Abstract

Engineering Management which is considered to be a “non-traditional” field of engineering has a long history of attracting high caliber students regardless of some questions about what this field really is. A study was done at the University of Missouri – Rolla to find out what motivated these students to pursue Engineering Management as a discipline, their perceptions, and their success in industry compared to “traditional” engineers. The data for the study was gathered from focused interviews of forty current students and ten alumni in industry. The results showed that Engineering Management students, just like others, choose a career path that satisfies their needs. These students tended to like the technical field, but they also desired to combine it with a more people oriented approach. Engineering Management as a distinct discipline is relatively new and still faces some challenges due to lack of understanding. Nonetheless, industries recognize Engineering Management as a much needed discipline.

Introduction

Engineering Management is relatively new among other engineering programs. “The Engineering Management program at the University of Missouri – Rolla began as an interdisciplinary M.S. program in the fall of 1965, and as a B.S. program two years later. It was established as a full Department of Engineering Management in the school of Engineering July 1, 1968.” (1) Engineering Management is considered “non-traditional” as it bridges the gap between traditional engineering and management by highlighting communication and people orientation. This sometimes is the reason for it to be thought of as “less” of an engineering degree compared to other more “traditional” ones like Mechanical or Electrical Engineering. The same problem often plagues other hybrid fields. A recent study of student perceptions of Industrial Engineering (2) demonstrated a similar lack of appreciation and understanding. Yet, Engineering Management at the University of Missouri – Rolla has a long history of success in attracting high caliber students and industry has found Engineering Management very desirable. The need for these “non-traditional” skills that Engineering Management provides is clearly shown in the following passage:

“It is often remarked that engineers communicate and express themselves poorly – this not only limits their effectiveness in the technical sphere, but can seriously
prejudice their success as managers. Sir Peter Walters, who began his BP career in the supply and development department when he was 24, rose to be Chairman of the company and, in 1986, president of the Institute of Directors. He has said that he first came to the attention of senior management through the ability to write a good report. A specialist may do brilliant original work in isolation, but if it is to have any practical application and benefit to the community, the ideas must be spread. They will be recognized and adopted in direct proportion to the clarity with which they are expressed.” (3)

Methodology

The specific purpose of the study was to answer the following questions:

- What motivates a student to pursue Engineering Management as a discipline?
- What are their perceptions and perspectives of the degree while on campus?
- Do they consider themselves to be different than a traditional engineering student?
- How well does the degree prepare them for success in industry and do they compete well with “traditional” engineers in their industry environment?

The study was done through focused interviews of thirty current Engineering Management students, ten “traditional” (non Engineering Management) engineering students and ten alumni in industry with Engineering Management degrees. The participating students and alumni were recruited at the University of Missouri-Rolla through phone, emails and class announcements. The reason for these different categories was to gain different perspectives of Engineering Management. Not much emphasis was given on equalizing the male to female ratio for this study as in general the male to female ratio is 3 to 1 at the University of Missouri – Rolla (4). An attempt was made to keep the class ratio even, but more importance was given to “randomness” for the fairness of the sample. Interviews were conducted to collect data to see if common response patterns existed, to help understand the discipline from the students’ perspective, as well as aid in efforts to potentially develop focused marketing and recruitment materials.

Hour long interviews were conducted to find a set of questions that would allow students’ responses to show some kind of a pattern [Appendix A]. Based on those questions survey forms were created [Appendices B & C] and given out to other Engineering Management undergraduates. Also, many of them were interviewed and asked about their inducement in choosing this area as their field of study and how they perceive it. They were also asked what they think about others’ perception. To make sure what they feel is in fact the general perception of engineering management by others, ten non-engineering management students were interviewed and their responses were matched against Engineering Management student’s comments and perceptions.

