# Student Assessments of Engineering First-Year Seminars

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## Abstract

As of summer 1999, the Pennsylvania State University requires all first-year students to complete a one-credit first-year seminar (FYS) as part of their General Education requirements. In fact, many engineering FYS's were first offered in fall 1998 (as electives), and assessment has been ongoing since that semester. Engineering seminars have these four specific goals:

1. Introduce students to a specific field, or a number of fields, of study in engineering;
2. Acquaint students with tools, resources and opportunities available to them;
3. Provide exposure to some of the professional skills and competencies associated with academic study and the practice of engineering;
4. Encourage networking and interaction with faculty, students, and engineers.

Thus far, engineering seminars with 51 unique titles have been offered. This paper reports on the assessment process and results from Fall 1998 through Spring 2000 (4 semesters). The assessment is performed in two ways; a written student survey completed at the end of the course, and focus groups conducted early in the semester following the completion of a seminar. The goals of the assessment are to answer these questions:

- Overall, how satisfied are students with offerings?
- Are seminar objectives being achieved?
- What activities are students experiencing in seminars?

The results are tabulated and summarized and given to the respective faculty members to guide the course development. They are also used to identify specific areas for development of workshops and course modules. In general, the results show that students are satisfied with their seminar experiences, and that seminar objectives are being achieved in the areas of teamwork and other aspects of active learning. The seminars help students use learning resources of the university, especially computers. The greatest effect on students is that they report a much better understanding of engineering, with increased motivation and confidence in majoring in engineering.

## I. Introduction

The Engineering First-Year Seminar Program was developed to meet new, university-wide general education requirements, and became mandatory in summer 1999. The general education program consists of 45 credits plus a minimum one-credit first-year seminar. The recommendations for general education that were eventually adopted unanimously by the Faculty Senate emphasized, above all, the active engagement of students in their education. A variety of measures were taken to foster curricular experimentation, encourage dialogue and critical thinking, and incorporate collaboration and teamwork into the courses that comprise the general education program. In order to establish this kind of expectation right from the start for incoming students, a new first-year seminar requirement was established. Rather than prescribe the content and format for the seminars, the proposal advocated that the faculty in the

individual colleges should have broad authority and flexibility in the design and delivery of the seminars. There were two reasons for preserving flexibility:

- Faculty buy-in would be critically necessary to make seminars available to the over 12,000 first-year students entering the University's colleges and campuses each year.
- The objective of immersing entry-level students quickly and deliberately in a small, discussion-centered setting (in contrast to the larger "survey" courses they often take in the first year) could be accomplished through a variety of formats.

The only boundary conditions that were specified for the seminars were that they be one to three credits, be offered in class sizes not exceeding twenty students, should be taught by "regular" full-time faculty and must be portable (in other words, would count towards the seminar requirement regardless of the college in which they were taken). Otherwise, the stated objective was simply to foster in students "an understanding of the importance of general education within the larger context of their undergraduate experience;" to facilitate their adjustment to the high expectations, demanding workload, (and) increased academic liberties that accompany the transition to college life; to engage them in the scholarly community and help provide a bridge to other academic and co-curricular experiences. Secondary goals included familiarizing students with university resources, learning tools and fields of study and enhancing their contact with the full-time faculty.

Through a variety of forums in the College of Engineering, including standing faculty councils and joint faculty-student workshops, the following specific goals were adopted, along with potential strategies for achieving them:

1. Introduce students to a specific field, or encourage their exploration of a number of fields, of study in engineering;
   - familiarization with the engineering majors and career options and with the objectives of general education and other components of the curriculum
   - development of a particular topic, contemporary issue, emerging or inter-disciplinary field of concentration, or professional responsibilities in engineering
   - plant tours or demonstrations of engineering facilities
2. Acquaint students with tools, resources and opportunities available to them in the Department(s), College and University;
   - exposure to learning support services and career development resources
   - information on participation in cooperative education, internships, international experiences, professional societies and other student organizations
   - help in developing effective study, time-management, decision-making, critical thinking and learning skills
3. Provide exposure to some of the professional skills and competencies associated with academic study and practice of engineering;
   - practice in skills such as use of e-mail and the Web, computation, library research
   - introduction to design, case studies, global perspectives, teamwork and problem-solving
   - opportunities to use laboratory facilities or engage in hands-on activities
4. Encourage networking and interaction with faculty, other engineering students, alumni and other industry practitioners;
   - in-class discussions or debate
   - guest visits and presentations

- collaborative projects and other group activities

For a more complete description of the history and development of the Engineering First-Year Seminar program at Penn State, please see the companion paper in these proceedings, *Engaging Engineering Students in Learning – A College-wide First Year Seminar Program* [1].

