
AC 2011-65: PILOT SURVEY OF ENGINEERING AND ENGINEERING TECHNOLOGY STUDENTS IN 2-YEAR AND 4-YEAR INSTITUTIONS

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Didion served as Executive Director for the Association for Women in Science (AWIS) for fourteen years (1990 to 2004). During tenure AWIS was awarded the U.S. Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring and she was the principle investigator for 17 government and foundation grants. Didion has presented testimony before the United States Congress and U.S. federal agencies and she was the editor for Women in Science Column for the Journal of College Science Teaching from 1993-2002. Didion has extensive experience on Capitol Hill including staff positions at the U.S. Senate Commerce, Science, and Transportation Committee, Office of Senator Robert Packwood (R-Oregon), the Senate Computer Center, and the Senate Press Gallery.

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Pilot Survey of Engineering and Engineering Technology Students in 2-Year and 4-Year Institutions

Taking full advantage of community colleges as sources of science and engineering majors is a critical component of U.S. science and technology policy. Data are available on the number of degree recipients in engineering and engineering technology (e/et) at the associate's degree level, but because many programs of study that prepare community college students to transfer to a baccalaureate e/et program do not require the student to attain an associate's degree as an intermediate step, there are not reliable data on either the number of community college students who intend to transfer to baccalaureate e/et programs or the number who successfully make the transition. This project seeks to fill that gap in the data.

Introduction

Taking full advantage of community colleges as sources of science and engineering majors is a critical component of U.S. science and technology policy. Within the baccalaureate engineering and engineering technology (e/et) communities, the most critical role of community colleges is as feeders to baccalaureate engineering and engineering technology programs. Indeed, some states (e.g. Florida and California) depend on community colleges as a key pathway for students seeking baccalaureate degrees in all fields^{1,2}. Data are available on the number of associate's degree recipients in e/et nationwide³. However, because many programs of study that prepare students to transfer to a baccalaureate e/et program do not require the student to attain an associate's degree as an intermediate step, there are not reliable data on either the number of community college students who intend to transfer to baccalaureate e/et programs or the number who successfully make the transition.

A study conducted in 2004 examined how the role of community colleges in engineering education has and will change, identified exemplary partnerships and practices between community colleges and 4-year institutions, and recommended areas for future study. The project findings included:

- Community colleges are already essential to the education of engineers in the US,
- Community colleges have not achieved their full potential as contributors to engineering bachelors degree graduates due to miscommunication about the roles of community colleges and challenges in articulation, and
- More data is needed on community college students and their transfer to engineering programs⁴.

The overall goal of the current project is to contribute to characterizing (1) the number of community college students enrolled in individual e/et programs, (2) the number of community college students who have either completed an associate's degree program or directly transferred to a baccalaureate program, and (3) the number of baccalaureate degree recipients who began their education in a community college. This data will allow us to answer our overall research question: "How many students who have substantially completed an e/et program of study in a community college transfer to a baccalaureate e/et degree program irrespective of whether they have completed the requirements to obtain an associates degree?" Determining the ability to answer this question is central to determining the ability to answer several broad follow-on

questions that will allow us to more closely gauge the preparation and success of community college students in baccalaureate engineering programs. For example,

- Do engineering students who begin at community colleges perform as well, better than, or not as well as other students? What factors influence their success rate?
- How many community college graduates are admitted to Research I Institutions?
- How many obtain graduate degrees?
- What career paths do students with A.S. degrees in e/et follow?

Two critical steps in this project are (1) examining enrollments of community colleges, numbers of transfer students, and numbers of associate degrees by e/et discipline, and (2) examining the fraction of e/et baccalaureate graduates who started their education in a community college.

As a first step in this large undertaking, the current project is a pilot study that is using a purposeful sample of 35 community colleges and 15 engineering colleges in the U.S. The 4-year institutions chosen for the sample represent a range of type in terms of highest engineering degree granted (e.g., doctorate, masters, baccalaureate), control (private or public), and focus (e.g., international research, national research, regional), while the community college sample includes both a range of geographic areas, including states with both low and high integration of 2-year and 4-year colleges, and a range of populations served in terms of racial, ethnic, and gender diversity. The sample represents about 3% of the approximately 1200 community colleges in the United States and approximately 4% of the 380 engineering colleges. We are working with the American Society for Engineering Education (ASEE) to apply their yearly survey of e/et colleges to community colleges, although given a lack of definite knowledge about the academic intentions of many community college students, the survey asks for “best estimates” of community college engineering or pre-engineering enrollments. The process of data collection will provide insight into how well community colleges track their students, as well as provide data on the progress of transfer student cohorts at 4-year institutions.

