

## Effective First-Year Engineering Program Improves Graduation Potential

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### Introduction

The problem of retaining students in a program of study in engineering has long been a problem for engineering educators. Shuman <sup>1</sup> notes that roughly fifty percent of the students who begin in engineering leave the field before receiving their engineering degree. Whitaker <sup>2</sup> states that programs of intervention aimed at identifying and treating these potential dropouts have grown dramatically. Additionally, Varma <sup>3</sup> demonstrates several programs that have proven to be effective for his institution.

Over the past five years, the School of Engineering at The University of Dayton has developed a multi-faceted program for first-year engineering students, a program that proves to be gaining a significant increase in retention. This integrated plan includes two different means of assistance made available to all first-year students, collaborative learning workshops and specialized advising. An introductory course in engineering design is a requirement for all first-year students and has proven to unfold the goals of the engineering discipline so that students gain clearer perception of their personal career goals. Additionally, two specialized programs oriented towards special-admit students and minority students were developed.

### Collaborative Learning Workshops

All students are required to enroll in collaborative-learning workshops for a minimum of two hours per week for both semesters of the first year. These workshops offer support for the first-year engineering students in chemistry, mathematics, and physics and are held in School of Engineering study centers. Upper-class junior- and senior-level engineering students serve as facilitators in these workshops, interacting with the first-year students to guide them in the process of problem solving. This interaction builds a strong bond between first-year engineering students and their upper-class peers.

## Specialized Advising Team

A specialized advising team for first-year students operates from within the office of the dean for all first-year engineering students. This team consists of select faculty representatives from each discipline, selected because of dedication, who form a group of highly motivated advisors. At least one advisor is on duty in the dean's office at all times for drop-in advising. While the preferred method of advising is often done in person, correspondence with an advisor through a dedicated Advisor E-mail address permits team members to be very effective in providing answers to students for their individual questions.

## Freshmen Engineering Design Course

The Introduction to Engineering Design course, initiated in 1997, places first-year students into laboratory environments with engineering professors of all disciplines. Students are assigned to groups where they are introduced to design concepts for chemical, civil, computer, electrical, and mechanical engineering disciplines. Although this course was originally developed to instill in the student a sense of excitement toward engineering, the students are now using it as a basis on which to choose a major.

## Enriched Engineering Program (EEP)

The Enriched Engineering Program, initiated in 1994, was an adaptation of the highly successful national Minority Engineering Program model. Students who are admitted to the School of Engineering in this category are those who would normally not be admitted into the program because of low SAT and/or ACT scores, but who are students that show a strong desire to excel by achievement in high school.

Students enrolled in this program enter into cohorted classes in chemistry, mathematics, and physics. They meet four hours per week in two separate required collaborative-learning workshops throughout the first year. They work under the guidance of a dedicated advisor during the first year. Beginning with 24 students in 1994, 58 percent of this group returned to classes the following year, all of whom subsequently graduated with an engineering degree. Retention data for this group depicts a strong increase in enrollment for the years 1994-1997. For 1998, 100 percent of the students who entered this program in 1997 registered for classes. For 1999, 84.2 percent of those students who entered this program in 1998 registered for classes within the engineering disciplines. While the number for 1999 indicates a decrease in retention rate, the retention numbers are qualitatively and quantitatively significant.

## Minority Engineering Program (MEP)

The Minority Engineering Program, initiated in 1996, promotes the recruitment and retention of underrepresented groups including African-American, Latin-American, and native-American students.