## II. Assessment Plan

In concert with the Director of Engineering Instructional Services, an assessment plan was developed to achieve the following goals:

- Determine to what extent the learning objectives of the program are being met and identify areas for improvement.
- Determine to what extent the FYS's are meeting students' needs and identify areas for improvement.
- Determine to what extent the FYS's are meeting faculty's needs and identify areas for improvement.

In order to achieve these objectives, the following assessment approaches will be used:

- An end-of-semester, written, student survey specifically designed for the engineering FYS's.
- Student focus groups involving about 8 groups of 10-15 students annually, with about 6 in spring (for those who completed seminars in the preceding fall semester), and 2 in fall (for those who completed seminars in the preceding spring semester).
- Post-seminar student surveys (two to three years after completing seminars) focusing on seminar effectiveness in retrospect.
- Post-graduation comparisons of retention and academic performance.
- Periodic written faculty surveys and focus groups.

This paper reports on the results from student surveys and focus groups in the first two bullet items.

The key to the success of this assessment process with respect to improving the seminars is feedback to seminar faculty and relevant administrators. Results of the written student surveys, including the specific section and the aggregate, are given to faculty along with a summary analysis and specific comments by the FYS Coordinator. Where special needs are indicated, the FYS Coordinator follows up with faculty on a personal basis. Focus group results are summarized in a report to the faculty. The longer-term assessment items will also be assembled into a report to faculty and administrators.

In addition to reporting results, where areas for improvement are clearly identified, the FYS Coordinator will inform the faculty (and perhaps students) what measures have been taken and what results have been achieved.

## III. End-of-Semester Written Survey

A three-page survey was custom-developed to provide insight into the students' perceptions of the effectiveness of the FYS's, primarily to provide feedback to the faculty teaching the

seminars. It was used beginning in Fall 1998 and remained essentially unchanged through Spring 2000. The instrument was a printed form with two kinds of student input, fill-in-the-blanks and check boxes. Data were retrieved by scanning the forms and then manually editing the datafile to correct any errors and to type in any text in the fill-in-the-blanks sections. This was a time-consuming and mind-numbing task given the number of forms involved. Furthermore, the survey was only being administered in about two-thirds of the seminars for various reasons including the infringement on class time and reliance on faculty to carry out the survey. Therefore, in Fall 2000, the survey was converted to a web-based survey with a few modifications to the instrument to make it clearer and to add a few more questions (this survey can be viewed at http://www.engr.psu.edu/fys/SurveyF00.htm). The response rate for Fall 2000 was about 66%. The results reported here include the four semesters prior to the new web survey, Fall 1998 through Spring 2000. Sample size is 1024 students.

One of the summary questions at the end of the survey asks students to rank how satisfied they are with the seminar. Although this question does not directly indicate effectiveness or achievement of learning objectives, it is an indicator of how well the seminars are meeting the students' expectations. The aggregate results are displayed in Figure 1 and show that most students, 63%, are satisfied with their seminars. On the other hand, it is significant that 22% expressed that they were somewhat or very unsatisfied with their seminars. Individual seminar results are compared with the aggregate result to identify those sections that are either much lower or higher in satisfaction. Those outliers are then scrutinized to try to identify reasons for variance from the average, including reviewing the individual student comments. Insights and observations are included in brief reports given to the faculty with their results.

