Academic Advisement Tool for Retaining Underrepresented Engineering Students

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Abstract

This report is an update on an advisement tool used in the School of Engineering at the City College of New York, an urban institution of higher learning, to retain students from traditionally under-represented groups. The manual requisite check process was initially introduced in 2001 as a way to insure that students had the necessary requisites for engineering courses. Since that time the method has been refined and has become a powerful tool for advisement and curriculum development. This paper will explore some of the advantages of using such a process by presenting both qualitative and quantitative analyses.

Introduction

The forever changing and increasing demands of a technology hungry society has the academic community straining to keep pace with developing engineers that are ready and able to get the job done. Engineers are expected to have a much more extensive tool set when dealing with today's technical and non-technical challenges. Employers are asking engineers to work more and more in teams consisting of members from dissimilar disciplines and often from dissimilar social and ethnic backgrounds.

In his paper "Engineering: Diversity of Disciplines and of Students", Mohammad Karim studies two important aspects of US engineering education: "student demographics and the nature of disciplines."[1] He explores the conflict in academia in its attempt to produce flexible and adaptive students for a changing world, while remaining primarily resistant to interdisciplinary and multidisciplinary practices. The case was made, that all engineering programs are expected to have a multidisciplinary aspect. This is an issue that is strongly supported and even demanded by the Accreditation Board of Engineering and Technology (ABET) in its Engineering Criteria 2000, requiring engineering programs to produce

engineers with skills to function on multidisciplinary teams, and a broad education to understand the impact of engineering solutions on society and the world.

The new criterion is a challenge for engineering programs and students alike and without proper attention from faculty and staff it could be another barrier between members of an underrepresented group and the attainment of a degree.

Underrepresented Groups

While much has been written about the obstacles to increasing the number of underrepresented groups in science and engineering, it is an important issue that warrants constant review in hopes of finding a solution to this human problem. Figure 1 shows the distribution of graduates from all engineering degree programs in terms of special subgroups such as Women, White Americans, Black Americans, and Hispanic Americans. The percentage of degrees for Native Americans is less than a percentage point; from 1990 to 2002 it has increased from 0.2% to 0.5%. From Fig. 1, we can see that some hard earned gains at increasing the diversity in engineering have been made. The percentage of White Americans earning engineering degrees has decreased over the past ten years. It seems that this percentage is holding steady over the last four years, because of the increase of engineering degrees earned by White Women. In Fig. 2, we can see the absolute number of engineering degrees awarded in the US. It also makes clear that more needs to be done.

