

GRADUATE SEMINAR AS A VEHICLE FOR INDEPENDENT RESEARCH

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Abstract -- This paper describes the personal experience of this professor in conducting a graduate seminar class, the primary purpose of which is to provide a vehicle within the graduate curriculum for students to engage in independent research. This paper describes the format and processes employed during the course which have proven successful in ensuring that students fulfill the course requirements and the objectives of their research projects.

Index Terms – Graduate seminar, independent research, professional growth, collaboration with industries.

INTRODUCTION

The evening Engineering and Computer Science Graduate Program at Loyola Marymount University is designed to accommodate working professionals who wish to obtain the graduate degree in a part-time basis. These students often pursue their degrees under their company's continuing education program. As such, the evening Graduate Program is not just opportunity to pursue theoretical interests, but also practical applications.

The Graduate Seminar is the terminal class that may be taken by graduate students in the Graduate Program in the Department of Electrical Engineering and Computer Science. It is a project-based seminar in which students are required to select, research, write about, and discuss a subject of current interest to computer scientists and electrical engineers. The objectives of the class are:

- To train students to perform independent research under the guidance of a faculty member;
- To provide students the opportunity to sharpen their technical communication skills by periodically giving oral presentations, submitting written progress reports, and composing a formal final written report and presentation to the department faculty;
- To broaden the students' technical background and awareness of contemporary issues through group discussions of the different research projects of seminar participants and through their required participation in meetings or conferences given by IEEE, ACM, or other professional groups;
- To further promote research and communication skills by encouraging students, upon finishing the seminar, to write (often with the help of their technical advisors) and

submit a formal paper for possible publication in a professional journal or presentation at a technical conference.

The tangible work in this class consists of the written reports and the oral presentations. Students are graded on the technical content of their written reports, progress made during the semester, communication skills demonstrated in the oral and written presentations, and on their participation in group discussions.

FORMAT AND PROCESSES

The class is open only to students who will graduate in the current semester whose grade point average is above 3.0 and who have met, or will have met after completion of this seminar class, all other graduation requirements. In addition, if the student elects to take the seminar concurrently with one or more other classes, the student must have the permission from their academic advisor.

Before the semester begins, prospective students of the Graduate Seminar are informed that they will be required to hand in a written research project proposal on the first day of class. Thus, students must do a significant amount of work in advance of the actual seminar. Students are told to select one subject as their seminar research project. It may be a hardware problem, a software problem, an in-depth study of a subject, a new development, or an extension of a subject the student already knows. The students are also informed that one of the faculties from the Department of Electrical Engineering and Computer Science must agree to be the student's seminar advisor during the semester. In some instances, part-time instructors from local industry who are experts in the selected topic may act as co-advisors to the students in certain research projects. The students must discuss the objective, scope and depth of their proposed research projects with their advisors, who must sign the written proposals that are to be turned in on the first day of class. Students are encouraged to see their advisors often during the semester, optimistically every week. The final grade in the seminar depends in major part on the advisor's evaluation of the student's progress.

The Graduate Seminar generally meets ten to twelve times in the semester. Students give four former presentations over the course of the semester: a project proposal presentation on the second meeting of class, two

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project progress presentations and the final project presentation. The final project presentation is presented to the full electrical engineering and computer science faculty, faculty from other departments and occasionally guests from families and industries. Presentations are approximately 15 to 20 minutes, with the exception of the final presentation, which is 40 to 45 minutes long. Students are required to use vu-graph or PowerPoint for their oral presentations. Presentations are followed by a question and answer period as well as by comments and critique of both technical content and communication skills. A written report is due on the day of every oral presentation. This report summarizes the research results and progress to date, as well as next steps. Students are referred to various books on how to design clear and effective visual aids and how to write clear and concise technical papers [1-4].

In class meetings when no project presentations are scheduled, the seminar focuses on informal discussion of various issues and problems raised by students' projects. Videos in wideband communications, supercomputer, fiber optics and high-speed modems have been used to introduce students the current engineering interests. During these general class discussions, students also fulfill the other seminar requirement that students give a written summary and an oral meeting report of at least one professional meeting attended given by IEEE/Computer, ACM, or other professional societies or groups.

Although the number of students who may elect the Graduate Seminar is not limited, class size of the Graduate Seminar generally ranges between five to eight students, mainly due to the advanced nature of the format and content of the class. In semesters when more students select the seminar, the class is split into two sessions for formal presentations, and more than twelve meetings are required in the semester. The final project presentations are usually a daylong event that concludes with an informal get-together with all the participating students and the faculty. The seminar is offered both fall and spring semesters and is conducted by a single instructor.

The final grade depends on how successful the student's project was and the technical content of the final written report (50%), the progress and participation in classes as monitored by the instructor and advisor (25%), and the evaluation of the final oral presentation by all the attending departmental faculty (25%).

ANALYSIS AND DISCUSSION

Collaboration with Local Industry

The Graduate Seminar was conceived and designed primarily to provide graduate students with training in communication skill and independent research experience. Although these

skills are highly desirable, local industries often do not have sufficient resources to support the further development of these skills in the working environment. Indeed, quite a few of the research projects pursued were work related and were encouraged or suggested by the students' management, but were projects for which the company did not have the budgetary and scheduling resources to support at work. As a consequence, the research performed and the training obtained in the seminar class not only satisfies the students' graduation requirements but also served to satisfy, in part, the research needs of local industries.