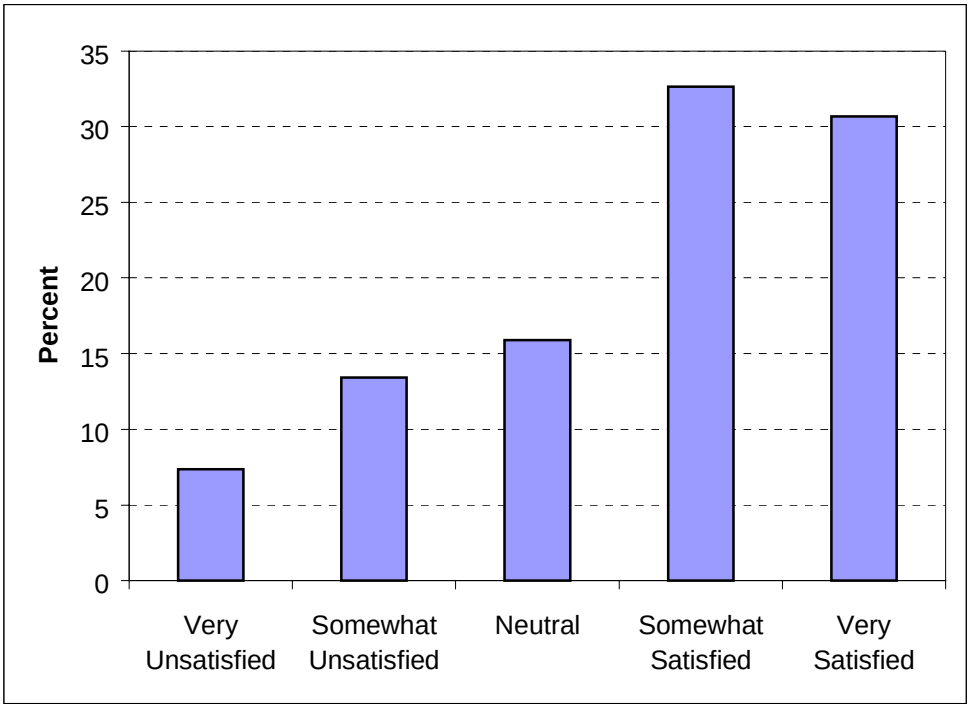


Figure 1 Student Satisfaction Distribution

One of the first survey questions asks students to indicate how often certain activities occurred as part of their seminar experience; these results are illustrated in Figure 2. Here, the three most frequent activities, in order of prevalence, are using the world-wide web for research, emailing faculty, and using the Center for Academic Computing labs. Clearly students are being engaged in using computers in their seminars. The activities that most students report doing only once or never are visiting faculty outside of class, meeting with an academic advisor, and visiting a campus Learning Center. Interestingly, 22% never used the library, and 19% only used the library once. This is an area for improvement since library use is important for later classes. It is possible, however, that when a student states that they used the world-wide web for research that they were actually using the library databases.

