

## **PERCEPTIONS FROM THE TRENCHES: ENGINEERING MANAGEMENT vs. MBA**

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### **Abstract**

What is the difference between an engineering management graduate and a student who obtains an MBA degree? If there is no difference, then why do we teach engineering management? This issue, EM vs. MBA, has been played out in the literature, in conference presentations, and discussions amongst practitioners, researchers, and students. Some claim there is no debate. Others are confronted regularly by questions from students, practitioners, industrial advisory board members as well as others on this issue. This paper explores the perceptions of students and professors (in Engineering Management and MBA programs) as well as other stake holders as to the distinguishing characteristics between the two disciplines. An informal survey was run to decipher some of the current views. Content rich data was collected and analyzed using both traditional survey questions along with content analysis of participant responses. The results are presented and analyzed with a discussion on the implications of the results obtained. In addition, some anecdotal data is provided on the running of the project which has some value to educators. The objective of this exercise is to provide engineering management educators some insights to our profession that may not be fully known.

### **Background**

The issue of instruction is of critical importance to educators [1], [4]. Instruction is intertwined with the subject matter being delivered and learned. Thus, a theory of teaching is content based. Much has been written on teaching and the improvement of teaching (see [3], [5], [7], and [9] to mention a few). Specifically, in engineering management education, which has been growing over the last number of years [6], the issues of instruction are being investigated, questioned, and debated [2], [8], [10]. This is not unusual, it is the nature of pedagogical evolution in most any organized field of thought. But with engineering management some questions arise as to its

uniqueness from traditional management instruction. Sarchet and Baker, [11] and [12], addressed this issue succinctly.<sup>1</sup> To many the question of EM vs. MBA is a non-issue. But many students and practitioners still have their doubts. Thus, this research investigates what differences, at least from a perceptual standpoint, may or may not exist between EMs and MBAs.

The problem was addressed as a research project for a graduate class in engineering management at Texas Tech University - course IE 5323 (The Engineering Management Environment). Five students in the course were given the assignment to construct a simple preliminary study to investigate this question of perception.<sup>2</sup> Thus in one semester's time, the group had to design the research and the research instrument; get approval to run the experiment (Committee for the Protection of Human Subjects); get questionnaires made, distributed, returned and analyzed; and present a report.

Many may view this project as undoable within the short span of time. The instructor was aware of the problems associated with the compressed time schedule. But this was designed purposely to place students in a "real life" situation where their technical expertise is required to manage a project with limited resources. This paper presents the results obtained from this effort. Two points need to be made explicit from the start. First, there are many limitations to this research effort, thus it is not presented as a complete rigorous scientific study. The results are preliminary, not fully reliable, and should be viewed as such. The results do provide a preliminary study that is intended to focus future research on the subject. Second, educators might find value in some of the points presented in the "What Has Been Learned?" section of this paper. The authors believe that educational experiences such as the one presented here provide valuable learning endeavors for future engineering managers.

### **Research Methodology**

Human subjects were used to complete the experimental questionnaire. There was little to no risk involved in anyone's participation and approval was obtained from the Texas Tech

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<sup>1</sup> Sarchet and Baker were probably the most capable authors on this issue since they are the founding fathers of Engineering Management as we know it. They founded the first EM program in the US at the University of Missouri-Rolla.

<sup>2</sup> The course had more than one group, which addressed other research questions as their course assignment.

Committee for the Protection of Human Subjects to run the experiment. The list of criteria for subject acceptance are given below:

- Subjects were recruited indirectly through engineering management faculty at various universities across the USA.
- Subjects were sought from MBA and EM degree plans only.
- Subjects were sought from the faculty and students of each test school.
- Both male and female subjects were sought with equal efforts.
- Subjects had to be at least 18 years old at the time of the data collection.

The test populations were drawn from four universities in the United States. These universities were chosen as test sites due to both the levels of contacts existing within those universities as well as the spacing of the universities across the nation. Table 1: Initial University Mail-Out, shows the four test universities along with the number of EM and MBA questionnaires initially sent. The University of Missouri-Rolla does not have an MBA program.

Table 1: Initial University Mail-Out

Institution	Number of Questionnaires	
	MBA	EM
Old Dominion University (ODU)	50	50
University of Alaska-Anchorage (UAA)	60	60
University of Missouri- Rolla (UMR)	N/A	100
University of Tennessee-Chattanooga (UTC)	100	150

Research Instrument A questionnaire was developed to examine the perceptions of MBA and EM programs by both MBAs and EMs. One questionnaire was distributed to each subject. Questionnaires were administered to students by their professors during class; faculty members completed the questionnaires at their leisure.