Results

It should be noted that selected comments from the interviews and surveys are used throughout. All the comments from the surveys are found in Appendix D. The first question participants were asked was, “What motivated them to pursue engineering management as a discipline?” The results are shown in Figure 1.
According to the majority of alumni and students, *career flexibility* was their number one reason for choosing engineering management as a career. Although students valued salary as their second most important reason, alumni seemed more inclined towards *status*. Two telling comments by current students also portray some common feelings:

Senior student: “It's the best of both [Engineering and Management] worlds.”

Junior student: "It was an easier degree. I could graduate faster."

The next question asked was, “What are their perceptions and perspectives of the degree while on campus and what do they think others’ perceive it as?” The majority of the respondents agreed that whereas they consider engineering management as a great program that bridges the gap between business and engineering worlds, “traditional” engineering majors think of it as a “fall back” program. Some representative responses are given below:

Mechanical Engineering student: “I thought about Engineering Management once, but decided against joining it as most of my friends thought of it as a sissy program.”

Engineering Management student: “I really like what this [Engineering management] department does and is doing for me, but the stereo-type really irritates me.”
Engineering Management student: "When they make fun of my discipline, I tell them to call me whatever they want now, but in ten years I will be bossing them."

Another common response was:

"Everyone thinks EMAN [Engineering Management] is an easy major, but we still take the same general courses other students struggle with at UMR [University of Missouri – Rolla]. Same people even struggle in the actual EMAN courses if they don't have a head for business practices.” says another Engineering Management junior.

A few students mentioned that this negative perception or rather misconception came because a lot of “traditional” engineering students changed their majors and joined the engineering management discipline when they found their respective engineering program to be hard.

Where most of the students had slightly different approaches to their answers, the majority mentioned something related to how people perceive Engineering Management as a “cop out” program that is for those “who can’t hack real engineering programs”. However, some respondents believed that Engineering Management is just a different program that requires interpersonal skills and leadership qualities and to those who do not possess these qualities it might seem the hardest program. The “cop out” perception seemed fairly strong among undergraduates in the traditional engineering disciplines as evidenced by several representative comments given below:

Mechanical Engineering student: “I personally believe that most of the engineering management students are those who can’t deal with real engineering, but still want to be called an engineer.”

Electrical Engineering Student: “I really don’t understand the point of engineering management. If I was an employer and needed someone to manage my company, wouldn’t I hire someone who not only has a real management degree like MBA, but also a hardcore technical base?”

Civil Engineering student: “I think that all the confusion in industry is because of these engineering management people who think they know everything and they are better than everyone else, but the truth is when a bridge falls it’s rarely our fault. It is usually because some genius engineering management messed up in translating. I like to think of them as Jack of everything and master of nothing.”

The responses of students in the traditional engineering disciplines were grouped into positive, negative, or neutral, and the results are shown in Figure 2.
Out of 10 out-of-department students, 20% had no opinion because they believe they did not know enough. The 10% answering in favor had responses typical of:

“I think they deserve some respect for who they are and what they do. It’s just a different career path and it’s wrong to be so critical about it.”

When alumni were asked the same questions, they all agreed with a ’98 engineering management graduate who is working in industry currently:

"I feel that Engineering Management is the meshing of an engineering background with a business mindset. While EMAN [engineering management] does not fully train you in either an engineering degree or a business degree, it prepares you to make these two worlds meet. Engineers often cannot communicate clearly and business majors often cannot relate the technical side of a company. Our degree allows us to make these two worlds successfully work together."

Another key question for Engineering Management students related to self-perception, “Do you really consider yourself to be different than a traditional engineering student and how?” Most participants responded, “Yes” and added “only because we are better in interpersonal skills.” A typical response is given below:

“I think we are as good as other traditional engineers. We take all the basic engineering classes, educating ourselves about engineering. Plus, we also enhance our learning with more versatility.”

Looking at the Engineering Management curriculum it became clear that they indeed take basic engineering courses just like most engineers. Robert Shaw, past president of the Engineering
Institute of Canada said, “I believe, that the key mission of the engineer in these radically changing times is to improve productivity. He must provide the energy and tools we need; he must innovate, research, develop and transfer technology from the laboratory bench to field and factory.” (5) And this is exactly what the engineering management program is all about.