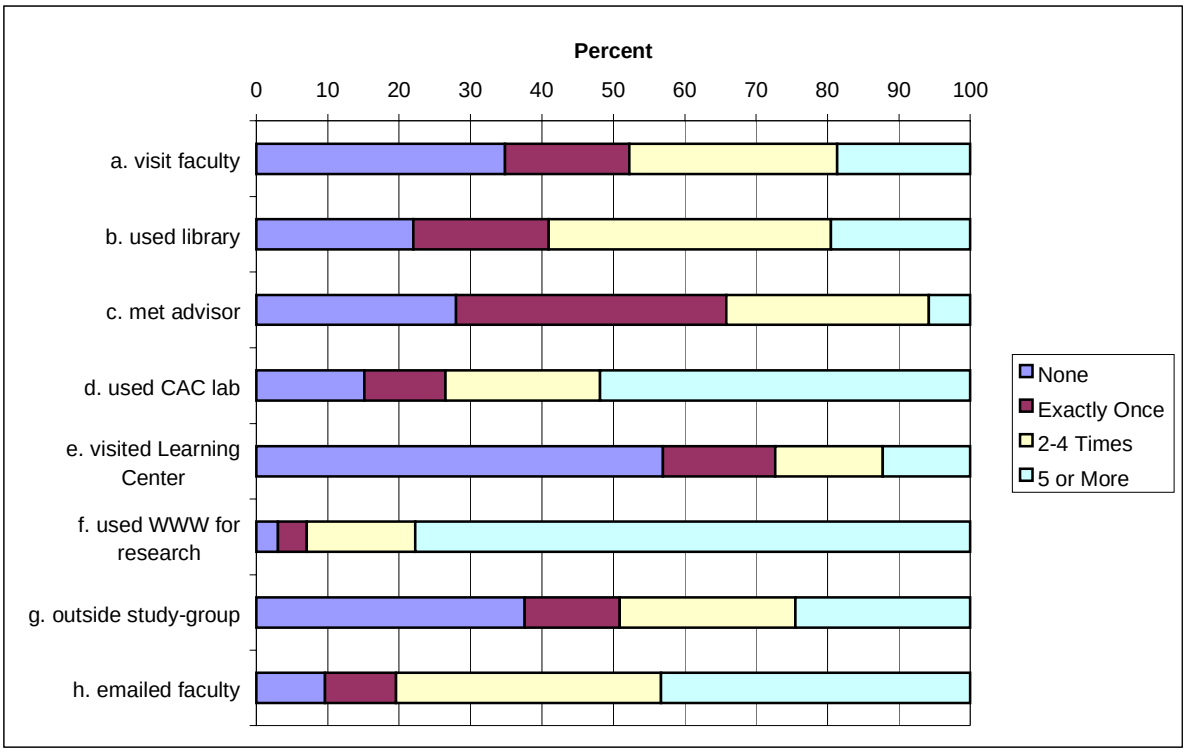


Figure 2 Frequency of Selected Activities

Figure 3 sheds some more light on class experiences. Here, the indications are that many of the seminar strategies are being used in the seminars. There are only four areas that the majority of students never or only occasionally experience: outside interaction with faculty, outside interaction with students, instruction on group work, and making oral presentations. Roughly half of the students never or only occasionally were engaged in writing. Of these less frequent experiences, making oral and written presentations and receiving instruction on group work are important for development of communication skills and are areas for improvement. FYS faculty have discussed ways for faculty to interact with students outside the classroom because this interaction helps to further develop a rapport and a connection for the students (and faculty). Some ideas are meeting students for lunch in the dining halls, inviting the student to the faculty's office for a chat (one colleague in another college requires that each seminar student schedule a

meeting in the faculty's office to get to know each other), or having individual or small groups meet the faculty in the place where they do research.

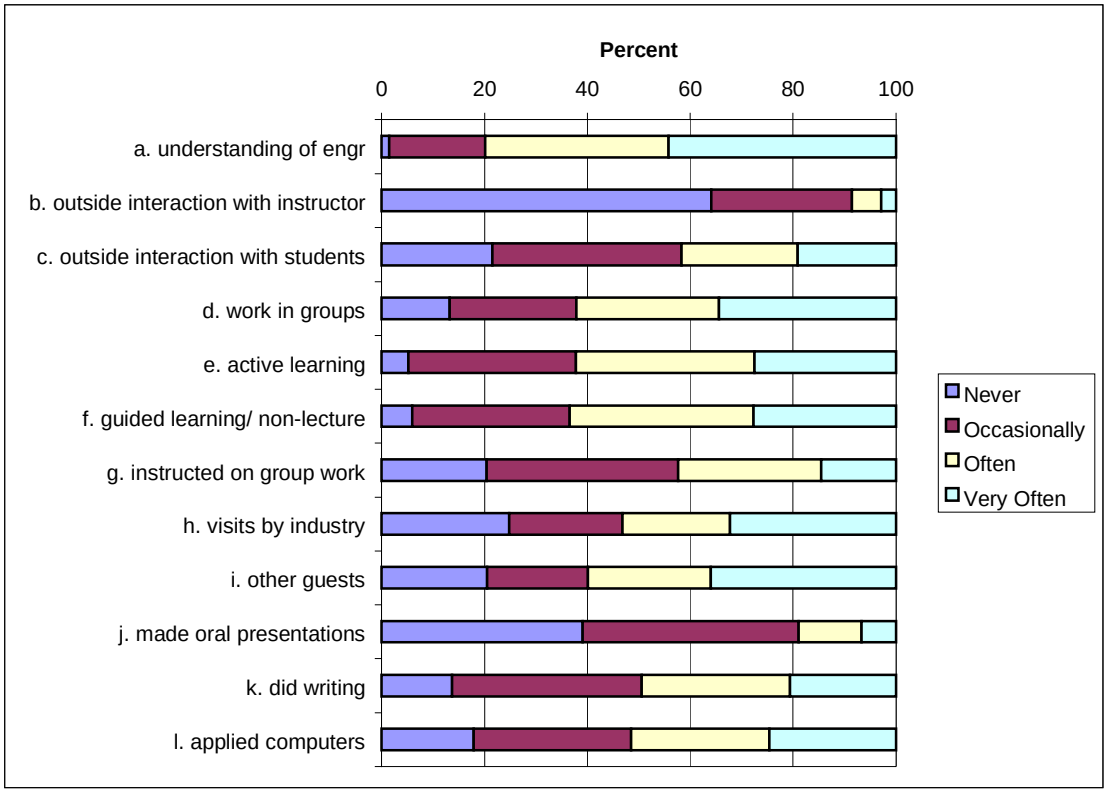


Figure 3 Frequency of Class Experiences

The next survey question addresses the students' perceptions of how much progress they have made in selected areas. These results are summarized in Figure 4. It is encouraging to note that many report moderate or greater progress in teamwork (37%), using computers (41%), and making life decisions (37%). Most disturbing here is that, despite all of the reported experiences and activities, the majority of students report slight or no progress in all the areas. Perhaps it is presumptuous to expect that a one-credit course can have more than a modest effect. Nonetheless, these results reinforce the earlier observations that point to the need to work on ways to develop communication skills, library use, and effective studying.