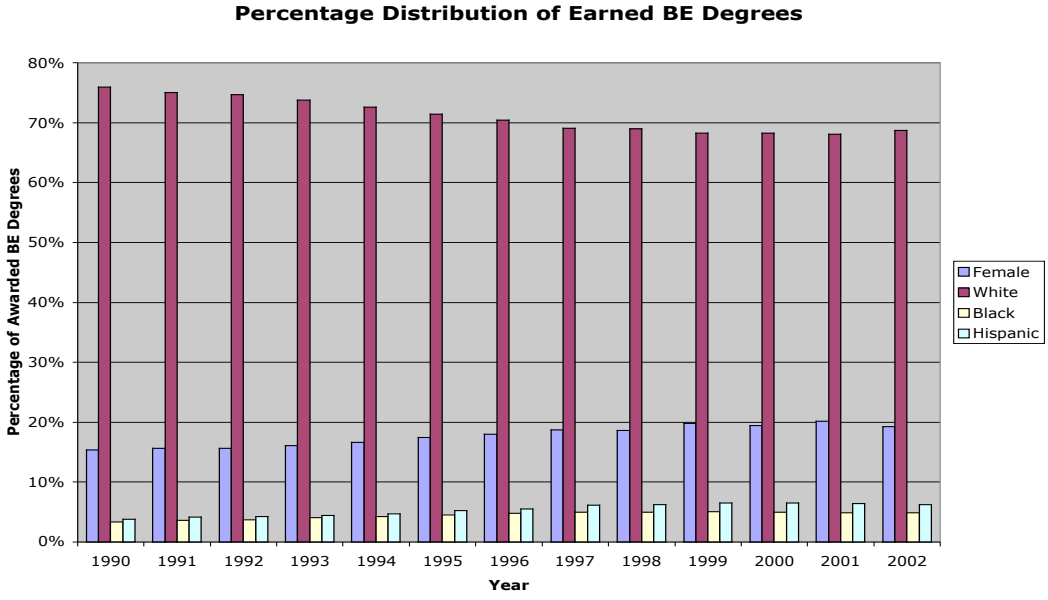

Figure 1. A demographic distribution as a percentage of the total number of graduates: from 1990 to 2002.[2]

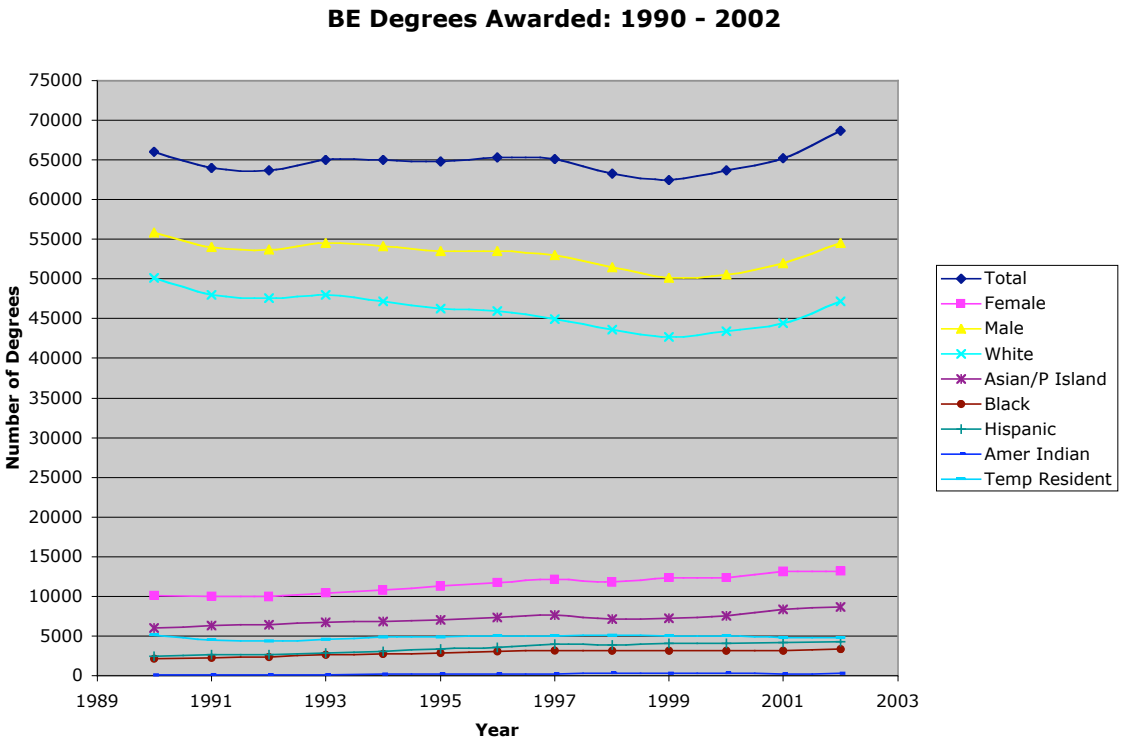

Figure 2. The number of bachelor of engineering graduates in the US: 1990 to 2002[2].

"Trends in African American and Native American Participation in STEM Higher Education" by Eleanor L. Babco[3], examines the statistics that tell the story of the African American and Native American experience in STEM (Science, Technology, Engineering and Mathematics) programs. She concludes with of some of the barriers to increasing the representation of engineering graduates:

- Poverty determines in a major way the quality of education received by children and in turn determines the interest in science and engineering. Poor students are less likely to become scientists and engineers.