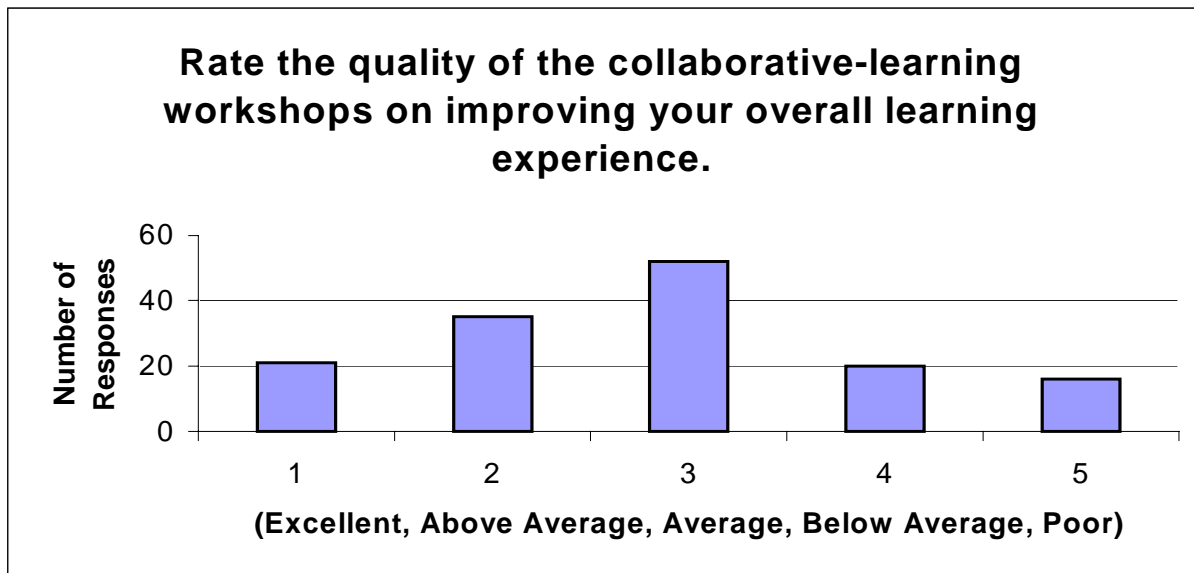
As with the EEP, students enrolled in MEP program also study cohorted classes in chemistry, mathematics, and physics. They also meet in required collaborative-learning workshops, four

