

AC 2007-903: CONCURRENT B.S./M.S. PROGRAMS: A METHOD TO INCREASE GRADUATE ENROLLMENTS AND ATTRACT TOP STUDENTS TO GRADUATE STUDY

Bradley Kramer, Kansas State University

Dr. Kramer is the Department Head for Industrial and Manufacturing Systems Engineering and the holder of the Ike and Letty Evans Engineering Chair.

Todd Easton, Kansas State University

Dr. Easton is an Assistant Professor in the Department of Industrial and Manufacturing Systems Engineering at Kansas State University.

Concurrent B.S./M.S. Programs: A Method to Increase Graduate Enrollments and Attract Top Students to Graduate Study

Abstract

Many universities face declining enrollments in their graduate programs due to a reduction in the number of international student applications and the increased cost of educational programs. This paper presents the concurrent B.S./M.S. degree that has been developed in the Industrial and Manufacturing Systems Engineering department at Kansas State University. The recently created integrated program has significantly increased the number of top undergraduate students who are choosing to attend graduate school in this program. This paper documents the program and shares some of its benefits. Some data are provided to demonstrate the success of this program for both the department and the students.

1. Background

The Industrial and Manufacturing Systems Engineering (IMSE) department at Kansas State University (K-State) offers a B.S. in Industrial Engineering, M.S. in Industrial Engineering, M.S. in Operations Research, Master of Engineering Management, and a Ph.D. in Industrial Engineering. Over the past five years, the program annually graduated 26 B.S., nine Master's, and two Ph.D. students each year (averages). There are ten members of the K-State graduate faculty in the department who typically teach four courses each year. The undergraduate degree is ABET accredited and the university is accredited by the North Central Association of Colleges and Schools of the Higher Learning Commission.

2. Introduction

The number of foreign graduate students studying in the U.S.A. has plummeted in recent years. Around the world international students have more options for graduate study than they ever had before. Today many international students find it less important to obtain a graduate education in the U.S. and prefer to pursue a degree closer to home. Furthermore, in today's "flat world" foreign countries offer many more challenging and rewarding jobs.

This phenomenon is of sufficient concern that MSNBC has provided headlines that describe this drop in foreign applications and why it is important¹. Some of the reasons that this phenomenon is occurring are described by Krupnick² and include:

- Excellent job opportunities in the students' home countries.
- More universities offering respected advanced degrees in the students' home countries.
- The U.S.A.'s stricter visa rules (post 9/11).

In addition, the financial burden for an international student to study in the U.S. makes it less attractive for international students to travel to the U.S. for graduate study. As an example, the amount of financial resources that an international student must be able to document in order to

obtain an I-20 to study at K-State has more than doubled over the past 10 years. For example, an international student must show that they have financial resources exceeding more than \$20K/year in order to attend K-State today. Many exceptional international students cannot document substantial funding with which they can support themselves in college. Consequently, the sponsoring department must either offer these applicants the balance they need for support as an assistantship or deny them the opportunity to study in the program. Due to the high cost of an assistantship, very few foreign graduate students are offered assistantships to study for their Master's degrees in the IMSE department at K-State.

For several years, the K-State IMSE Department has been severely impacted by a dramatic drop in foreign students pursuing graduate degrees. Prior to 2001, the department regularly received more than 200 foreign applications (complete applications) a year for our graduate programs. In 2001, for example, we received 229 complete applications for our Master's and Ph.D. programs from foreign applicants. Up to that time, our department typically hosted more than 50 foreign graduate students at any given time. In 2006, the IMSE department only received 70 applications from foreign students for our graduate programs. Currently, the IMSE department has around 20 foreign graduate students in departmental programs. This drop in our graduate student population creates a huge problem for the faculty to fill graduate courses and to successfully complete its research mission. Furthermore, the decreasing foreign enrollment problem described by MSNBC is nearly impossible for a single department to combat.

In addition to the problem of reduced applications from foreign graduate students, our department also struggled to attract domestic students. This problem was described in the February 13, 2006 recent issue of Time magazine in the cover article titled "Is America Flunking Science." This issue describes why fewer domestic students are pursuing graduate degrees³. Furthermore, Kuo⁴ states that fewer students are studying traditional engineering fields, such as Industrial Engineering and even fewer are pursuing graduate degrees.