For demographic purposes each subject was asked information on: sex, age, race, zip code, occupation, course of study, classification, and highest degree earned. The questions were designed so that both EM and MBA students would be confronted with general perception issues for the two degree programs. These questions covered the following areas:

1. The difficulty of both programs at the subject's university.
2. The ability for EMs to substitute for MBAs, and vice versa.
3. The career mobility of men and women with each degree.
4. The expected leadership abilities associated with EMs/MBAs.
5. The types of jobs for which both career plans are suited.
6. The types of communication used within each group.

These six categories represent nine major questions, with each major question comprised of two to nine subquestions. The subjects were asked to choose their response for every subquestion from a Likert scale that ranged from 1 (Poor) to 5 (Great). Additionally, there were four qualitative questions. Two of these questions asked the subjects to use three words to describe an EM and three words to describe an MBA; the other two asked the subject to suggest the best way to utilize each type of degree in the business world.

Test Hypotheses The focus of this study was to determine any differences between MBAs and EMs, with respect to their perceptions of both programs. The test populations for the MBA data and the EM data were listed as  $T_{MBA}(x)$  and  $T_{EM}(x)$ , respectively. The test hypotheses for this study are given below:

$$H_0: T_{MBA}(x) = T_{EM}(x) \text{ for every } x \quad -\infty \leq x \leq \infty$$

$$H_1: T_{MBA}(x) \neq T_{EM}(x) \text{ for any } x \quad -\infty \leq x \leq \infty$$

Data Treatment and Analysis Each questionnaire had 13 questions. Of those 13, questions 3-11 were quantitative, containing a total of 34 subquestions. The responses to these subquestions were on a Likert scale with a range from one (1) to five (5). Once the data was returned from the test sites, the information from each questionnaire was entered into a spreadsheet.

Since direct supervision of the questionnaires was impossible, it was assumed that they were administered in the manner prescribed in the instructions. If a question had more than one answer on a single Likert scale, then that specific answer was not included in the analysis. This, along with a failure to answer a question, were the only reasons for which a data point would not be counted.

Only 104 questionnaires were returned. 25 of them were from MBA students from UAA, while the remaining 79 were from EM students and faculty from UAA, UMR, and UTC. ODU did not return any of the questionnaires.<sup>3</sup> The data was entered into a spreadsheet; the sample means, sample standard deviations, and sample sizes for every question were calculated.

Statistical Test A two sample t-test was used to compare the MBA and EM populations for each subquestion. Each test population was assumed to have normally distributed data. This assumption was based on the Central Limit Theorem.<sup>4</sup>

Research Limitations This study contained three major limitations. The questions were reviewed by two EM professors, two professional managers, and revisions were made accordingly. First, no MBA professor ever critiqued the questionnaire; therefore, it could contain a bias toward EM perceptions.

Second, all schools that contained both an EM and an MBA program should have had an equal chance of being selected as a test site. The nature of the experiment, coupled with the time constraints, prohibited such a sampling scheme. Instead, the investigation relied on EM programs where personal ties existed. This constraint limits the inferences from the data. Since the schools were not determined completely by random, there may have be a bias in the type of school examined and the type of student questioned.

Third, it was assumed that the populations within each strata (MBA and EM) act in a homogeneous fashion. There was, however, the potential problem of spurious significance; the way a subject answered one subquestion affected the way he or she answered another subquestion. Because of this, p values near .05 should be regarded with some skepticism.

## **Results**

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<sup>3</sup> The 18% response, as well as Old Dominion's failure to return any questionnaires was due to the timing of the study and the academic calendar of ODU. They received the questionnaire as the fall 1996 final exams were commencing, which precluded them from participating in the study. More will be discussed on this later.

<sup>4</sup> With a Likert scale of 1-5, the Central Limit Theorem becomes applicable with very few samples. Some accept this theorem at 4 samples, but a more conservative number is 10. No subquestion had fewer than 11 samples. This information was obtained during a conversation with W.J. Conover, a statistics professor at Texas Tech University.

For each data pair, a two-tailed, two sample t-test was run to determine whether or not the sample means differed from one another. The least critical p-value accepted as significant was  $\alpha=0.05$ .<sup>5</sup> Results from the t-tests exhibiting a p value significantly less than 0.05 are summarized on Table 2: Statistically Significant Survey Questions.