The next question was: “How well does the degree prepare them for success in industry, and do they compete well with traditional engineers in their industry environment?” Although most of the Engineering Management student participants believed that the degree was preparing them very well with some real life experiences as they worked in teams and did a lot of group projects, most accepted that they have only heard that Engineering Management students get jobs quickly and they excel in what they do. To get a more reliable and first hand response, inquiry turned towards alumni. Two typical alumni responses to this question are given below:

"I feel that EMAN [Engineering Management] gives its students the necessary skills and knowledge to succeed in the industry. I found that EMANS do very well when competing with traditional engineers, because they are more flexible and can communicate better.” said one alumnus.

“I would say we do relatively well. Most of my engineering management friends already have a job, whereas, some traditional engineering friends of mine are still looking.”

The study went further to find out after so many positive responses why engineering management is still a small department. Participants were asked numerous questions such as why they preferred this department or how their families responded to this decision of theirs, etc. In response to the first questions, most participants admitted that people orientation was the major reason why they chose this discipline over others. The summary of the responses is given in Figure 3.
For alumni their second most important reason was problem-solving skills, whereas students preferred communications. Engineering Management has a well-rounded approach to it including broad range of emphasis students can choose from. In addition, most student participants acknowledged all the support they have from friends and families, but some indicated that people make fun of them and want them to change their discipline. Some typical responses are shown below:

"My parents are happy because they are both Engineers, so they thought this department was perfect for me. I was excited because this department was exactly what I wanted." said a sophomore.

"They are somewhat supportive, some say, "get a real degree", but I love it and that's what matters" said a freshman.

In contrast, most alumni mentioned either their families did not know about Engineering Management or were plainly not supportive of it.

"My dad thought, I needed to change it [engineering management discipline] in order to find a job." said an alumnus.

"They were just happy to know that I was going to graduate. They said, "Thank God, Graduation is in his future!" said another.

The summary of family support of alumni and students who majored in Engineering Management is shown in Figure 4.
When the data was compiled, it was apparent that most alumni’s parents were less supportive than the parents of current students.

Conclusion

The results show that negative perceptions about engineering management still exists, although the results suggest some improvement in awareness of the program and in respect for it. Negative perceptions will most likely always exist. Traditional engineers and traditional engineering students tend to be hostile toward any “other” engineering degree. It is likely that will always be the case. However, continuing to promote the benefits of the degree to the students and industry with the many real life success stories which exist is the best way to tackle this continuing challenge. The study showed a variety of perspectives and opinions. Most Engineering Management students believe that the undergraduate program is a good one that is not only teaching them actual engineering, but also developing and preparing them to be a more “well-rounded” engineer. They think of themselves as just an engineer if not more so than other “traditional” engineers, but they also consider themselves people-oriented. The majority of the participants were motivated by time flexibility, career flexibility, money or high position. They all like the engineering aspects of the degree, but also wish to enhance that with some interpersonal skills. Participants mentioned communication and problem-solving skills being another reason why they became interested in Engineering Management. Students also mentioned Engineering Management might be easier for some who think communication and management classes are easier than the hardcore “traditional” engineering classes, but to those who do not have good interpersonal skills or a business mind, it might as well be the hardest. A number of the alumni surveyed confirmed that engineering management is indeed very popular in industry and most students get jobs easily. Starting salaries for Engineering Management graduates are nearly the same as traditional engineering degrees such as Electrical and Mechanical Engineering. However, as careers advance, and Engineering Management graduates move into the mid and executive level positions, a distinct salary differential is evident. Two successive alumni surveys indicate that about 1/3 of Engineering Management graduates...
advance to executive level positions. These advanced positions lead to higher salaries than traditional science and engineering career tracks.