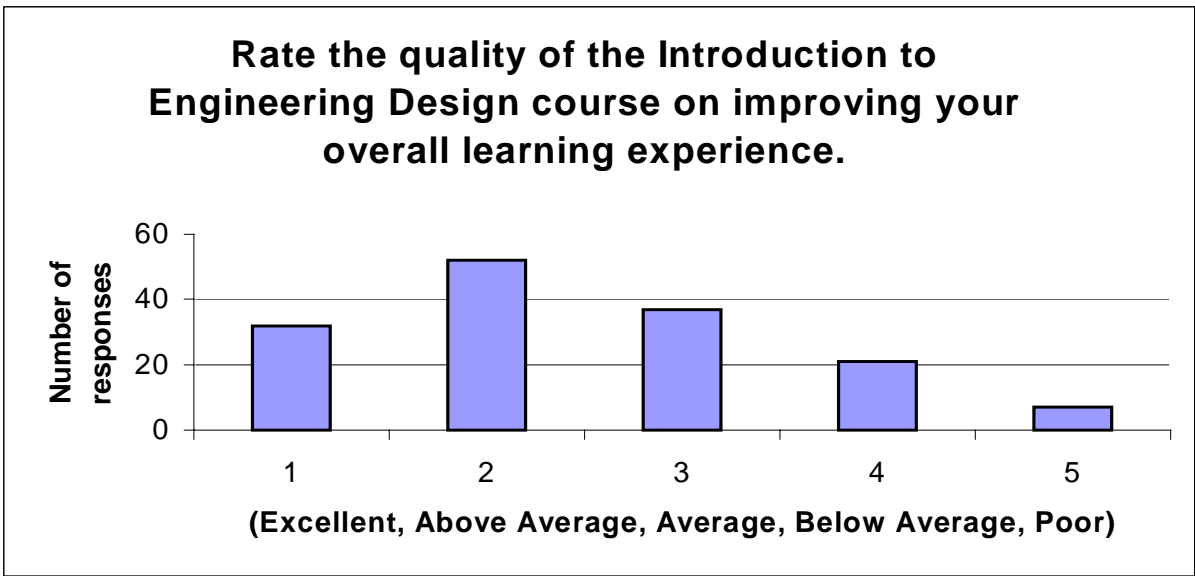
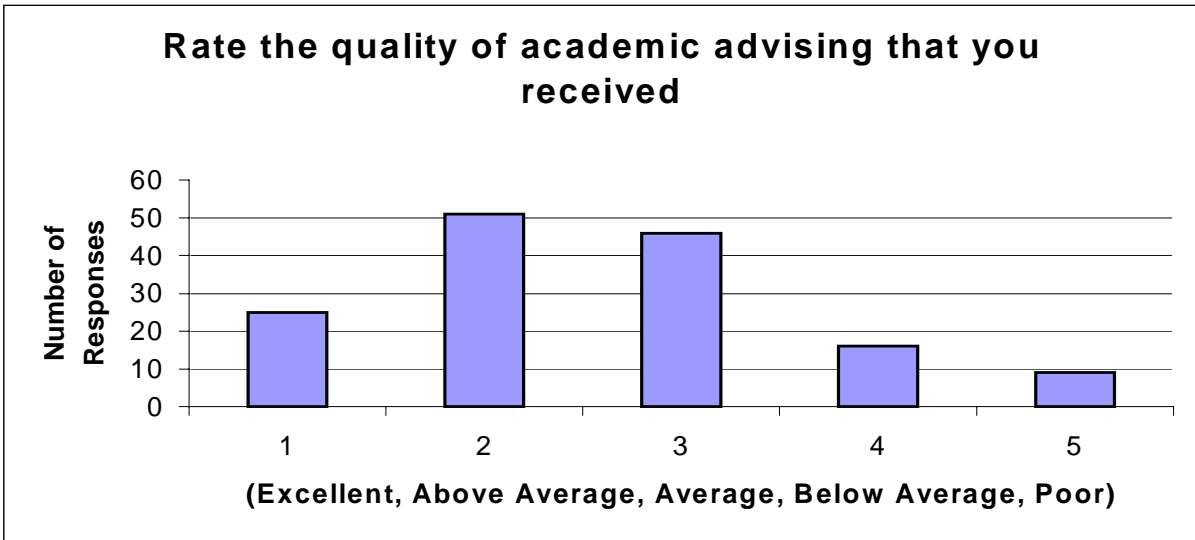
hours per week for both semesters in the first year and work under the guidance of a dedicated advisor during the first year. To enhance professional development, individual students in this group consult with mentors who are, themselves, minority engineers working in industry within the immediate Dayton area. These students obtain a significant amount of encouragement from their professional mentors. They also have access to MEP sponsors who provide continuous feedback, a relationship that permits these students to identify both with individual mentors and career opportunities in industry. Through his experience, they gain confidence in their preparation for a career in engineering.

Begun in 1996, the first MEP class had 10 of 14 students returning for a retention rate of 71 percent. Twenty students entered the program in 1997 with 17 returning in the fall of 1998 for a retention rate of 85 percent. Twenty-two students started in 1998 with 15 returning in the fall of 1999 for a retention rate of 68 percent. While exhibiting some decrease, the rate of retention remains significant for this group.