The next survey question addresses the extent to which students have changed because of their seminar; see Figure 5. On the positive side, if there is any change, more students report an increase rather than a decrease. For example, because of the seminar, 47% report that their confidence in their major choice has increased, 49% have increased motivation to become an engineer, and 44% are more likely to continue in engineering. And most significantly, 58% report increased understanding of the learning resources at Penn State.

As with the previous question, though, except for knowledge of learning resources, the majority report no change or some amount of decrease. The seminars appear to have the least effect on a student's desire to obtain a broad education, indicating that the seminars are not successful in

achieving the goal of "an understanding of the importance of general education within the larger context of their undergraduate experience." This is an area to be addressed with the faculty to identify ways that the seminars could foster the students' desire for a broad education.

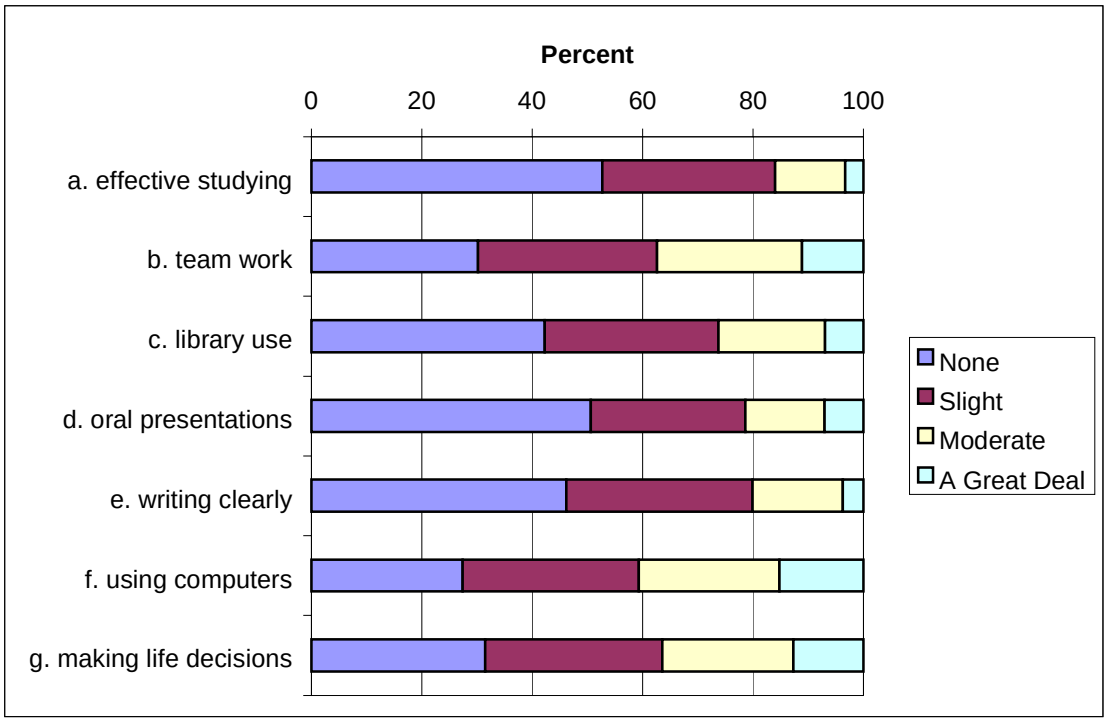


Figure 4 Progress Due to the Seminars

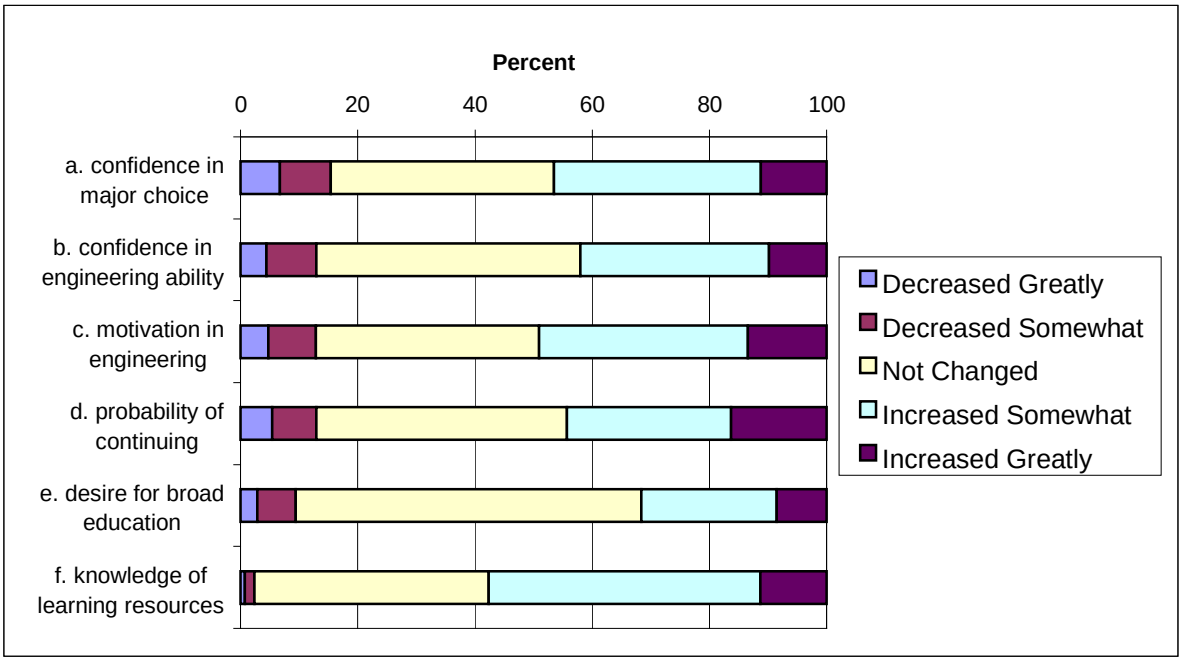


Figure 5 Change Due to Seminar

A final part of the survey comprises two questions: the student's intended major at the beginning of the course and at the completion of the course. While we cannot conclude that the FYS was the sole or predominant factor in any changes, it does help us to understand these changes, and may be useful in identifying those seminars and strategies that influence choice of major. Although the College of Engineering is concerned about student retention in engineering, we are most interested in helping students to make career and major choices that are best