foundation's Innovative Technology Experiences for Students and Teachers program. The paper argues that the Community of Designers approach provides a unique structure for community-wide collaborations where participation of post-secondary colleges and schools, area school districts, and business, industry, and government sectors is required. The paper concludes that the theoretical promises of the FI$^3$T project’s Design Communities approach warrants testing.

Introduction

In recent years, due to the relentless advance of competitive global information technology (IT) developments, the business, industry, and government sectors in Southeastern Michigan are facing fierce global competition from around the world that has simply decimated the region’s traditional regional manufacturing based workforce. Subsequently, this has led to a steep decline in the local, state and to some degree national economies (Friedman, 2006). One of the steps deemed absolutely necessary to competitively transform the region from a “brute-force” to a “brain-force” is to provide K-12 student-centered research vehicles via inquiry-based, real-world project-based IT/STEM (information technology in science, technology, engineering, and mathematics) initiatives with a strong emphasis on innovative 21st century career and educational pathways (National Governors Association, 1997). The global competitive demands facing the region and the nation as a whole can only be met by diversifying the current/future IT workforce while also encouraging underrepresented and underserved populations to pursue careers in IT and IT-STEM intensive fields (Mendoza and Johnson 2000; The American Competitiveness Initiative, 2006). Aligned with this notion, the Fostering Interest in Information Technology (FI$^3$T) project is designed to increase the opportunities for underrepresented and underserved high-school students, particularly those from disadvantaged urban communities in Southeastern Michigan, to learn, experience, and more importantly use IT within the context STEM and explore 21st century career and educational pathways.

The FI$^3$T project (see project Web site at http://fit.umd.umich.edu/) approaches the 21st century skilled IT workforce issue as a community-wide responsibility. Therefore, the project calls for the investment and robust participation of post-secondary colleges and schools, area school districts, the region’s business, industry, and government sectors, and parents and volunteers. The project views this partnership as vital to provide high-school students with opportunities and support to work directly with IT and STEM professionals, see examples of real-world workplace applications, and develop inquiry-based authentic IT-STEM projects. As the FI$^3$T project launches its planned activities in the fall of 2008, this paper describes the project’s critical framework—“Community of Designers.” At the time of the SITE 2009 conference, the authors will be able to provide early indications of the Community of Designers approach on the planned activities of the FI$^3$T.

Critical Framework: Communities of Designers

How can we create a collaborative engagement among a range of participants from universities, K-12 schools, and corporate institutions to provide high-school students necessary IT/STEM experiences that generate interest in pursuing IT/STEM careers? The Community of Designers approach introduced by Mishra, Koehler, & Zhao (2006) provides a basis for such a collaborative partnership. As Mishra, Koehler, & Zhao describe, the Communities of Designers is an environment in which group of individuals work collaboratively to design and develop solutions to authentic problems. Mishra, Koehler, & Zhao highlights that the essence of this approach lies
with four key words: community, design, products/solution, and authentic problems. “Community” defines the social arrangement of the approach. Within the context of “social constructivism” the design community lends itself to sustained inquiry and revision of ideas. “Design” specifies the activity dimension of the approach. Building upon ideas grounded in “situated cognition theory,” learning is contextualized in the process of doing–solving an authentic problem of practice. Design-based activities provide the rich context for learning, sustained inquiry, and revision and are well-suited to develop the deep understanding needed to apply knowledge in the complex real-world domains. Whereas “products/solution” stresses the goal-oriented psychological dimension, “authentic problems” address the motivational challenge, which become the driving force behind the work of the community. “Authentic problems” that project participants face and have to work on provide the connection between what they learn and what they actually do. Learners have to actively engage in practices of design, inquiry, and research, in collaborative groups to design tangible, meaningful artifacts as end products of the learning process. The actual process-by-design is the anchor around which learning happens. This evolving artifact is also the test of the viability of individual and collective understandings as participants test theirs and others’ conceptions and ideas of the project. Mishra, Koehler, & Zhao also indicates that implementing a community of designers breaks down into four stages that each design team experiences over its lifecycle: identifying participants and problems, forming communities, providing leadership and support, and working on the authentic problems.

