

## Equipping Undergraduates for the Graduate School Process

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### ABSTRACT

The objective of this paper is to document a successful seminar series developed and used at Purdue University which educates undergraduates about graduate school and equips them to successfully move through the application and financial aid processes. The seminars are designed for all engineering disciplines. At Purdue the series consists of four seminars given during a two week period. The four seminars are “Graduate Study in Engineering: To Go or Not to Go, That is the Question”, “Helping Engineers Prepare for the General Graduate Record Exam (GRE)”, “Approach and Helpful Hints on the GRE Engineering Exam” and “Strategies for Applying to National Fellowship Programs”. An alternative format of a single seminar highlighting all four topics is also discussed. Data from student evaluations are summarized and show that while students are not initially well informed about the above topics, the seminars provide a significant increase in their understanding.

### INTRODUCTION

During the past decade, there has been a growing concern over the steadily declining percentage of U.S. engineering undergraduates pursuing graduate study. U.S. students have earned less than half of the Ph.D.’s granted since 1991<sup>1</sup>. Many concerns have also been expressed about the small percentage of women and minorities seeking graduate degrees. While recent efforts have increased the number of minority and female engineering students, the percentages are notably lower than those found in the pure sciences and significantly below the demographic representation of the U.S.<sup>2,3,4</sup>.

There are numerous reasons that U.S. students do not choose to pursue graduate degrees, but many stem from misconceptions and incomplete information<sup>5</sup>. This provides a powerful opportunity for ASEE student chapters to impact undergraduate interest in graduate school by formulating means to educate them on the merits of graduate school.

Although there are numerous efforts underway around the country to produce “engineering pipelines” encouraging U.S. students to pursue higher degrees, most are limited to the local institution and have not been successfully transported to other institutions. Also, most do not involve cooperation between the different departments at an institution.

This article outlines a successful approach taken by the ASEE student chapter at Purdue to educate the undergraduate population on the pros and cons of advanced degrees. The approach is a four seminar series held each semester which highlights reasons for pursuing graduate education and equips the students with



information to enhance their chances for admission and for financial support. The seminars also help direct the students other resources so that they can make the best decisions for their own careers.

## OVERVIEW

The seminar series is comprised of four individual seminars entitled “Graduate Study in Engineering: To Go or Not to Go, That is the Question”, “Helping Engineers Prepare for the General Graduate Record Exam (GRE)”, “Approach and Helpful Hints on the GRE Engineering Exam” and “Strategies for Applying to National Fellowship Programs”. These are given at Purdue during the Tuesdays and Thursdays of the third and fourth weeks of the fall and spring semesters. The seminars are ordered with the most general target audience first and the smallest target audience last. The initial seminar provides a general overview of graduate studies, and funnels students to the other seminars on the GRE, the GRE engineering exam and national fellowships. All the seminars involve overhead slides and the students are given reduced copies for their reference. What follows is a more detailed description of each seminar.

### Graduate Study in Engineering: To Go or Not to Go. That is the Question!

This seminar is designed to be a general overview of graduate studies and covers motivation, selection of a university and an advisor, the application process, timetables and references on graduate schools. The format is a one hour lecture with overhead slides followed by a thirty minute panel discussion.

The main speaker for the hour lecture has in the past been a faculty member but is currently a Ph.D. student with industrial experience. The experience at Purdue has shown either can be very effective. If a student presents, it helps if that student has spent some time outside of a university environment. Since the graduate school experience is compared with industrial experience in the seminar, credibility increases dramatically if the speaker can talk about the industrial side from first hand knowledge. The student should also already have an M.S. so he or she can speak about his or her research experience and advisor relationship.

The lecture is split into sections, with the first section addressing motivation. Here the pros and cons of graduate school are addressed. The presentation is designed to help students clarify their future goals by addressing concerns rather than just trying to convince them to attend graduate school. An effective icebreaker is to have the audience generate reasons why they would or would not attend graduate school.

The second section helps the students identify schools that might meet their needs. This needs to be broader than simply an advertisement for Purdue’s, or any other institution’s, graduate program. Here the students are told how the selection of the advisor, as well as the school, plays an important role in the decision process. The students are given sample lists of questions to ask a potential advisor and current graduate students.

After this, the students are stepped through the application process. The presentation shows that most of the process is straight forward and provides general suggestions for enhancing applications and gaining reference letters. Detailed suggestions are given for the statement of purpose which tends to be a point of confusion for many students.

Suggested timetables for the students are included. These have been very well received and student comments have shown that these prompt them to begin the process of applying or looking into fellowship



opportunities early. General references of national and regional resources are also included. A list of the department contact-people at Purdue is also provided.

