

## **AC 2009-1143: BENCHMARKING DISTANCE EDUCATION IN ENGINEERING MANAGEMENT PROGRAMS**

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# Benchmarking Distance Education in Engineering Management Programs

## Abstract

Distance education is a strategic initiative that has been applied by a number of universities over the past decade. Before deploying a new distance education program, it is very important to understand the impact of such a strategic decision on the program growth. The purpose of this paper is to identify the possible impacts of distance education on both enrollment and the number of degrees granted in Engineering Management (EMGT) programs. The results of a benchmarking analysis among the top twenty EMGT programs with the highest number of degrees granted show that although programs that deploy distance education techniques might have less full-time students, a significant increase in part-time enrollment could result in an overall increase in the total enrollment and degrees granted. The paper also discusses some of the best practices used by these programs for distance education delivery techniques.

## Introduction

### *Motivation*

Based on Gibbons<sup>[5]</sup>, the number of Master's-degree students enrolled in engineering management programs doubled between 2003 and 2006, despite an overall decrease of 9% in engineering Master's enrollment. In 1999, the total engineering management Master's enrollment was about 1,767 students. In 2003, this number went further up to 2,229 and it was up to 4,625 in 2006. This trend is also supported by the continued increase in the number of programs over the past 30 years. As reported in Alvear et al.<sup>[1]</sup>, about 30 engineering and technology management programs existed in 1970s, and currently this number is over 160.

According to the Bureau of Labor Statistics<sup>[4]</sup>, the need for Engineering and Natural Science Managers is projected to increase by 8% (estimated as 14,000 people) between the 2006 - 2016 time period. Based on this projection, one can expect further growth in engineering management programs over the years to come.

Given all these good news about growth, if you are an engineering management program that did not observe any of these trends in the enrollments, you might be asking yourself, what should you be doing to get on this pleasing growth wave?

The Systems Engineering and Engineering Management Program at University of North Carolina at Charlotte has been granting MS Degree in Engineering Management over ten years. Eighty percent of the MS program's students are working professionals, whereas the rest are full-time students. It is a relatively small program with about 25-30 graduate students. Recently, distance education, specifically online learning has been considered as one of the major strategies to grow the MS program. The main question was whether

one could find evidence from existing institutions that distance education can enable the desired growth.

### *Online Learning*

Online learning (or e-learning) is a subset of distance learning where the delivery of the class material can be accomplished asynchronously, synchronously or using a blended approach of any combination of the asynchronous and synchronous methods with face-to-face interactions in the traditional sense. The interest in online learning has been growing rapidly, since it provides convenience and flexibility both in terms of location and scheduling. In other words, students can attend classes anywhere, anytime (depending on the online delivery method and technical constraints), with all the class material being available 24/7. Students usually have to participate in some kind of regular discussion about the material since that is usually part of the requirements which “forces” the students to have a better, and more frequent interaction. The students also improve their computer and technological skills as they depend on their computers for participation in the online classes. For more information about online teaching practices the reader can refer to e.g. Bender<sup>[3]</sup>.

While online learning seems to be a pathway to the future, and it seems to be beneficial to the students in many situations, it can also bring new challenges to education as well. Online classes require special infrastructure, student connectivity, and availability of technical support and help desk. The students have to have high motivation and self-discipline to participate in these online classes. Online assessment can be also difficult, and some students might also find it hard because of the lack of personal interaction. It is probably easier to misinterpret things in writing than face-to-face because of the lack of body language and tone of voice. It is also important that all the participants understand and follow the rules of “netiquette”. Another possible drawback of online classes is that some students might have a fear of technology, which probably stems from not completely understanding how the material can be efficiently delivered online. Online education is not without challenges from the educator point of view either. For example, teachers in an online learning environment not only have to understand the material very well but they need to have some technical expertise on the tools available in an online environment. In addition, online learning requires a significant amount of preparation, organization, and additional communication, especially when a new course is developed, thus brings additional work burden to the instructors.

As Alvear et al.<sup>[1]</sup> indicates, despite all its benefits, distance learning methods are supporting traditional techniques in the existing Engineering and Technology Management Programs, but not replacing them. They report that a survey conducted among 142 Engineering and Technology management programs indicated that 36% of the universities are using web delivery combined with classroom teaching.

## Scope

The main purpose of this study can be summarized as to identify whether distance/online education can enable growth in Engineering Management program. Our secondary objective is to see whether we can have an idea of this potential program growth.

## Methodology and Analysis

In order to answer the research questions, we applied a benchmarking study by researching ASEE<sup>[2]</sup> databases and university websites and complemented the collected information with surveys. For our initial analysis, we used the list of top 20 programs granting most EMGT Master's degrees as identified by Gibbons<sup>[5]</sup>. This list provided in Table 1 below considers the number of Master's degrees awarded between 2005 and 2006.

