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Interventions for increasing male and female undergraduate interest in information technology

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ABSTRACT

There is a continuing worldwide need for developing a larger and more diverse workforce in the broad field of information technology (IT). We report on two activities conducted by the project within selected classes of a postsecondary finite mathematics course: 1) a student-written blog about practical applications of computing, and 2) after-class seminar sessions with professionals about the importance of computing in the work world. It was found that the hundreds of students who actively participated in these activities were significantly more likely to enroll in a computing course or declare a computing-related major than were non-participating students, despite the fact that the two groups of students displayed identical attitudes toward computing at the start of the term. The study demonstrates that relevant blogs and sessions with professionals can be effective tools for recruiting students, including women, who otherwise would not have chosen to complete more course work in computing.

1. Introduction

Throughout the developed world the continued development of appropriate digital computing devices and relevant ways of applying them requires an innovative and creative workforce, with the requisite background knowledge and skill.

However, a lack of adequate diversity in the computing workforce is thought to be an impediment to innovation and competitiveness, even if there are adequate numbers of skilled individuals in the field (Computing Research Association, 2013; Diaz-Garcia, Gonzalez-Moreno, & Saez-Martinez, 2013; DuBow, 2013; Herring, 2009; Hewlett, Marshall, & Sherbin, 2013; Page, 2008).

Postsecondary computing education should, therefore, not merely produce an adequate number of qualified IT professionals, but also ensure diversity in that talent pool. However, cultural or family influences easily prevent large groups of young adults from seeing the value of their completing postsecondary course work in IT. A well-known example is found in the widespread, dramatic underrepresentation of women in postsecondary programs in computer science, throughout almost the entire world (Galpin, 2002).

Since qualified students in many cultures choose their own fields of study at the postsecondary educational level, it is reasonable to conclude that a student's fields of study are largely determined by what he or she perceives to be overall worth while studying. Research in young adult development has provided strong empirical support for the notion that personal

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assessments of value tend to guide choices (Eccles, 2007) (Rimini, 2014). However, as Plato (ca 380 BCE) famously pointed out, it is obvious that ignorance leads people to make mistakes in assessing value. One obvious role for education thus emerges: elimination of the ignorance that leads some students to undervalue participation in IT.

One might object that most contemporary young adults do already value computing, since digital computing devices are used extensively many parts of the world. But one must not confuse being a user/consumer of technology with being committed to learning enough to be engaged in IT-related development work. Moreover, familiarity and comfort with digital computing devices varies with gender, socio-economic status, or ethnicity among the young even within technologically developed societies (Jackson, 2008; Li & Kirkup, 2007; Recabarren, Nussbaum, & Leiva, 2008; Taylor, 2002).

So, the question remains: how might a larger number of talented students with diverse backgrounds be provided sound reasons to value the broad field of IT enough to complete significant course work in it? This paper describes one strategy that could help educators to fulfill the social need for an innovative, creative, skilled computing workforce—a strategy that not only increases the total number of students interested in developing their skill and knowledge in computing, but at the same time does so by increasing the ethnic and gender diversity within that population.

1.1. Background information

The context for our study was a US state-operated university enrolling over 18,000 undergraduate students drawn from rural, suburban and urban environments primarily in the US. The institution does not operate an engineering college, and has no doctoral program in computer science – which means it is an institution that would not typically be seen as a well-known center drawing in computer-oriented students. Its students are typically 17–23 years of age. The institution offers six different IT-related majors, including five that do not require calculus: Business Information Systems, Accounting Information Systems, Computer Systems, Information Systems, Telecommunication Management, and Computer Science. The study aimed to determine whether in such an environment, with no special advantages provided by institutional history or culture, but with a variety of credible computing majors nevertheless available, it would be possible to influence more students, including more female students, to enroll in computing course work or majors.

The study employed interventions in a mathematics course enrolled by a diverse group of freshmen and sophomores with a wide variety of majors. The course chosen for the study was a course in linear algebra and basic probability and statistics, not available for credit toward the Mathematics major. The course requires a background that demonstrates at least moderate mathematical skill, since the course is designed to be just one level below calculus. The course may be used toward meeting graduation requirements in all of the above-listed computing majors except for Computer Science, but about 90% of the course enrollment consists of students with majors from a wide variety of non-IT fields, such as business, the social sciences, or biology. As a result the course enrollees are widely diverse in terms of backgrounds and interest. Close to 50% of the students enrolled are female. These characteristics made the enrollees an appropriate study population consisting almost exclusively of undergraduates with no demonstrable antecedent interest in computing.

Two interventions were conducted within selected classes of the mathematics course: a) Each term, the study employed four advanced students with knowledge of IT to post articles twice per week to a non-technical blog about practical applications of computing, or about what it is like to be a computing student or professional. These students were hired after personal interviews and background checks that suggested they had strong writing skills and good sense about what might interest other students. Also, by sharing a bit about themselves, and their experiences in computing courses, the student writers attempted to humanize the field, and potentially increase the readers' confidence in their ability to be successful in computer courses. Students in the study sections of the mathematics course were invited to read the blog (A “section” of a course refers to a group of students enrolled in the course, with a scheduled class meeting time with an instructor. The mathematics course used in this study was offered in multiple “sections” every semester, but the study worked with only some of them—mostly large sections enrolling 150 students or more.) b) Each term, once per week for about nine weeks, students in one of the selected sections of the mathematics course were invited to meet with a computing professional (or a team of professionals) for about 45 min, after their mathematics class meeting, to learn about the interests of the professional and about what their professional lives were like. An additional one of the sessions was devoted to advising about the computing courses and majors offered at the institution.

1.2. Review of literature

Leading students to understand the social impact of science and engineering has been shown to be effective in attracting a diverse population of students to science, technology, and engineering (Bennett, Lubben, & Hogarth, 2007; Lee & Erdogan, 2007). We successfully employed that strategy ourselves in a previous study in which science professionals visited informally once a week after class with first-year postsecondary students (Machina & Gokhale, 2009). The point is to “humanize” science and to increase its perceived value by showing its positive potential for society. The same approach could reasonably be expected to work for generating student interest in IT.

There is also substantial literature in support of forming online learning communities among students in order to promote learning and student engagement (Palloff & Pratt, 2007). One relatively simple and effective way to create such a community is through a student-written blog (Glogoff, 2005; Williams & Jacobs, 2004). Even though less personal than face-to-face