-At the conclusion of the lecture portion, a panel of about five graduate students field questions. This informal portion of the presentation has been very well received. The key to effectively reaching a diverse audience is to have the panel include people the audience can relate to. This means the panel should be diverse by gender, ethnic background, discipline and future career plans. Having a faculty member available is also very helpful during the questioning. The panel members stay after the presentation to answer questions individually and offer a personal touch which makes the audience more comfortable with the entire process.

### Helping Engineers Prepare for the General Graduate Record Exam (GRE)

The second seminar in the series covers the GRE general exam and provides students with strategies for improving their scores. This is also targeted at students in the general student body who are interested in graduate study. The format is a one hour lecture given by a graduate student. While any graduate student who has taken the GRE could present this, someone who had studied from a GRE review course or used one of the GRE review books would have valuable experiences to share.

The seminar begins with a general overview of the GRE. It covers the scoring, costs, schedules and students' logistical concerns. The reasons for taking the GRE are covered to make the students understand who needs to take them and why.

The seminar then moves into general test taking strategies which are collected from review references of the GRE General Exam. Specific strategies are presented for the verbal, analytical and mathematics sections. Example problems are worked to give the students a feel for the problems.

Concluding the seminar is a summary of the tips. The importance of early planning and test preparation are stressed and can not be overemphasized. A list of resources for the review materials is also provided.

It should be noted that this seminar will go through a major revision with the GRE changing format. The new format will include a larger number of sections covering a wider range of topics. The students should be made aware that there will be a change so that they can properly prepare.

### Approach And Helpful Hints On The GRE Engineering Exam

The third seminar is on the Engineering Subject Exam of the GRE. The format is similar to the general GRE using a lecture format and overhead slides. The presenter is a graduate student who has taken the GRE Engineering exam. As with the previous seminar, a student presenter should be one who had used preparation materials before he or she took the test so that they could speak from first hand experience.

The target audience is smaller than the other two since the national fellowships are the main reason for taking the exam. The seminar begins with an explanation of who needs to take the exam and why. General test taking tips and strategies are reviewed. Each of the 11 subject areas is highlighted and a problem is worked in all 11. Strategies for each section are presented.

Concluding the seminar is a list of references the students can consult for review materials. The future of the test is also covered. As with the general GRE, the test is going to go through a change of format and



would require a change in the seminar. The new format will allow participants to choose questions in their specific discipline. This information should be communicated to the students so that they can properly prepare.

### Strategies For Applying To National Fellowship Programs

The last seminar is again targeted at a smaller audience, those who are interested in applying for the national fellowships. The format for this seminar is an hour and a half lecture with overhead slides. The faculty member who presents this is a former reviewer for the NSF graduate fellowships. Obviously the presenter does not have to be a former reviewer and could even be a student who had received a national fellowship if he or she were given additional information and support.

The seminar leads off with why to apply for the fellowships and where to find them. The opportunities and resources available are reviewed with the students. Typical application materials are presented followed by methods to enhance their chances of obtaining a fellowship. Actual applications from previous students are used with permission and critiqued during the seminar. Copies of reviews can be requested from NSF by former fellowship winners and these are used during the seminar as well. The names of the students are removed from all materials. This is where a former reviewer can add a lot since he can add the reaction of reviewers to different styles and examples which is a great benefit to the audience.

Concluding the seminar is summary of the evaluation process. Data is also shared from previous years on the number of winners by disciplines. The goal is to motivate those students who meet the qualifications to apply by showing them that students in their field do actually win these types of fellowships.

### Single Graduate Seminar

Some schools may not want to host four seminars. A single seminar format is available on the ASEE web page. This seminar includes the entire first seminar. The remaining three seminars are summarized in one or two slides. These slides contain the dates for the exams and fellowships and the resources where students can go get more information. For the GRE tests, these are the review books and for the fellowships, they are the places to get application materials. The review strategies and specific information are left out.

Another format which has been used at Purdue is when a single, thirty minute seminar is desired. The above seminar can be modified to meet this by taking out the details of applying to graduate school. What remains is the motivation and lists of resources to go to for more information. This makes a good introductory talk and can motivate students to attend the entire seminar when presented or to investigate it further themselves.

## **STUDENT EVALUATION**

At each of these seminars students sign an attendance sheet which provides a valuable database for the graduate school contacts of each department. The students also fill out seminar evaluations. Two of the questions asked the attendees to rank their knowledge of graduate school before and after the seminar. The averages of the responses for the seminars given in the 1994-1995 academic year are shown in figures 1 and 2. They show that while the initial understanding of the student body was low for all four topics. The post-seminar ratings show that the seminars significantly raised this understanding. The numerical and qualitative answers to the questions show that the seminars are a very effective means of educating undergraduates on graduate studies. Student comments show that many are planning to take the GRE in the spring of their junior



year and begin the process early. Several other comments indicated that students who had not planned on graduate study began to explore it as a possibility.