- African Americans, Native Americans and Hispanics are underserved by our educational system. This is evident by NAEP assessment results and SAT scores.

- African American and Native American women are much more likely to attend college than African American and Native American men. And like all women they are less likely to choose a STEM major.

- African American and Native American undergraduates face more risk factors than the general undergraduate population. Factors include delayed enrollment, part-time attendance, having dependents, being a single parent and working full time, and may contribute to the termination of the pursuit of a degree.

It is for the welfare of these very vulnerable students and the future of engineering that we must do more than create better engineering programs, we must find creative ways to deal with the social component of the college experience.

Advising

As an urban commuting college, the City College of New York (CCNY) provides education to a highly diverse student body, including traditionally underrepresented groups, working adults and immigrants in the metropolitan New York area. In the fall of 2001, the School of Engineering (SOE) at CCNY implemented a new process to help retain at risk students, called the manual requisite check. This process allows advisors in the SOE to monitor students' progress through the curriculum. It also gives them an opportunity to provide proper advisement to students, improving their students' chances of successfully completing the program. This paper is a progress report on the process and how its use has evolved in the School of Engineering at the City College of New York.

Process and Outcomes

A detailed description of the process was described in a previous publication[4]. We will give some of the salient features of the process here and discuss what we see as positive outcomes due to it implementation. At the beginning of the semester, each student's transcript is reviewed along with their course selection to determine if they are in violation of any requisites. If a requisite appears to be missing, the student's (hard-copy) file is reviewed to see if the requisite has been waived. If no documentation of a waiver is found, the student is notified and instructed to see the Associate Dean of Undergraduate Studies or the Department Chair. In order to remain registered for the course in question the student must provide proper documentation and explain the apparent requisite violation to the Dean or the Chair. If proof is not provided, the student is de-registered from the course. It still takes about a week to review each transcript and send letters to students suspected of being in violation of a requisite. However, the time it takes students to respond to the notice has decreased. We attribute this to students growing accustomed to the process and understanding better what they are required to do.

A student's visit to the Dean provides an opportunity for them to receive help if needed. Many of the students that violate course requisites tend to be in academic trouble and require advising and counseling. The requisite check helps to ensure that "at risk" students see advisors while they still can be helped. The validity of a requisite comes into question if too many waivers for the course are issued. As part of the requisite check process an accurate count of waivers is kept and sent to both the Department Chair and the Department Curriculum Committee. This feedback has been used to streamline a number of engineering programs at CCNY. A final and important outcome of the requisite check process is the decrease in the percentage of students who have insufficient

requisites for one or more courses. To avoid problems during registration, students, in increasing numbers, are visiting advisors first to make sure they have the proper requisites and to receive advisement on courses to take. In Fig. 3, the black squares indicate the total percentage of registrations in all courses of the respective program appearing to violate requisite(s).