After 40 years, misconceptions about engineering management remain. Some student’s who seem to like it or could possibly be really good at it, never pursue it because families and friends still have a negative perception and the peer pressure is a lot to deal with. Looking at the data from alumni interviews, it seems that Engineering Management is gaining respect as a practical degree as industry learns more about it. Industry appreciation of the qualities an Engineering Management graduate can bring right from the start is increasing as more Engineering Management alumni populate engineering positions and eventually move into management. It well may be that broad appreciation of Engineering Management will require a fuller population of Engineering Management graduates in senior management positions. It would be useful to take the results learned from this initial study and conduct a larger and more involved study with current students and alumni from the UMR Engineering Management program, and those students and alumni from Stevens Institute of Technology and the United States Military Academy at West Point. If perceptions are the challenge, then more information, especially from the larger alumni populations may provide the key to changing the perceptions once and for all.

Appendices

Appendix A Initial Interview Questions for Undergraduate Students

1. What is your status at school? (Freshman, sophomore, alum, etc.)
2. What do you like about Engineering Management?
3. Why did you want to major in this department?
4. How did you heard about Engineering Management? What was your first reaction?
5. What kind of students does Engineering Management attracts?
6. Did you switch from some other department/major? If yes, what was your major? When and why did you decide on switching?
7. What do you think Engineering Management is all about? Please describe. Sometimes it gets really hard to explain people what Engineering management is about, what they do, why we need this department etc.
8. When did you find out about EMAN? Do you think it’s as known as some other traditional engineering programs? Why /why not?
9. Some people consider EMAN as an invisible/imaginary/not-real engineering/stupid engineering/easy degree. What do you have to say about that? Where does this perception come from?
10. How would you describe EMAN?
11. What are the qualities/skills that make a good EMAN?
12. Have you heard any negative/positive comment about Engineering Management?
13. How do you feel about the negative perception about this department and how did you overcome it?

Appendix B Interview Questions
1. What’s your status at school? Freshman, sophomore etc.
2. How and when did you hear about this department?
3. What was your first reaction about the Department? (Any stereotypes you came across)?
4. Did you switch from some other department/major? If yes, what was your major? When and why did you decide on switching?
5. What do you think Engineering Management is all about? Please describe. Sometimes it gets really hard to explain people what Engineering management is about, what they do, why we need this department etc.
6. When did you find out about EMAN? Do you think it’s as known as some other traditional engineering programs? Why/why not?
7. Some people consider EMAN as an invisible/imaginary/not-real engineering/stupid engineering/easy degree. What do you have to say about that? Where does this perception come from?
8. If you had to recruit someone in this department what would you tell them?
9. If you had to generalize the type of students we have in EMAN, what would you say?
10. What motivated you to become an EMAN? Status, money, time flexibility, career flexibility, other ______?
11. What’s your perception of EMAN?
12. How do you think others in and outside the department (EMAN) perceive it as?
13. Do you consider yourself to be different from a traditional engineering student? In what ways? How do you feel about it?
14. How well does the EMAN degree prepare students for success in Industry? Do EMANS compete well with traditional engineers in their industrial environment?
15. Why did you choose this discipline? People oriented, communications, problem solving, other ______?
16. What are your plans after graduation?
17. Where do you see yourself in five years?
18. How will your degree in EMAN fill into your goals?
19. How did your friends and family respond to your decisions of being an EMAN? How did you react?
20. How would you describe EMAN?
21. What are the qualities/skills that make a good EMAN?
22. How do you feel about the negative perception about this department and how did you overcome it?