The three major activities to be undertaken in this pilot study are to (1) confer with e/et faculty and deans within 2-year and 4-year e/et programs to determine key data questions to be asked of the participating e/et programs; (2) work with the data research staff at ASEE to survey a sample of community colleges and engineering baccalaureate degree granting institutions; and (3) debrief key contacts at the sampled institutions on any challenges encountered during the data collection process and how such challenges might be avoided in the future. This debriefing meeting will take place in June, 2011.

After identifying community college e/et faculty members at the target institutions, those faculty members were asked to engage their academic deans in the project and ensure the participation of either a provost or the dean in the June 2011 debriefing meeting. In addition, faculty and deans at the target 4-year institutions were asked about their ability to examine the transfer population of their undergraduates as well as the types of data they would need from community colleges to help students plan their transfer. Faculty and deans from all institutions were also asked for input on the draft surveys.

The survey of the identified institutions is underway. Survey questions for the community colleges include the estimated number of students interested in enrolling in e/et programs, in which disciplines, as well as the demographics of the students and the number expected to

transfer in 1, 2, 3, or 4 years. The 4-year engineering colleges answer questions about the numbers of transfer students among undergraduates, in which disciplines, as well as the demographics of the students and the numbers who graduated with bachelor's degrees within 1, 2, 3, or 4 years of transferring to the institution. Institutions are asked to provide the raw numbers for incoming cohorts in each year between 2002 and 2010, so we are examining the number of students and not tracking the individual students. In engineering terms we are taking an Eulerian rather than Lagrangian analysis of student flow through the engineering pipeline. The 4-year institutions are also asked to provide contact information for the community colleges with whom they have articulation agreements and that send the most students. Table 1 presents some of the information being asked of the institutions in the survey.

Table 1: Information being collected at 4-Year Institutions, for each cohort year 2002-2010.

	Gender/Race/Ethnicity/Nationality Information								
	All	Female	African-American	Asian-American	Hispanic	Native American	Caucasian	Other/Unknown	Foreign National
Community College Program of Study									
Total Transfer Head Count									
Technician Program									
Engineering Technician Program									
Engineering Program									
Science Program									
Arts & Sciences Program									
Test Scores									
Average SAT									
Average SAT Math									
Average ACT									
Average ACT Math									
Average GPA									
Average GPA in Major									
Continuation and Graduation Count									
Continued to 4th Year									
Graduated within 4 years									
Continued to 5th Year									
Graduated within 5 years									
Continued to 6th Year									
Graduated within 6 years									
Continued to 7th Year									
Graduated within 7 years									
Graduated within 8 years									

The race and ethnicity data being collected apply to United States citizens only, and all non-permanent residents will be counted in the foreign national table. The cohort head count includes all students who reached junior/third year status to that point, so students who transfer prior to their third year will be counted in the year's cohort when they reach third year status. The GPA data is calculated at the time of transfer, and SAT and ACT scores are not required data. The continuation/graduation count begins the year following transfer, so for example the 2002 cohort continued to their fourth year in the fall semester of 2003, and those who graduated between fall 2004 and summer 2005 would be counted as "graduating within 4 years."

The June debriefing meeting will include two representatives from each of the 50 institutions involved in the pilot survey. Each institution will send one high-level administrator (i.e., president, provost, academic dean) as well as one faculty member or administrative professional

with experience in gathering the data requested in the survey. The meeting discussions will focus on identifying impediments or challenges to completion of the surveys as well as suggestions for improvements to the survey process in order to mitigate those challenges. In addition to a broad discussion of these topics, the attendees will determine if there are particular issues based on geographic region, degree of articulation agreements, or other factors. Attendees will also comment on their interest in using the data from the pilot study as well as whether this type of study should be repeated regularly.

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