To rebuild our on-campus graduate enrollments, the K-State IMSE department developed a Concurrent Bachelor of Science/Master of Science in Industrial Engineering degree (Concurrent B.S./M.S.I.E.). This program is the first of its kind in the K-State College of Engineering. This concurrent degree has quadrupled the number of domestic students that are pursuing graduate degrees. This paper describes the establishment and success of this degree.

3. Establishing A Concurrent B.S./M.S. Degree

The quickest and lowest cost way to replace the declining foreign graduate enrollments was to recruit from within the department. There are some substantial departmental advantages that occur when one of its undergraduate students stays for a graduate degree. For example, we have outstanding undergraduate students, many of whom have earned prestigious national scholarships. These students are known to us to have sufficient background to excel at graduate school and do not need to include deficiency make-up courses in their graduate program. In addition, these students know the department faculty and their research and so selecting an appropriate advisor is accomplished early. Faculty members also know the brightest students in their courses and can actively recruit them into their research groups. It is important to note that this recruitment can occur early during the student's academic career, which allows substantially

more time for research than a traditional master's degree student. In addition, a recruited domestic student can be paid far less than the \$20,000+ required to support a foreign graduate student on a graduate assistantship. These benefits along with others provide ample reasons for the IMSE department to recruit heavily from among our own undergraduate students.

Unfortunately, prior to the existence of the Concurrent B.S./M.S.I.E. degree, there was little reason for domestic students to seek a graduate degree from the IMSE department. For starters, the average starting K-State M.S.I.E. salary was less than 2% higher than the starting salary of a B.S.I.E. The authors believe that this small increase in salary was a result of the nationality of the degree recipients and not necessarily based upon the degree attained. Second, other universities had equivalent programs and the students could seek an alternate exposure to the discipline by pursuing a degree at another school. Students can also choose to earn a graduate degree from a growing number of excellent distance programs where a student can simultaneously hold a full-time job and pursue a master's degree (usually with the support of their employer).

Consequently, between May 2000 and May 2005 only three undergraduate students from the IMSE department received an on-campus master's degree from the IMSE department (approximately ½ students per year). In addition, only three other students went directly to other universities to pursue research graduate degrees (approximately ½ students per year). In aggregate, these numbers can be combined to state that only one of our B.S. graduates pursued a graduate degree every year – or approximately 4% of our graduates directly pursued a research graduate degree directly upon completing their baccalaureate degree.

To successfully recruit top undergraduate students into our research graduate degree programs there had to be some increased benefit for the student to stay for graduate school. Our strategy was to provide two significant benefits to our students: challenge our top students with problems that piqued their interest, and entice them with the opportunity to reduce the time it takes to earn a Master's degree by enrolling them early into the program.

4. Basis for the K-State Concurrent B.S./M.S. Degree Program

An interesting fact is that many of IMSE's upper division classes could be taken for either graduate or undergraduate credit. In fact many such classes have both undergraduate and graduate students in the same class with the graduate students required to perform some additional work.

It seems natural that an exceptional student should be able to take one of these courses for graduate credit and have it count toward both their graduate and undergraduate degrees. Thus, a student would benefit by a decreased number of classes that a student must take to graduate with both a B.S. and an M.S. degree. However, the K-State Graduate Handbook⁵ states: "No graduate student may use credit from the same course in meeting the requirements for both an undergraduate and a graduate degree."

Hidden in the last section and second to last paragraph of the Masters Degree Section of the K-State Graduate Handbook was the exact answer to this dilemma of counting classes toward both

degrees. The section involves Concurrent Bachelor and Master's degrees. It should be noted that at K-State a concurrent degree is a special degree and in most cases a student graduates with both a bachelor and master's degree in the same semester. The K-State Graduate Handbook⁵ reads:

“Graduate programs are invited to develop program specific guidelines for recruiting current undergraduates into the Concurrent Degree Program and for guiding students admitted to the program. ... Should there be deviations (for example, should the program request that certain graduate coursework be also applicable to the undergraduate major), these will require approval at the college, Graduate Council, and Faculty Senate levels. One deviation from the standard programs may be the possibility that a limited number of hours taken for graduate credit can be applied to the Bachelor degree (not more than 9 hours).”