Appendix C Survey Form

Name:_______________ (Optional)

1. Are you an Engineering Management student? Yes/No_________(major)
2. Are you a Male/Female
4. What motivated you to be an EMAN? Status/Money/Time flexibility/career flexibility/other__________
5. Why did you choose this discipline? People oriented/communications/problem solving, other____
6. What’s your perception of EMAN?
7. How do others perceive it as? Please try to use direct quotes.
   Negative: ______________________________
   Positive: ______________________________
8. What are the qualities/skills that make a good EMAN?
9. How did your friends and family respond to your decision of joining EMAN?
10. Some people consider EMAN as an invisible/imaginary/not-real engineering/stupid engineering/easy degree. What do you have to say about that? Where does this perception come from?
11. How do you feel about the negative perception about EMAN dept? how did you overcome?
12. If you switched from a different major? What major was it? When and why?
13. Do you consider yourself to be different from a traditional engineering student? In what ways? How do you feel about it?

Appendix D Written Responses to Survey Questions
<table>
<thead>
<tr>
<th>Positives comments</th>
<th>Negatives comments</th>
<th>Qualities/skills for a successful Engineering Manager</th>
<th>Suggestions for Recruitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>“We get the best of both worlds”</td>
<td>“You’re not a real engineer”</td>
<td>Outgoing, social, organized, adaptable</td>
<td>“I would tell them that it’s a great degree if you like technical things, but want to interact with more people and be in office atmosphere instead of on the factory floor. Career flexibility, “Opportunity to gain high management status”</td>
</tr>
<tr>
<td>“It’s interesting”</td>
<td>“It’s the easiest one at UMR.”</td>
<td>Common sense, Business oriented</td>
<td>Money</td>
</tr>
<tr>
<td>“Easy major”</td>
<td>“In all honesty, I think it’s really not needed.”</td>
<td>Leaders, Fun spirited</td>
<td>“I would tell them that they would have a much broader degree that is more people oriented than technically oriented.”</td>
</tr>
<tr>
<td>“…Emans are needed to coordinate projects and maintain the peace between civilians and engineers.”</td>
<td>“Emans are outgoing, fun spirited and not afraid of skipping homework to go to the bar. May be b/c they think they can cope up.”</td>
<td>Good listener, Good organizer, good problem solver</td>
<td>“…Eman is where leaders are made”</td>
</tr>
<tr>
<td>“You will go far in life”</td>
<td>“Eman is more of a concept based learning process while the other majors have more of a technical emphasis. Plus, most- ummm…how would you say – less than bright students – tend to migrate toward Eman and seem to thrive.” Where leaders are made</td>
<td>Status, Money, time flexibility, Career flexibility</td>
<td>“…If you have any interest in business or entrepreneurship it is a great avenue to build technical knowledge and grow your people and business knowledge.”</td>
</tr>
<tr>
<td>“It’s easy and pays good.”</td>
<td>“It is easy to get.” “If you can’t do something else, you go to Eman” “…bunch of sissies”</td>
<td>Intelligent, enterprising</td>
<td>Time flexibility, career flexibility, broad field, Reasonable graduation time</td>
</tr>
</tbody>
</table>

Bibliography


**Biographies**

**Vaishalee Naruka**

Vaishalee is currently an undergraduate student at the University of Missouri-Rolla (UMR) pursuing a double major in Engineering Management and Electrical Engineering. Vaishalee has conducted undergraduate research with the Chemistry department on campus, and conducted this study under the Opportunities for Undergraduate Research Experience program at UMR. She is a member of the Kappa Delta sorority where she is involved in many projects and leadership efforts.

**Dr. William Daughton**

Dr. Daughton is Professor and Chair of the Engineering Management and Systems Engineering Department at the University of Missouri – Rolla. Prior to this position, he spent 10 years as the Lockheed Martin Endowed Chair and Program Director of the Lockheed Martin Engineering Management Program at the University of Colorado – Boulder. Dr. Daughton also has considerable industrial management experience in the microelectronics industry holding senior positions in quality, R&D, and business unit management.

**Dr. Stephen Raper**

Dr. Raper is an Associate Professor and the Assistant Chair of Undergraduate Studies in the Engineering Management and Systems Engineering Department at the University of Missouri-Rolla. His teaching and research interests are in the areas of packaging systems...
engineering, operations and quality management. He has industrial experience in packaging engineering in the consumer foods and beverage industries.