The FI^T Program

Consistent with the aforementioned discussions, the FI^T project calls for the collaborative engagement of high-school students, K-12 STEM teachers, undergraduate/graduate student assistants (U/GSAs), and post-secondary STEM content experts [HOW ABOUT REGION’S BUSINESS/INDUSTRY SECTORS] to create high-quality learning projects, strategies and curriculum models for use in after school, weekend, and summer settings through hands-on, inquiry-based activities with a strong emphasis on non-traditional approaches to learning and understanding. Figure 1 illustrates the project’s conceptual basis, showing that students’ IT-rich enenculturation process within the context of STEM is at the core of the project, assisted by a support layer comprised of K-12 STEM teachers, U/GSAs, and post-secondary STEM content experts [SAME COMMENT AS ABOVE].

Figure 1: Structure of Communities of Designers
content area high school teacher from the participating school district, one U/GSA and one post-secondary STEM content expert from UM-D’s colleges and schools. Each design team, therefore, consists of 13 collaborating members. One specialized member of the project leadership team leads each design team.

The science design team concentrates on three different but related applications of IT in the sciences; measurement, modeling, and mapping. The technology design team focuses on technological tools and languages for designing and developing Web applications such as Web-based games and chat-rooms. The engineering design team emphasizes the basics of robotics and its applications as related to IT, including modeling robots, programming robots, and integrating robots into an application environment such as a manufacturing system or a medical application. The mathematics design team focuses on statistical science with applications in three increasingly important areas of scientific investigation: public health, environmental issues, and, manufacturing reliability and safety.

The FI³T project will be implemented from September 1, 2008 to June 30, 2011. The project will sponsor two cohort groups, each participating for two consecutive years. Each design team’s members will participate in several year-round project activities that will create IT enrichment experiences within the context of STEM and explore related 21st century education and career pathways. The project will also distribute online learning activities using the project’s Web site, blog, and podcasting sites, and will thus establish a culture of collaboration and discourse that extends participation outside the confines of the formal scheduled events.

Implementation of the project activities breaks down into three stages—capacity building, summer externship, and project design. Capacity building stage provides a set of IT intensive STEM area workshops for students to learn about IT toolsets within the context of STEM. Summer externship consists of field-based experiences for students to meet and observe the work of scientists and professionals in IT/STEM fields. By improving the IT/STEM readiness of participating students through capacity building activities and field-based experiences, all students will be prepared to undertake the work of designing IT-intensive authentic projects within the context of STEM, work that will start during the program explorations and continue into the second year. The overarching task of each design team in this year is to design inquiry-based authentic projects that are of at least science fair quality using one or more content-specific IT tools explored during the previous capacity building year and stimulating ideas/experiences gained during the field trips. Aligned with the cyclic inquiry model’s five major steps (Bruce, 2003)—Ask, Investigate, Create, Discuss and Reflect, the design year involves five segments, each including multiple site-based sessions. As part of the summer program discussed above, the project facilitates collaborative learning experiences where students learn how to design and conduct inquiry-based authentic projects, more specifically learn how to Ask, how to Investigate, how to Create, how to Discuss, and how to Reflect. These theoretical discussions will then be linked to students’ authentic projects to provide practical applications.

Conclusion

The FI³T project introduces high-school students and teachers to cutting-edge IT within the context of STEM. It also provides opportunities for intellectual collaboration between content experts in different STEM subject areas. Through the Community of Designers concept, the project establishes a unique partnership between higher education colleges and schools, the area school districts, and the business, industry, and government sectors. The impact of the project is expected to benefit academia, K-12 schools, business, industry, and government sectors. The theoretical promises of the FI³T project’s Design Communities approach warrants testing. The authors plan on reporting the impact of the Community of Designers approach on the planned activities of the FI³T as the program moves on to the implementation phase.

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References


