IT SCHOLARS - A COLLABORATIVE WIE/MEP/UROP INITIATIVE AT THE UNIVERSITY OF MICHIGAN

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Abstract *— There is increasing national concern over the continuing underrepresentation of women and historically underrepresented minority students in computer engineering, computer science, and electrical engineering. At the University of Michigan, all first year engineering students are required to take an introductory programming course in C++ and Matlab. Although this course is not intended to be an introduction to computer engineering and computer science fields, many students perceive that it is. If students do not have a successful or encouraging experience in this course, they are not likely to consider further courses or a concentration in related fields. In order to make this gateway course a positive experience for all students, the University of Michigan Women in Science and Engineering Program, the Minority Engineering Program Office, and the Undergraduate Research Opportunity Program developed and implemented the IT Scholars Program. This presentation will describe the implementation of this program and evaluation results.*

Index Terms — career information workshops, mentoring, supplemental instruction

INTRODUCTION AND BACKGROUND

At a time when industry is increasingly seeking highly qualified electrical and computer engineers from diverse backgrounds, the University of Michigan Electrical Engineering and Computer Science (EECS) department is facing challenges in its efforts to graduate increasing numbers of high-performing women and minority students. The Intel Foundation has provided funding to help create collaborative efforts that link teaching faculty within the EECS department with academic and student services support offices across campus to address the problem.

The IT Scholars Program is a collaborative approach to encourage and academically support women and underrepresented minority students pursuing degrees in Electrical Engineering (EE) and Computer Engineering (CE). Our current experience indicates that many of the barriers for women and minority students in these fields occur in the gateway courses. We believe that with additional academic support for the gateway courses, accompanied by such things as mentoring and career exposure workshops, we can positively impact the enrollment, achievement, and graduation of women and underrepresented minority students in EE and CE. Through this project, we have created an integrated effort involving the Minority Engineering Program Office's (MEPO) Engineering Learning Resource Center (ELRC), the Women in Science and Engineering (WISE) Program, the Undergraduate Research Opportunity Program (UROP), and the Electrical Engineering and Computer Science (EECS) department.

All University of Michigan College of Engineering Students are required to take a first-year course, Engin 101, which is C++ programming and introduction to Matlab. Approximately 500 students a semester, divided into three setions, take this course. Until fairly recently, students couldn't even place out of this requirement, so students with years of programming experience were in the same class with students with little or no computer experience. The college does not think of this class as a pre-requisite to CE or EE majors. Instead, it is more of a "transition" course, to help the student start thinking more as a college student and less as a high school student. Students, however, very much perceive of this course as the first step to CE and EE concentrations. Their experiences and success in this course very much influences whether or not they will continue in CE and EE courses, or even engineering itself.

PROGRAM DESCRIPTION

The IT Scholars Program combines a variety of tactics, focusing on recruitment and retention of undergraduate women and minority students to computer science, computer engineering, or electrical engineering. Because of the enormous diversity in student backgrounds, faculty members must make a decision about the skill sets and experiences that students are bringing to the class. Due to the sheer number of students, some of the assumptions will be incorrect. The IT Scholars program attempts to level the playing field, ensuring that every student, regardless of background, will succeed in this class. Specifically, the program consists of the following components:

- Career information workshops and mentoring experiences to excite students and expose them to the

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enormous wealth of career possibilities in information technology;
- Computer skills workshops to ensure first-year students have the pre-requisite computer skills for introductory computer courses; and
- Supplemental instruction activities for computer engineering/computer science and electrical engineering gateway courses to increase the academic achievement of potential and declared EECS students.

PARTICIPANT RECRUITMENT

Students are recruited into the IT Scholars Program during the first week of classes through targeted mailings and emails which identifies them as "IT Scholars." We invite all women and underrepresented minority students who are enrolled in the Engineering 101 course (Introduction to Computer Programming) to attend an Orientation Session to learn more about the components of the program. In particular, students are introduced to a brief simulated Supplemental Instruction session followed by a discussion of the benefits and expectations of the program. Of the approximately 200 targeted women and underrepresented minority students in the course each term approximately 70-80 students participate in the program. Although women and underrepresented minority students are targeted, all students are welcome to participate.

CAREER INFORMATION WORKSHOPS

As part of the IT Scholars Program, we offer a series of career information workshops to expose students to career possibilities in Information Technology areas. The workshops bring in exciting and dynamic individuals working in IT fields to talk about career options and day-to-day life. (They also talk about the academic preparation needed for their careers.) Attendees have the opportunity to see the multitude of options available while at the same time establishing valuable networking links with these individuals.

MENTORING

Working with Intel representatives, we formalized a mentoring component of IT Scholars that utilizes Intel employees who are UM alumni. These mentors and their protégés are part of a structured "virtual" mentoring program in which mentors provide academic and vocational coaching to students and help students connect their college experience to real work experiences.

SUPPLEMENTAL INSTRUCTION

Supplemental instruction sessions are structured to include academic skill development, course content reinforcement, and training in pre-requisite skills not necessarily covered in the course. Our model consists of the following components:

- Active participation of course faculty who are directly involved to
  - identify course "bottlenecks";
  - create tools to quickly assess student preparedness for particular course topics and concepts; and
  - create supplementary materials to assist students with "bottlenecks" and lack of preparation for particular course topics.
- At least three or more hours of supplemental instructional sessions each week led by a Graduate Student Instructor (GSI) or senior level undergraduate student who
  -models application of study strategies such as graphic organization, questioning techniques, test prediction and preparation;
  -provides content expertise; and
  -facilitates collaborative learning and support among the students through problem solving and discussion of concepts.
- Project supervision and GSI training provided by the Engineering Learning Resource Center coordinator.

EVALUATION

We have been operating various components of the IT Scholars Program since Fall Term 2000. The collaboration with WISE and UROP began in Fall 2001 at which time we included non-minority women as part of the target group and officially named it the IT Scholars Program. In the most recent terms, we have been able to demonstrate that non-minority women students and underrepresented minority students who have participated in the program have averaged approximately .30 to .40 GPA higher than their counterparts in the course who have not participated in the program. We have also decreased the failure rate (C- or below) by more than one-half for those students participating in the programs, compared to their counterparts who did not participate. The following table shows performance of participants in Supplemental Instruction (SI) versus performance of their non-participating cohorts (non-SI). (Note that non-minority women were included in the target group beginning Fall 2001.)

TABLE I
PERFORMANCE OF UNDERREPRESENTED MINORITIES AND WOMEN IN ENG101

		Fall 2000		Winter 2001		Fall 2001		Winter 2002	
		SI	Non-SI	SI	Non-SI	SI	Non-SI	SI	Non-SI
Underrepresented Minority	Number	33	35	28	31	25	59	30	60
	GPA	2.29	2.25	2.35	2.20	2.55	2.41	2.72	2.30
	Failure rate: *(C- or below)*	24%	40%	21%	39%	16%	24%	13%	32%
Non-Minority Women	Number					10	165	39	72
	GPA					3.00	2.88	3.19	2.90
	Failure rate: *(C- or below)*					10%	14%	3%	13%

EXPANSION OF PROGRAM

The success of the IT Scholars Program has encouraged us to consider expanding the initiative to other "gateway" courses for engineering students. We have recently started supplemental instruction sessions for students in introductory mechanical engineering courses and are considering expanding our efforts into the introductory mathematics and science courses.

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