-Another means to measure the success rate is in winning results. In 1995 Purdue students won 11 NSF graduate fellowships which placed Purdue third nationally. This is more evidence that the seminars are benefiting the students.

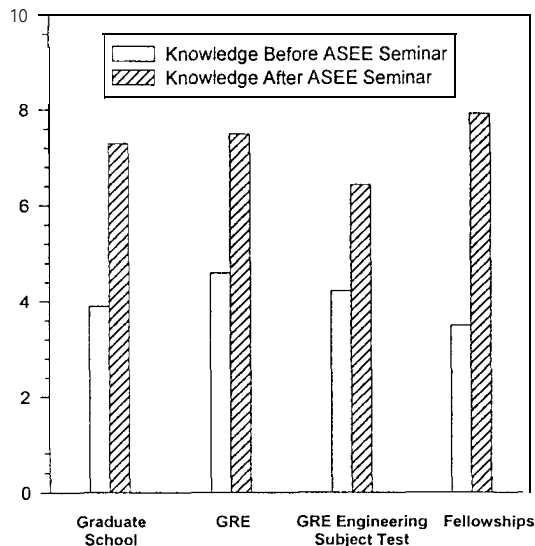


Figure 1: Student Evaluation Results, Fall 1994

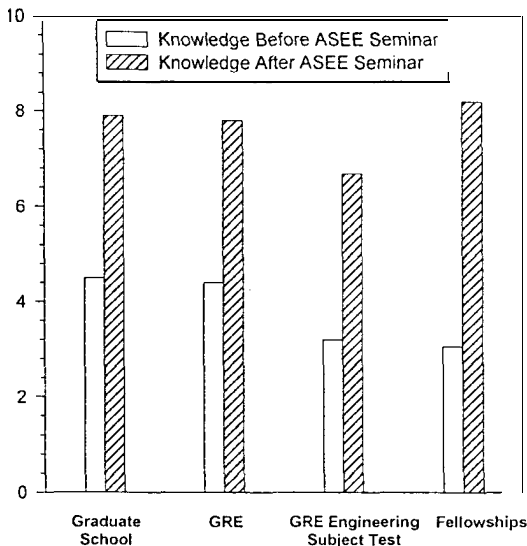


Figure 2: Student Evaluation Results, Spring 1995

## LESSONS LEARNED

There can be many problems associated with advertising, organizing, and coordinating four seminars each semester. The Purdue seminars are advertised four ways. First, the students are contacted electronically using email and a message of the day on the computer network. Emailing all juniors and seniors is the most effective way of reaching them all since most of them have accounts by then and are using them for classes. Fliers are also posted in all engineering buildings. Figure 3 shows a sample of a summary flier. Individual fliers for each seminar are also used. Announcements made in key junior and senior classes are effective too. The last method is individual invitation which is especially key for the last two seminars. Many students who are eligible for national fellowships may not think so or may need that extra push to get them there.

Coordination of the individual departments is sometimes difficult. Some departments may have their own graduate review. A centralized information seminar is a powerful tool which can aid the individual departments with some coordination. It is worth being patient and tying the departments together to reduce redundant work and to utilize the combined resources of the institution. It also makes quite a positive impression on the student to see a large number of their peers interested in a graduate school seminar as opposed to a small number from an individual department.

During the past year we have been using an extra enticement of pizza and soft drinks at the start of the seminars. The response, as expected, to free food for college students has been very positive. This is



# Thinking About Graduate School?

**Graduate Study in Engineering:  
To Go or Not to Go, That is the Question!\***

Speaker: Bill Oakes

Topics:

- Advantages and drawbacks of graduate school
- Basic entrance requirements
- Considerations in choosing a school
- Financial aid opportunities
- Suggestions on how to enhance your application
- Recommended timetable
- Resource materials

When: 6:00 - 7:30 p.m., Tuesday, January 23, 1996

Where: ME 161

\* Sponsored by the Purdue Student Chapter of the American Society for Engineering Education. All engineering disciplines are welcome.

\*\*\* Free pizza and drinks will be provided \*\*\*  
(through a grant from the GE Foundation)

**Helping *Engineers* Prepare for the  
General Graduate Record Exam (GRE)\***

Speaker: Ed Berger

Topics:

- Test taking strategies  
(based on the Princeton Review - Cracking the GRE)
- "Intelligent Guessing" techniques to increase your probability of guessing your way to a correct answer
- Description of how the exam is written and how to use this information to your advantage
- Problem solution methods for each of the English, Math, and Logical Reasoning sections

When: 6:00 - 7:30 p.m., Thursday, January 25, 1996

Where: ME 161

\* Sponsored by the Purdue Student Chapter of the American Society for Engineering Education. All engineering disciplines are welcome.