Team Teaching

The Graduate Seminar has both a full time instructor, but has evolved to require that students find a faculty as their technical advisor. This is necessary, as it soon evident that it was too much burdensome for a single instructor to act as every students' advisor given the breadth and diversity of research projects proposed by the seminar participants, especially when a seminar is particularly well subscribed. There have been instances, for example, when as many as 8 or 10 students attend the seminar. An added benefit of this team teaching effort between instructor and advisor is that the seminar gives the students as close to one-on-one instruction as possible within the university setting. A substantial amount of one-on-one interaction occurs between advisor and student at every step. The advisor not only is consulted in the beginning on the proposed project, but also must have reviewed every one of the student's oral and written presentations. The advisor discusses the student's progress with the instructor and suggests a grade for the technical content of the research project. Indeed, a key factor in the seminar's general success in ensuring participants satisfactorily and promptly complete their research projects is the important role the advisor plays in leading the student in the right direction when they encounter obstacles during the course of their research project.

Exposure and Networking

Several IEEE professional societies and ACM are routinely hold their technical meetings at universities such as UCLA, LMU or at nearby companies such as TRW, Aerospace Corporation, and LA Department of Water and Power. Graduate Seminar students are required to attend at least one meeting during the semester and give a report in the discussion sessions on the material learned. Students are also encouraged to join IEEE or/and ACM for many of their professional benefits. In so doing, students gain an opportunity to interact with their professional peers, and to make contacts with experienced engineers for their

professional growth. The students are also encouraged to write a formal paper for possible presentation to a conference or for publication in a professional journal once they finished the seminar class. Many times, the publication of the research results is the student's first publication experience. Finally, the connection between the advisor and the student established through the seminar and the arduous writing process often endures long after the student graduates. On occasions, it has developed into future research and publication collaborations.

Pitfalls to Avoid

Time Constraints: Students in the fall seminar generally have better results because they generally use the summer months to get a head start on their research. To do any meaningful and satisfactory research in one semester usually requires that students start planning the project in previous semesters, take only the seminar class in the semester, and work extra hard. Students who are not able to do the above usually fail to finish the class in time and have to postpone their work until the following semester.

In acknowledgment of these time constraints, students are told, as a precaution, that the one semester research project is not as elaborate as what would ordinarily go into a Master Degree thesis. It is stressed to students that they ensure that their chosen research topic is a topic that the student can finish in one semester with reasonable efforts. These time constraints have also led to the requirement that the student provide an initial written proposal and the requirement that the advisor sign off on the proposal. The types of research topics that have done well in the seminar setting have proven to be very well defined, concrete, and detailed, a little narrower, with set parameters, and not overly broad or theoretical in depth. Successful projects in recent years include computer simulation of a well defined communication system, study and simulation of CDMA modulation techniques, Web site design of a fabulous business, and examination of the issues raised by real time object-oriented programming.

Format Constraints: Since the majority of graduate students work in the day and the Graduate Seminar meets only once a week in the evening, the seminar format posed the potential problem that the faculty would loss control of the students' efforts and progress on the research projects. This problem, however, was minimized by the special emphasis of the one-to-one personal attention given to all of the students by the engineering faculty at LMU. The students were asked to see their advisor often, hopefully once a week before the class or during the lunch hour, to discuss issues, problems encountered, and progress made on the research topic. The students were able to effectively communicate over the telephone and through e-mail with the instructor and their

advisors. When student had legitimate reasons for missing class meetings, for example, because of business related travel, he or she was given the opportunity to make-up the oral presentation and written report in the following discussion sessions. Overall, close attention and supervision by the advisor and the instructor proved effective in reducing and minimizing the problem of students going off track in their research and of the instructor/advisor losing control over the students' progress.

Resource Constraints: Loyola Marymount University is a well-known regional university in Southern California. Its library collections are adequate but less enormous in comparison with some of the research universities, such as the Universities of California, especially in engineering subjects. Fortunately, LMU has an inter-library loan agreement with UCLA, where students from LMU have the full privileges to UCLA's library collections. Students can either sign a request at the LMU library and get the material the next day, or go to UCLA to browse through the materials and check them out locally. Furthermore, many local industries have sizable technical library to which some students were able to gain access through work affiliation. Consequently, it appears that the more limited collections in engineering subjects at LMU have not been an obstacle in students' efforts to research fully their chosen topics. With little extra efforts, students have been able to obtain the references they need from multiple sources.

CONCLUSION

Through the careful evolution of its format and procedures, the Graduate Seminar at LMU has achieved its objectives. The class is well regarded by students who have finished the seminar and the overall quality and scope of research that has resulted from the course has been very good. It has proven to be among the most, if not the most, rigorous academic experience of the students in the Electrical Engineering and Computer Science Graduate Program. And it has provided students with an opportunity to conduct independent research that they would ordinarily not have had otherwise, either in their academic or professional pursuits. An added benefit has been the contribution the seminar class has made to enhance the cooperative and collaborative relationship between the College of Science and Engineering at LMU and the local industries for which many graduates work. In short, the experience at LMU demonstrates that the seminar format can play a valuable role in the engineering and computer science graduate curriculum by providing students with a vehicle for conducting independent research.

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