#### Assessment

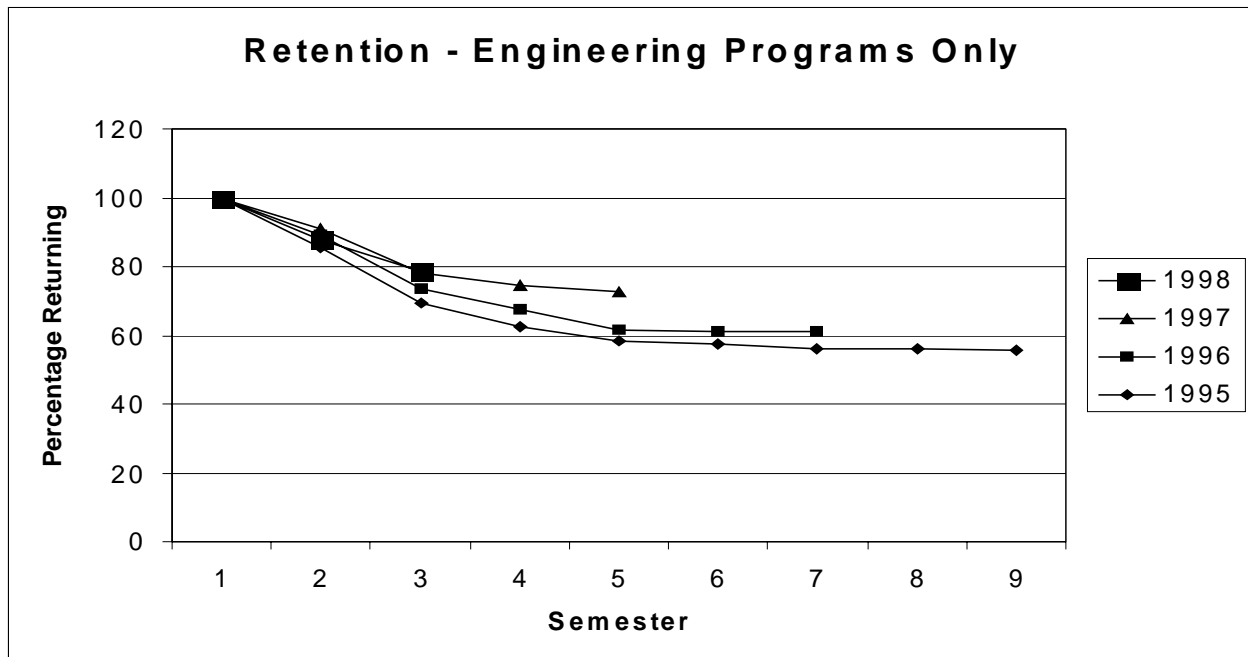
Assessment was made for collaborative-learning workshops, advising, and the Introduction to Engineering Design course. Those results follow.





No one specific method of support proves to be a major contributing factor to improving retention, but the combined effect is having a positive impact.

The effect on retention within the School of Engineering can be best depicted with the following graph that shows percentages of students retained in engineering programs only. Since the enrollment of engineering students differs from year to year, percentages are used exclusively, then to compare the individual year groups to one another, they are compared by semesters with semester one being the entry year, semester three being the first semester of the sophomore year, etc.



Fifty-six percent of those students who entered an engineering program at The University of Dayton in 1995 have either graduated or started their fifth year of study. Those students who are starting their fifth year are the co-op students. The class entering in 1995 was the last class to start before the combined first-year program was initiated.

Sixty-two percent of those students who entered an engineering program in 1996 entered their fourth year of study. This group is the first one to experience the collaborative-learning workshops and specialized advising.

Seventy-four percent of those students who entered an engineering program in 1997 are starting their third year of study. This is the first group to be enrolled in the Introduction to Engineering Design course.

Eighty percent of those students who entered an engineering program in 1998 are starting their second year of study.

#### Conclusion

Clearly, the focus of this first-year program is on student success. The combination of facilitated collaborative-learning workshops, competent and committed advisors, and programs for select groups of students provide fertile grounds for educating engineering students. All of these factors blend synergistically to enhance competence, confidence, and professional growth in potential engineers. Ultimately, the rapport and the networking with facilitators, advisors, and faculty in connection between theory and practice provide for a superior academic environment.

## References

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- 2 Whitaker, W, "Benefits of a Successful Retention Program," *1999 ASEE Annual Conference Proceedings*, Charlotte, NC.
- 3 Varma, V. Grimes, J and Wang, H. "Exploring the Recruiting & Retention Paradigm: What Works & What Doesn't," *1999 ASEE Annual Conference Proceedings*, Charlotte, NC.

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Richard J. Kee is the Associate Dean for Undergraduate Programs in the School of Engineering at The University of Dayton. He has been involved with the first-year engineering program since its inception in 1996. He holds a Doctor of Engineering degree in Electrical Engineering from The University of Dayton and is a Registered Professional Engineer in the states of Ohio and Indiana.

### RIAD AL-AKKAD

Riad Al-Akkad is a lecturer in the Department of Civil and Environmental Engineering and Engineering Mechanics at The University of Dayton. He established the Enriched Engineering at The University of Dayton in 1994 and has been actively involved in all programs relating to the first-year experience in the School of Engineering since that time. He holds the MS degree in Civil Engineering from The University of Dayton.