This single paragraph allowed the IMSE Department to create the Concurrent B.S./M.S.I.E. degree, which allows students to count up to 9 hours of IMSE graduate courses toward their undergraduate degree requirements. This new degree program provides sufficient benefit for students to stay at K-State and complete a graduate degree in the IMSE department.

By allowing 9 hours of graduate credit to count toward the undergraduate degree, the concurrent B.S./M.S.I.E. can theoretically be accomplished in 5 years. In actuality, the B.S.I.E. degree typically takes slightly under 4 ½ years. This then allows nearly all students to complete the Concurrent B.S./M.S.I.E in only an extra year (5 ½ years).

To help assure that the students were not missing out on some vital information by taking fewer courses, the department faculty decided to only allow students with more than eighty credit hours who have earned a cumulative GPA greater than 3.25 (K-State uses a 4.0 scale) to apply for the concurrent B.S./M.S.I.E. program. Thus, students who had not demonstrated sufficient mastery of their undergraduate courses would be required to complete the B.S. degree prior to being admitted into the M.S.I.E. degree program.

There is also a financial benefit for the department to fund Concurrent B.S./M.S. students. Since the degree only requires an additional year, the students only expect to be on a GRA/GTA for a year, which is shorter than the 1 ½ to 2 years that it takes for a foreign graduate student to earn an M.S. degree in our department. In addition, concurrent B.S./M.S. students write and speak fluent English, have taken the departmental classes and make excellent graders and teaching assistants for departmental classes.

5. Program Status

The student response to this new Concurrent B.S./M.S.I.E. has exceeded our expectation. The first batch of 5 students will graduate in May 2007. There are 2 more students who should graduate with their degrees by May 2008 and another group of 5-7 students that should be graduating in May 2009. During the next three years, we expect four domestic students per year will complete a graduate degree. This is a four fold improvement over the previous 5 year average. When isolating the numbers to domestic students who complete a graduate IMSE

degree from K-State, the improvement is eight fold. The reader should also note that the number of our concurrent B.S./M.S. graduates over this period will constitute 16% of the number of total baccalaureate degrees we expect to award in this time period.

The students have pursued the Concurrent B.S./M.S.I.E degree for various reasons. Some students just wanted to remain a student for a longer period of time. Others couldn't pass up to opportunity to receive a master's degree in an additional year. (In one exceptional case, the student had two six hour semesters to receive an undergraduate degree and so the concurrent B.S./M.S.I.E. only took an additional semester.) Other students just enjoyed the research they had begun as an undergraduate honor's student and decided to continue the research and to earn a graduate degree.

Our program does not require that students complete a thesis for graduation. Each student has the option of choosing to complete a course-work only program of study. However, the department has a policy of only supporting students who are conducting thesis research on teaching and research assistantships. Thus far, every student who has joined the program has chosen the thesis option.

Besides increasing the graduate enrollments, the department has been dramatically impacted by these students. Of the 12 students pursuing the concurrent B.S./M.S.I.E. degree between 2007-2009, nine of them have cumulative GPA's over 3.7 and six have cumulative GPA's over 3.9. These students are clearly the cream of our crop. All seven of the 2007-2008 concurrent B.S./M.S.I.E students will complete the thesis option. Furthermore, these students have been able to perform research with their major professor for 2 to 3 years, which has allowed/will allow them to produce above average theses.

The diversity of IMSE's graduate student population has also dramatically benefited by the development of this concurrent degree. K-State's Engineering programs are well below the national average in both females and minorities. Between 2001-2006, none of department's minority students chose to pursue a graduate degree at any institution and none of the department's female students chose to pursue a graduate IMSE degree from K-State. In contrast, of the first 12 Concurrent B.S./students, four are females and three are minorities. These three minority students represent 1/2 of all the minority students that we expect will graduate from the IMSE department over this time period.

The Concurrent B.S./M.S.I.E. students have also substantially benefited by pursuing this degree. The average starting salary for these five May 07 graduates is slightly over \$70,000, which is well above the national average for an M.S.I.E. student (approximately \$60,000) and even further above the average B.S.I.E. degree \$51,000. The students also have had an additional summer to seek internships (four of the five May 2007 concurrent students had internships during the summer of 2006 and the other one was taking classes to complete his degree). These students were able to excel at their internships because they had mostly completed their undergraduate degrees and had also taken a few graduate courses. In fact, three of the four students who had internships received offers from their internship company for over \$65,000.