1	Old Dominion U.
2	George Washington U.
3	Missouri U. of Science & Technology
4	U. of Southern California
5	Duke University
6	U. of Michigan, Dearborn
7	U. of Pennsylvania
8	Santa Clara U.
9	New Jersey Institute of Technology
10	California State U., Northridge
11	Florida Institute of Technology
12	Southern Methodist U.
13	MIT
14	U. of Kansas
15	Colorado School of Mines
16	Dartmouth College
17	Wayne State U.
18	U. of Colorado at Boulder
19	OGI School of Science & Engineering at OHSU
20	U. of Louisville

Table 1. Top 20 EMGT Programs based on number of degrees granted in 2005-2006 (Gibbons<sup>[5]</sup>)

For the subsequent analysis and discussions reported below, we used more recent data for enrollment and number of granted degrees available from the ASEE<sup>[2]</sup>. We also checked each university's website to verify whether the EMGT Master's programs is offered under the distance education programs or not.

Table 2 below provides a summary of the 20 EMGT programs with the corresponding total enrollment and degrees awarded in their Master's programs. The last column in the table indicates whether the EMGT Master's degree is offered as part of a distance education program or not. It is noteworthy that based on the degrees rank (i.e. based on

the number of degrees granted) among the top 10 universities in Table 2, 8 of them deploy distance learning. This number decreases to 3 out of 10 for the universities ranked from 11 to 20. Note that the largest EMGT enrollment is in schools (Old Dominion and George Washington), which aggressively deploy distance learning.

2007 Degrees Rank	2007 Enrollment Rank	Institution	Masters Enrollment			Degrees Granted			Distance Education
			Total	FT	PT	Total	MS	MEM	
1	1	Old Dominion U.	327	33	294	168	5	163	yes
2	2	George Washington U.	276	76	200	162	148	14	yes
3	10	California State U., Northridge	126	70	56	94	94	0	yes
4	3	Santa Clara U.	169	30	139	91	91	0	no
5	11	Southern Methodist U.	115	5	110	77	77	0	yes
6	18	Missouri U. of Science & Technology	70	32	38	66	66	0	yes
7	9	U. of Southern California	130	42	88	62	62	0	yes
8	8	U. of Pennsylvania	134	2	132	56	56	0	yes
9	5	Duke University	155	146	9	54	0	54	no
10	6	New Jersey Institute of Technology	147	32	115	51	51	0	yes
11	13	U. of Colorado at Boulder	108	44	64	51	51	0	yes
12	14	MIT	100	100	0	51	51	0	no
13	7	U. of Michigan, Dearborn	142	1	141	49	49	0	yes
14	19	U. of Louisville	19	1	18	38	38	0	no
15	12	OGI School of Science & Engineering at OHSU	109	2	107	36	36	0	no
16	15	Wayne State U.	77	31	46	35	35	0	no
17	16	Dartmouth College	74	74	0	35	35	0	no
18	20	Colorado School of Mines	15	11	4	35	35	0	no
19	17	Florida Institute of Technology	73	25	48	25	25	0	yes
20	4	U. of Kansas	163	6	157	20	20	0	no

Table 2. 2007 EMGT Master's level enrollment and number of degrees awarded (Data Source: ASEE<sup>[2]</sup>) and whether the EMGT degree is part of distance education (Source: each university's web-site)

Further analysis presented in Figure 1 indicates that that the average EMGT enrollment in universities deploying distance education is 53% higher than the ones not deploying distance education. Also these programs that leverage distance education grant 78% more degrees per year compared to the programs without distance education.

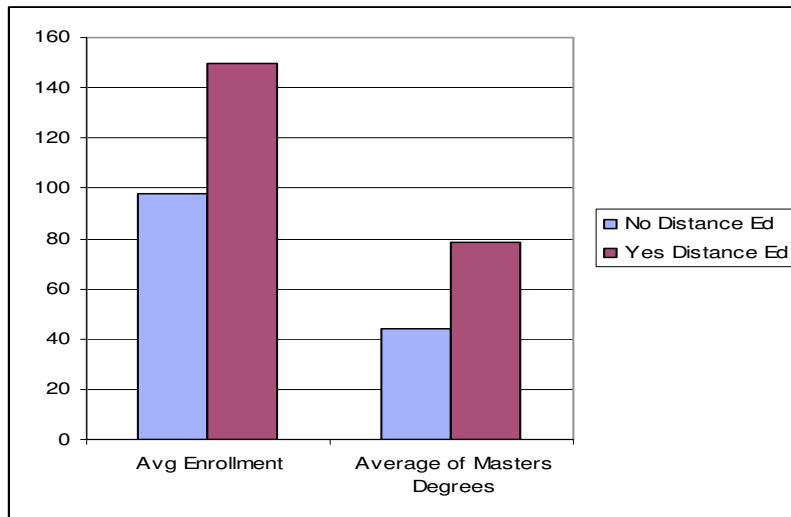


Figure 1. Average enrollment and average Master’s degrees offered in the selected EMGT programs (Data Source: ASEE<sup>[2]</sup>).