\*\*\* Free pizza and drinks will be provided \*\*\*  
(through a grant from the GE Foundation)

**Approach and Helpful Hints on the  
GRE Engineering Exam\***

Speaker: Linda Blevins

Topics:

- Test taking strategies
- Time management
- Process of elimination techniques
- Type of questions to expect
- Solved problem in each topic

When: 6:00 - 7:30 p.m., Tuesday, January 30, 1996

Where: ME 261

\* Sponsored by the Purdue Student Chapter of the American Society for Engineering Education. All engineering disciplines are welcome.

\*\*\* Free pizza and drinks will be provided \*\*\*  
(through a grant from the GE Foundation)

**Strategies for Applying to National  
Fellowship Programs\***

Speaker: Jim Jones

Topics:

- How to write a successful fellowship application
- How to access applications of previous fellowship awardees
- Methods of enhancing your chances of winning
- Resources to locate appropriate fellowship programs
- Evaluation criteria by which you will be judged

When: 6:00 - 7:30 p.m., Thursday, February 1, 1996

Where: ME 261

\* Sponsored by the Purdue Student Chapter of the American Society for Engineering Education. All engineering disciplines are welcome.

\*\*\* Free pizza and drinks will be provided \*\*\*  
(through a grant from the GE Foundation)



Figure 3: Sample Flier for All Four Purdue Seminars



something that is recommended if the funding can be secured. While the funding required is not large, it can go a long way in helping to get students to the seminars. Therefore, pizza and soft drinks are a good investment.

The timing of the seminars has worked very well. By the third week of the semester most student groups have had their organizational meetings or callouts so conflicts are reduced. It is important to have the seminars early in the semesters to give the students time to act on the information. It is also important to have them each semester if your institution has a co-op program. Otherwise those on the wrong rotation will be missed.

With proper planning and organization, an undergraduate seminar series like the one presented here can be successful in educating students at other institutions or conferences. Understanding the culture at a given institution and adapting to that is a key element to being successful.

## CONCLUSION

A series of seminars has been developed at Purdue which has proven to increase student knowledge levels in graduate school, the GRE's and national fellowships. Student evaluation forms show that many undergraduates have an unclear picture of what graduate school is and how it would benefit their careers. The data shows that the seminars significantly increase the students understanding. Coordinating the individual departments, selecting speakers, advertising and recruiting students to attend are some of the obstacles overcome at Purdue to produce a successful series of four seminars held each semester. Understanding the culture at a given institution and adapting accordingly is critical to conducting a successful seminar series.

The seminars could also be a powerful way to promote women and minority interest in graduate school by presenting the talks at national or regional conferences of Society of Women Engineers (SWE), the National Society of Black Engineers (NSBE) and the Society of Hispanic Professional Engineers (SHPE). A version of the first seminar was presented at the SWE Region H Conference which was held at the University of Wisconsin at Madison this past year. Fifty-eight students representing 18 universities and 14 majors attended the seminar, which received a very positive response. Such seminars could be replicated at other conferences as an effective means of outreach.

Copies of the overhead slides used at Purdue have been placed on the internet and are available on the Purdue ASEE web page at <http://widget.ecn.purdue.edu/-asee>. They are designed to be adapted and used by other institutions or organizations.

## ACKNOWLEDGMENTS

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## BIOGRAPHICAL INFORMATION

William Oakes is a Ph.D. student in Mechanical Engineering at Purdue University and a student member of ASEE. He received both his B. S.M.E. and his M.S.M.E. from Michigan State University in 1985 and 1987, respectively. He is currently on an educational leave of absence from GE Aircraft Engines in Cincinnati, Ohio until he completes his Ph.D. in Mechanical Engineering which he anticipates will be in the summer of 1997.

Linda Blevins is a Ph.D. student in Mechanical Engineering at Purdue University and a student member of ASEE. She received her B.S.M.E. from the University of Alabama in 1989 and her M.S.M.E. from Virginia Tech in 1992. She anticipates receiving her Ph.D. in Mechanical Engineering in August of this year..

Ed Berger is a Ph. D.. student in Mechanical Engineering at Purdue University and a student member of ASEE. He received his B.S.M.E. and his M.S.M.E. from Penn State in 1990 and 1992, respectively. He anticipates receiving his Ph.D. in Mechanical Engineering in May of this year.

Jim Jones is an Associate Professor in Mechanical Engineering at Purdue University. He is a member of ASEE and the faculty advisor for the Purdue Student ASEE Chapter. He received his B.S.M.E. from Tennessee Tech in 1981. He received both his M.S.M.E. and Ph.D. in Mechanical Engineering from Virginia Tech in 1982 and 1987 respectively.