for them. It is quite possible that by helping students to make better-informed decisions about their major, some students may be "counseled out" of engineering. If that is the case, the seminars were successful both in helping the students make a better choice, and in improving the confidence (and motivation?) of the pool of students that continue in engineering.

Table 1 shows the comparison between major choice at the end and beginning of the seminar. A large majority of the students report no change in major. Some (6.7%) switch from one engineering major to another, and 11.5% change from an engineering major to either a major outside the college or to being undecided. This is partly balanced by the few students who change from non-engineering or undecided to engineering (5.4%). The net loss to engineering is then 6.1%, much lower than the longer term attrition of students.

Table 1 Changes of Major During Semester

| Effect on Major | Percent |
|---|---|
| No change | 74.7 |
| Engineering to Another Engineering | 6.7 |
| Engineering to Non-Engineering | 3.8 |
| Engineering to Undecided | 7.7 |
| Non-Engineering to Engineering | 0.1 |
| Undecided to Engineering | 5.3 |
| Undecided to Non-Engineering | 1.4 |
| Non-Engineering to Undecided | 0.3 |

## IV. Focus Groups

In order to gather student opinions on the quality and effectiveness of First Year Seminars in the College of Engineering, five student focus groups were conducted in Spring 1999, and six in Spring 2000. A total of 30 students participated in Spring 1999, and 16 in Spring 2000. The students were asked specific questions about their experiences in the seminars, the seminar's impact on their academic plans, and suggestions for improvement. Interviews were conducted by two assessment professionals outside of the college.