6. Implementation Issues

Thanks to other programs such as accounting, architecture, etc., many universities already have a mechanism in place to allow for the establishment of a concurrent degree. However, even with this mechanism in place, substantial red tape needed to be eliminated at K-State in order for the IMSE department to create this degree. Here we document some of the major obstacles encountered so that the reader can be aware of these potential problems and avoid some red tape at their university.

One of the largest unseen problems was the total number of hours. At K-State, an undergraduate B.S.I.E. degree requires 127 credit hours and an M.S.I.E. requires 30 credit hours. Counting nine graduate credit hours toward the undergraduate degree would reduce the undergraduate program to a total of 118 undergraduate credit hours. However, the Kansas Board of Regents has a policy that each undergraduate degree must have at least 124 credit hours. To account for these extra six hours, our Concurrent B.S./M.S.I.E. degree requires six undergraduate credit hours be taken as free electives so that the undergraduate degree program includes a total of 124 credit hours. These classes are truly free electives and can include non-engineering topics such as band, art, athletic classes and even such things as courses that did not transfer. Surprisingly, the engineering college faculty provided substantial resistance to this notion of six hours of free electives.

In addition, K-State engineering faculty wanted Concurrent B.S./M.S.I.E. students to enroll in both our undergraduate assembly class and the graduate assembly class, since the students are classified as both graduate and undergraduate students. The undergraduate curriculum needed to be changed to reflect that each semester a Concurrent B.S./M.S.I.E. student must enroll in either the undergraduate or the graduate assembly and that the student must have at least a year of the graduate assembly.

The IMSE department is fairly small and elective graduate courses are typically offered once every 2 or 3 years. The department began allowing students to enroll in the Concurrent B.S./M.S.I.E. degree after the student had at least 100 credit hours. Unfortunately, this resulted in numerous letters to the graduate school to allow undergraduate students to take high level graduate courses. The department has since changed this to 80 hours (half way through the junior year) with the idea that the students will be accepted into the program before their senior year begins and the students will have two full years to intermix undergraduate and graduate courses.

Advising Concurrent B.S./M.S.I.E. students is extremely complex and should be done by the professor who is directing the thesis work. Due to the limited offering of graduate classes, care had to be taken to ensure that the students take the graduate classes to support their research and are still able to achieve their undergraduate degree. In fact, of the first five Concurrent B.S./M.S.I.E. students, four of them are taking undergraduate courses in the same semester that the student plans to defend his/her thesis. These courses range from the capstone IMSE undergraduate experience to Technical Writing and even some undergraduate general education classes.

7. Future of the Program

Our program was the first of its kind in the K-State College of Engineering. It caused considerable debate among the engineering faculty during course and curriculum procedures. Most questions were challenging whether the program met university guidelines. After successfully answering these questions, many engineering faculty member expressed support for our program and were clearly interested in duplicating the program in their own departments. The program was approved unanimously by the engineering faculty.

Furthermore, student interest in the program continues to be strong. The information we now have about the challenging positions and outstanding job offers that each of the integrated B.S./M.S. students have earned has made our recruitment of future program participants even easier. In fact, there has been enough interest that our advisors are using the 3.25 GPA (out of 4.0) grade requirement for admission to challenge interested students to higher performance in their course work so that they can earn admission to the program.

The biggest challenge we are now facing is to determine how to support all of these new students. We are currently supporting most of these students on department funds to assist faculty members with their courses. However, we foresee that the program will soon exceed our needs for these assistants. Furthermore, our departmental priority for extramurally funded research assistantships is to support Ph.D. students. Consequently, we are working to develop applied research projects that can utilize the B.S./M.S. students to work on projects for industry that support our research priorities.

8. Conclusion

The success of the Concurrent B.S./M.S.I.E. degree has been astounding from both the departmental and students' perspectives. This program has been extremely beneficial for both the IMSE department and its students. The number of IMSE undergraduate students pursuing graduate degrees has soared. Furthermore, these students are above average and have more time to conduct their research when compared to a traditional master's degree student. These qualities have led and should continue to lead to above average masters theses. The students have also benefited and have received strong job offers. This paper is written to document the results of our efforts to develop a concurrent B.S./M.S.I.E. degree program that might help other engineering department's to increase their pool of good graduate students.

References

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