

NEW JERSEY INSTITUTE OF TECHNOLOGY

RESEARCH WITH SENIOR LEVEL STUDENTS: Advantages—Disadvantages— Recommendations

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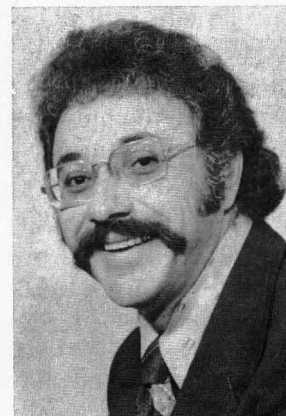
NEW JERSEY INSTITUTE OF TECHNOLOGY (NJIT) is in a period of transition: from a college dedicated to undergraduate education to a technological university where research is becoming more and more a major objective of the faculty. Therefore, it does not yet have the reputation that attracts a substantial number of graduate students from other institutions. In addition, its location (Newark) is not particularly enticing. The Department of Chemical Engineering and Chemistry, where the author teaches, currently has 13 full time faculty members in chemical engineering and 20 in chemistry with a full time graduate student enrollment of about 30 and a part-time enrollment of about 100. In both groups the vast majority are M.S. students. Full time students are expected to write an M.S. theses (6 credits). This was also a requirement for part-time students until 1975, but now they are only required to write an M.S. Project (3 credits).

Seniors with a GPA of 3.0 or above (maximum 4.0) can register for ChE 491 and 492, each worth 3 credits, to satisfy two of the required

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technical electives. The title of the course is "Independent Research and Study." Considering the limited availability of graduate students for research, seniors represent a significant resource for the research efforts of the faculty (especially its junior members).

Advantages and disadvantages of the research effort with seniors will be described in this paper, based mainly on the experiences this author has



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had with about 15 students. A five year program leading to the B.S. and M.S. degrees, which can eliminate some of the disadvantages and contribute to the growth of the graduate program, will also be presented.

ADVANTAGES

Starting with the students, the advantages of being involved in these two courses are several and I would like to identify two that I consider to be the main ones; introduction to the exciting world of research, and personal contact with the faculty.

The heavy undergraduate course load (along with the continuously expanding content) substantially limits the amount of time that can be spent in the classroom discussing current research efforts in each field. As a result the students do not develop an understanding or an appreciation of how research advances the frontiers of the profession. And here lies the major (perhaps) advantage of these two research courses. They introduce the student to the exciting world of research. As one of my students observed: "Doing research gives you the feeling of being involved in the frontiers of chemical engineering, not in

what was developed a hundred years ago.”

In addition, as class sizes increase (as a result of the sharp expansion of chemical engineering enrollments and the reluctance of state legislators to provide additional financial support for the hiring of new faculty members) these two courses represent the only opportunity for students to interact with faculty members on a person-to-person basis.

For the faculty, the advantages are also several. The seniors can provide invaluable help in the initiation of projects; they can participate in on-going projects; or they may work on individual problems that with proper planning and supervision (and somewhat extraordinary effort on behalf of the student) can lead to publications (three in the case of this author). We should not forget that in many cases seniors represent the only research assistance available to junior faculty members, especially in the first and second year of their career. Finally the aforementioned advantages for the students also apply to the faculty member. He shares their excitement about research and through his personal contact with the student is better tuned to the student body as a whole.

DISADVANTAGES

The seniors involved in research are expected to spend the equivalent of one three-credit course per semester time, about 8 to 10 hours per week. In addition, the heavy demand imposed on them by the other courses—especially Plant Design and Unit Operations Laboratory—and their employment seeking efforts tend to direct their concentration away from research. This lack of time and concentration, combined with a very small budget and sometimes promoted by poor supervision, can lead to incomplete or even poor results. And here lies the source of some major disadvantages in carrying out research with seniors: for the students, there is a sense of disappointment because they do not see the fruits of their efforts or, still worse, a demoralizing effect when the results are unsuccessful; for the faculty members, in addition to sharing the feelings of the students, a low return on the time they invested since the students leave when they are ready to perform the most productive work.

THE FIVE-YEAR B.S./M.S. PROGRAM

To ameliorate some of these problems and also

strengthen our full time graduate program, at least at the M.S. level, with the infusion of some of our better graduates, a five-year program leading to the B.S. and M.S. degrees was introduced at the recommendation of this author. The program can be described, briefly, as follows:

ELIGIBILITY: All students with a GPA of 3.0 or better.

DURATION: Five academic years plus the summer between the fourth and fifth years.

FINANCIAL SUPPORT: Students receive financial support, in terms of a fellowship, for the fifth year plus the summer between the fourth and fifth years.

M.S. THESIS: The M.S. thesis is a continuation of the research done in ChE 491 and 492. The students, hence, register for M.S. thesis in the summer following graduation. Regular graduate students can not register for M.S. thesis until they have completed 12 graduate credits.

It is evident that ChE 491 and 492 serve a dual purpose in the five year program: They allow the student to meet the requirements of the two technical electives if, of course, they are successfully completed; and they prepare them for the M.S. theses work. However, in spite of this preparation we have found in our limited experience with this program (it only started in 1978) that the summer following the fifth year is often needed for the successful completion of the M.S. program. Finally, the program suffers (but to a lesser degree) from the same problem that afflicts graduate enrollments: the small salary differential between the B.S. and M.S. degrees (typically about \$1500 per year) leads the student into quitting the five year program and accepting an industrial position. This problem is, unfortunately, often exacerbated by many industrial recruiters who attempt to persuade the students that a M.S. degree is of no value to their professional career.

CONCLUSIONS

It appears that research with seniors can be rewarding for both faculty and students, especially if the project is carefully chosen and continuous supervision is exercised. In addition it often represents the only source of research assistance available to junior faculty members. However, it may also lead to problems in terms of low return on the faculty member's effort, and disappointment and low moral for the students.

The proposed five year program, leading to the B.S. and M.S. degrees, can eliminate some of these problems while strengthening the department's graduate program. □