As indicated in Gibbons<sup>[5]</sup>, enrollment in EMGT programs seems to have an upward trend. Gibbons shows that that this trend is especially true in the increase of part-time enrollment. We believe that one of the main reasons for this trend is correlated with the adaptation of distance education in EMGT programs in recent years. As seen in Figure 2, the number of part-time students is significantly higher in programs offering distance education compared to the ones that are not offering distance education. More specifically, this figure indicates that in distance education programs, while the average number of full-time students is about 26% lower than the non-distance education programs, the number of part-time students is 119% higher than the non-distance education programs.

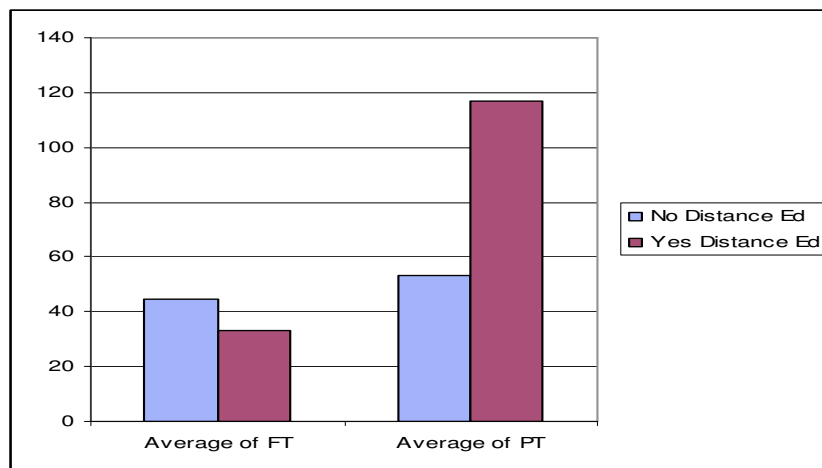


Figure 2. Average of part-time and full-time enrollment in the selected EMGT programs (Data Source: ASEE<sup>[2]</sup>).

We would like to note that while the above analysis establishes a correlation between the existence of online/distance education programs and the program size, it does not necessarily indicate whether online education is the primary catalyzing factor for the growth of a program. In order to answer this question and to understand the online learning practices at leading institutions, a survey has been designed and been administered among 70 engineering management programs in the United States. Again, our working hypothesis is that those engineering management programs that deploy distance education have a better chance to grow and have a higher enrollment compared to those without distance education programs. One of the main questions in the survey is aimed to obtain detailed enrollment information focusing on enrollment before and after the introduction of the distance/online program. Unfortunately, some of the early responses indicated some challenges collecting this data; either that some of the big distance education programs started a long time ago, so the corresponding detailed enrollment information was not available at all, or the detailed enrollment information is not readily available for them to share it. And unfortunately, some universities are also being reluctant to share detailed enrollment information. While the few responses that we received support our hypothesis, more data would be desirable to validate this hypothesis.

Part of this survey also focuses on best practices of these online programs being deployed. Here is a summary of some of these best practices: None of these surveyed programs distinguish between the online and on-campus degrees; they use the same degree name for both. Only a couple of them have separate admissions for online and on-campus students, the majority of the responding universities do not distinguish between online and on-campus programs during the admission process, and the majority of the programs mix the online and on-campus students. There are about twice as many programs using only asynchronous versus synchronous delivery methods and a few of them use both. Blackboard Vista seems to be overwhelmingly popular learning management system among the universities surveyed: about 3 times more universities use Blackboard than the runner-up WebCT (which is owned by Blackboard Inc. since 2005). Other commonly used learning management systems include Desire2Learn, WebEx, Spiderphone and eCollege. All programs without exception use presentation slides and most of them use recorded presentations with both voice and video for the delivery of their material. But the way the programs record these lectures is roughly split in the middle: slightly more than half of these programs record these lectures during the on-campus lectures, while the others record these lecture specifically for the online students.

## **Conclusions**

Based on this analysis, we believe that EMGT programs that deploy distance education have a better chance to grow. Online learning, an important part of distance education, is being deployed by many of the leading EMGT programs analyzed here. Therefore, we believe that distance education coupled with online learning can be an important strategic direction for EMGT programs. These programs attract business professionals who need time and place flexibility to educate and train themselves on an ongoing basis. As

distance education and online learning techniques are adapted more, the reach of EMGT programs increases resulting in an increase in enrollment.

The University of North Carolina at Charlotte, Systems Engineering and Engineering Management Program, has decided to jump on the online bandwagon. Online delivery has been selected as a strategic initiative, which resulted in the establishment of an Online MS in Engineering Management that will be starting during the Fall of 2009.

As future research, it is recommended to benchmark each of the leading universities in their offerings, program structures, faculty profiles and industry relations. This benchmark information will be very important for engineering programs that are aiming to grow further.

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