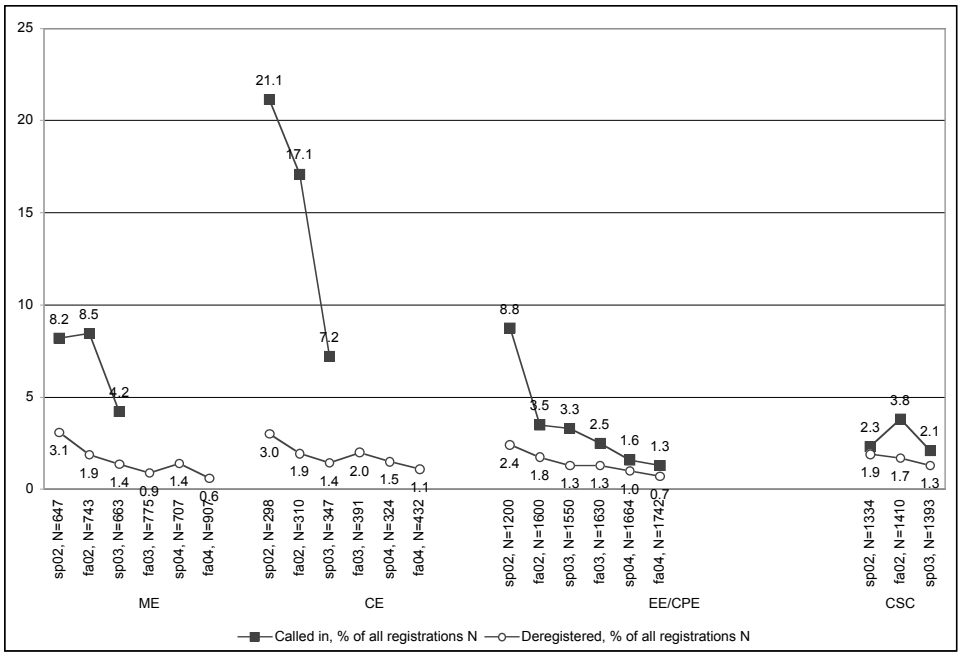

Figure 3. Requisite checks in three (3) semesters for the Mechanical, Civil, Electrical/Computer Engineering programs and the Computer Science program at CCNY.

The white circles indicate the total percentage of those registrations deregistered from the total number of registrations in all courses of the respective program. The symbol N in Fig. 3, concerns numbers and percentages of registrations, not students, since a student generally registers for more than one course and could also be de-registered for more than one course. Civil Engineering had a relatively high number of apparent violations in Spring 2002, because there had been extensive changes in the curriculum in prior years, including the requisites. In many cases this made it difficult to determine exactly what curriculum the students were in, and the requisite check turned out to be a good instrument in clarifying matters for students, as well as the Department.

As Fig. 3, shows, the percentage of actual de-registrations appears to be approximately the same from department to department for a given semester and appears to decline overall for the respective Departments with each successive semester. This would infer that the departments have a consistent policy on decisions regarding student deregistration. The declining percentage of apparent violations (black squares) would

indicate that the documentation in the student's file has improved so students do not need to provide information each semester to their respective departments or the SOE.

It is very difficult to connect a specific outcome to a specific process when dealing with complex issues such as student advisement and retention. While it is fairly clear that the reduction in the number of students that are in violation of requisites is predominantly due to the requisite check process, we can only infer from the outcomes that this process has improved the retention of at risk students. To strengthen this conclusion we looked at the percentage of students on probation. In Fall 2000 over ten percent of all students in the SOE were on academic probation. By Fall 2004 the number of SOE students on probation dropped below six percent. This along with the other indications supports the claim that the implementation of the requisite check process has had a positive impact on SOE students and programs.

Conclusion

We have given a progress report on the implementation of a new advisement process called the manual requisite check. We have provided evidence that supports the idea that this process can be a powerful tool for improving the retention of at risk students, because they receive better advisement and are better prepared for the courses they take.

Bibliography

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Biography

Annita Alting has a Masters degree in physics from Groningen University in The Netherlands and a PhD in physics education from Eindhoven University of Technology. She taught physics and mathematics in Dutch secondary and higher education, and worked as an educational researcher and academic advisor in the areas of science and engineering. After her arrival in the United States, she was a research associate in IBM Research in Hawthorne, NY, for three years. Since 2001 she works as ABET accreditation specialist in the School of Engineering of the City College of New York.

Edward Baurin holds a Bachelor and a Master of Electrical Engineering from N. Ogarev State University in Russia and a Master of Arts from Teachers College, Columbia University. He worked as an engineer and researcher in Russia for thirteen years. He worked in the field of international higher education from 1994 to 2001. Mr. E. Baurin was an active member of AACRAO and NAFSA. He made numerous presentations at annual conferences of these organizations. Mr. E. Baurin has been working as an ABET accreditation specialist at the School of Engineering of the City College of New York since 2001.

Ardie D. Walser is an Associate Professor of Electrical Engineering and Associate Dean of the School of Engineering at the City College and Graduate Center of the City University of New York. He has collaborated in the creation and direction of numerous faculty development workshops that have been held through out the country. Dr. Walser is the recipient of several faculty awards including the faculty of the year award from the Eta Kappa Knu engineering honor society.