In early April 1999, students who were enrolled in Engineering First Year Seminars in Fall 1998 were asked to participate in a one hour and fifteen minute focus group. Students were contacted through email and telephone. The students were told the purpose of the focus group and that pizza and beverages would be provided during the session. A total of 30 students attended the five focus group sessions. The moderator of the session asked each student to sign two copies of an informed consent form, one for the student to keep and the other for the Office of Regulatory

Compliance. The students were told that their involvement was both voluntary and confidential. In addition, the moderator notified the participants that they could discontinue their involvement in the focus group at any time. The moderator of the focus groups used a protocol (available from the authors upon request) to guide the discussion.

A similar process was used in January 2000 for students who were enrolled in FYS's in Fall 1999, but due to a low turn-out at sessions in early February, two other focus group sessions were held in March. To ensure more student participation, students at those two sessions were also offered $10 gift certificates to the Penn State Bookstore. A total of sixteen students attended the six focus group sessions.

Following is a summary of the comments made at those focus group sessions involving a total of 46 students.

*Expectations for the Course*

- Engineering 100 (*Introduction to Engineering*) seminars provided students with a good overview of the major and career options within engineering; however, concern was expressed that the different recitation sections were inconsistent in terms of amount of work required. This was one of the factors that led to a complete redesign of Engineering 100 in Fall 2000.
- Students in the overview and topical seminars expected to get an overview of the different majors in their first year seminars.
- Students enrolled in the introductory and lab/hands-on seminars expected to get an overview of that specific major.
- The seminars for the most part met the students' expectations.

*In-and out-of class activities*

- Engineering 100 seminars consisted mostly of in-class guest speakers and lectures from the instructor. Little or no group work was performed in these seminars. The revised course is almost completely team-based.
- Most of the other seminars consisted of some type of group-work component, primarily through in-class activities.
- Most students worked in teams to some extent in their seminars.
- Activities and assignments in the seminars included panel discussions, lectures, group work, projects, and lab reports.
- Most students thought that the amount of work in their seminars was appropriate.

*Effects of the seminar*

- Information given in the seminars helped the students to choose a major if they were undecided or to solidify their decision about their major.
- Very few students thought that the seminars strongly affected their study skills or use of the library or technology.
- Some students learned about internships, co-ops and career opportunities in their seminars.

*On-going interactions with students and faculty*

- The amount of student-to-student interaction was limited in the seminars, particularly outside of class. Most of the students did not interact with the faculty member(s) outside of class or beyond their enrollment in the course.
- Students in the lab/hands-on courses interacted the most with their FYS instructors outside of class.

*General comments*

- The students in Engineering 100 had several ideas for improving the seminar, including standardized recitations, field trips, visits to labs, involvement in research, a project in the engineering library, more class discussion, and a change in the class meeting time.
- Students in Engineering 100 mentioned that there was an inequity in the amount of work and number of meetings for their seminar in comparison to other first year seminars.
- Some students thought that a FYS should be offered for each engineering major. Actually, there is, but this indicates that students weren't aware of all the options. Since then, an improved web site has been implemented to help students understand their choices and select a seminar.
- Other suggestions included careful selection of seminar instructors; exposure to the Learning Factory and more library projects for all seminars; mandatory appointments with the professors; inclusion of group work, hands-on activities, and variety in classroom presentations (not predominantly lecture) in all seminars; providing more major-specific seminars (e.g., for chemical and mechanical engineering); increasing the number of credits of certain seminars; stimulating more student discussion; and having enthusiastic instructors teach the seminars.

In general, the focus group results served to reinforce the observations from the written surveys. It is interesting that students noticed the lack of library work and thought that there should be more. Students also requested hands-on activities, field trips, group work, and discussion, all consistent with the goals and strategies of the program. One additional insight was that, with some exceptions, students felt that the amount of work was appropriate.

## V. Conclusions

The First-Year Seminars at Penn State provide a special opportunity for students to find out more about engineering careers and to learn skills that will enhance their chances for success at the University. Over the last four semesters, 63% of the 1024 students surveyed indicate that they are satisfied with the seminars. The greatest reported progress made by students is in the areas of teamwork, using computers, and making life decisions. Students also report that the FYS has increased their confidence in their major choice, their motivation to become an engineer, the likelihood of continuing in engineering, and their understanding of the learning resources at Penn State. Areas where improvements are needed are in communication skills (including oral presentations and writing assignments), library use, effective studying, and appreciation for general education.

## References

1. Lau, A. S. and Pangborn, R. N., "Engaging Engineering Students in Learning – A College-wide First Year Seminar Program," *ASEE Annual Conference Proceedings*, 2001.

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