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<sup>5</sup> The p values near 0.05 should be looked at suspiciously, due to the possibility of spurious significance.

Table 2: Statistically Significant Survey Questions ( $p < .05$ )

Survey Question	Sample Size	
	MBA	EM
3B	25	44
7B	25	76
8D	24	79
8F	25	79
9C	25	77
9D	25	77
9E	25	77
9F	25	77
9G	25	76
9H	25	77
9I	25	77
10C	21	70

It is important to note the sign of the  $T_{calc}$  value. A positive sign shows that the MBA subjects questioned, as a whole, ranked a specific item more favorably than did the EM subjects polled. Conversely, a negative  $T_{calc}$  value indicates the opposite situation. A brief description of each item in table 2 follows.

In question 3B, subjects were asked to rank the difficulty of the MBA program at their university. The two groups of subjects had very different views on the topic. The MBA subjects considered their program to be demanding, while the EM subjects viewed the MBA program at their universities to be somewhat easy. The two groups differed similarly in opinion on question 7B. This question requested a ranking of the expected leadership ability from students exiting either program. The EMs surveyed did not think very highly of their counterparts' leadership skills, while the MBAs surveyed thought they were very well trained to lead others.

Question 8 asked the subjects to rank the compatibility between EMs and certain jobs. Question 9 looked at the same scenario for MBA graduates. The following is a list of the jobs against which EMs and MBAs were compared. The jobs appear as they did in the questionnaire: bank officer, chief financial officer, corporate or division level manager, hospital administrator, chief operating officer, director of information technology, entrepreneur (company founder), manufacturing plant manager, and R & D manager. In evaluating the EMs, two subquestions produced significant results. Subquestion 8D asked about the EM's ability to be a hospital administrator. Subquestion 8F concerned an EM's ability to be a director of information

technology. In both cases, the EM subjects thought themselves much more capable to perform the task than did the MBA subjects.

Question 9 produced many more significant results than did question 8. In all instances of significance, the EM subjects ranked the MBA subjects lower than the MBAs ranked themselves. The first three subquestions to produce significant results were 9C-E. Job titles for these questions were corporate level manager, hospital administrator, and chief operating officer, respectively. All three jobs were put into the questionnaire as positions traditionally held by MBAs.<sup>6</sup> Subquestions 9F-I, asking about an MBAs suitability for a job as a director of information technology, entrepreneur (company founder), manufacturing plant manager, and R & D manager, respectively, were also found to be significant. It was not surprising that these categories were significant. They can involve a good deal of technical knowledge, and the EMs might not have perceived MBAs as having a suitable level of technical expertise to manage those positions. Question 10 asked the subjects to rank the usage of upward, downward, and horizontal communication channels among MBAs. It was slightly nebulous, so the result was questionable. Based on the results from the data, MBAs think they communicate with their peers much more effectively than EMs think MBAs communicate with their peers.

### **What Has Been Learned?**

Here we address both the results of the informal survey as well as the educational experience of the project. Even with all the limitations of this research, we can safely say that the question of perceptual difference exists. It would be interesting to re-run this research improving upon what was learned (errors committed) to further evaluate the perceived differences between EMs and MBAs.

From an educational point of view, this type of project provides students with a real life situation of the demands placed on them in industry: a technical solution seeded with limited resources to accomplish it in a compressed time frame. Specifically, the group made several project management mistakes. They were not active in following up on milestone events that they set up

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<sup>6</sup> See previous discussion on a potential bias in this area.



in their project schedule.<sup>7</sup> An example of this was in getting approval to run the study from the Committee for Protection of Human Subjects. The group turned in their paperwork and waited for a response to their request (which was filed under expedited review). The other group walked the paperwork through the process and saved themselves over ten days. The lack of “follow through” prevented the ODU group from participating in the study. The project group also failed to get survey instrument pre-testing from MBA professors (only EM and managers were consulted). This of course places doubt on the validity of the instrument.

Projects of this nature provide students with hands on experience on how to deal with project management issues, how to deal in small group interactions, the scheduling of different group members and dealing with a variety of personalities. These types of projects have been used by the lead author for several years as an educational experience for students and has resulted in some valuable learning experiences. Students appreciate the knowledge acquired, although not when they were in the midst of the project. This type of learning experience requires much preplanning and play acting by the instructor to get the students to provide solutions and not expect the instructor to provide the answers.

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<sup>7</sup> Note, the other group (which had a different research problem) did follow-up on their tasks and did not have half the problems this group experienced.

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## **Biographical Notes**

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