

The Engineering Management Role Shaping and Constructing the Personality of Graduates in Gaza

دور الادارة الهندسية في صقل وبناء شخصية الخريج المهندس في غزة

Hussein, M.T.

محمد توفيق حسين

Associate Dean of Engineering for Research & Development Islamic

University of Gaza, Gaza City, Palestine

E-Mail: mhussein_98@hotmail.com, mhussein@iugaza.edu.ps

Abstract: Generally Engineering students need managerial training to be coupled with their intensive technical skills which they obtained during their five years engineering program at Islamic University of Gaza (IUG). There is always a legal marriage between academia and industry to reduce the gap between both of the them; therefore this paper presents the importance and the urgent needs for introducing an Engineering Management (EM) course as a technical elective in the curriculum of Electrical and Computer Engineering Department at IUG, as it was assessed by both academies and practical engineering managers as part of the joint need assessment efforts, Hussein (2010). This article addresses the link between industry and the management skills that students normally gain. Several interviews were conducted as a research methodology instrument used to validate and give credibility to the main issue of this paper; therefore as a result some valuable comments from current and previous students who graduated as well local industry engineering managers are given, on the other hand current enrolled students fill a standard e-survey to evaluate the course as well. Finally the paper presents the implementation of the state - of - the art e-Learning virtual environment by using open source Moodle as an enhancement tool for the traditional existence course in addition to utilization Face Book to show the effect of the course on improving the case studies and projects.

Keywords: *Engineering Management, Need Assessment, Blended e-Learning, Moodle, Case Studies.*

المستخلص: عموماً طلاب الهندسة بالجامعة الإسلامية يحتاجون خلال دراستهم إلى مهارات إدارية مع مهاراتهم العلمية التقنية المكثفة. هناك اهتمام من قبل قطاع الصناعة بهذه المهارات حتى تكسر الجمود الأكاديمي لدى الخريجين، لذلك تأتي هذه الورقة لتناقش وتعرض مساق اختياري تم اعتماده لقسمي الهندسة الكهربائية والحاسوب في مجال الإدارة الهندسية وذلك بناءً على مقترحات قطاع الصناعة، ومن خلال منهجية البحث المتمثلة في عقد مقابلات مع شرائح ممثلة مع الطلاب والخريجين وأرباب العمل تم استعراض آرائهم ومدى تأثير هذه المهارات وانعكاس هذه المهارات عليهم، وقد تم عرض وتدريس هذا المساق من خلال مهارات التعليم الإلكتروني الحديث كوسيلة مساندة.

كلمات مدخلية: *إدارة هندسية، تقييم الاحتياجات، التعليم الإلكتروني المساند، برنامج مودل، دراسة حالات.*

INTRODUCTION

The engineering profession can be justifiably proud of its achievements. Engineering skills alone, however, are not sufficient to guarantee success. Industry requires competent managers to ensure that products are developed and brought to the market-place to meet the ever increasing needs of sophisticated consumers. It has been said that successful companies are run by accountants. This is a fallacy. In the modern technological area, where information can span the globe in a fraction of a second, travelling as pulses of light or as radio waves, engineering companies need to be led by managers who understand the technology they are controlling. Engineers are therefore, finding that paths to executive positions, are now available to them and it is essential that they take advantage of these opportunities. This does not mean that the requirement for good engineers has diminished. On the contrary; the pace of development has meant that, in parallel with the demand for good engineering managers, the need for good engineers has also increased. No longer should engineers feel that the only way to promotion is by moving to management. Most of the organizations now operate a dual career ladder so that engineers can stay in progress within their discipline, and only those who have a genuine desire to move into management can do so, Mazda(2000).

Management is not easy, however, and too many engineers make the move without first considering what is involved and without any preparation for the new role. There are many differences between engineering and management; the two that the new engineering manager is most likely to encounter are the need to manage people, and to interface with a wide variety of different functions.

To understand the engineering management discipline, we need to understand how the discipline relates to other disciplines. In reviewing the history of EM, we assert that EM has evolved from the engineering and management disciplines, Kotnour (2005).

Normally, engineers are engaged to the process and challenges of teamwork with implications for effective project management. To provide focus, this discussion is divided into five parts, consistent with five assets of performance influences summarized in figure 1: people, work,

organizational process, tools and techniques, and leadership. Each of these five parts is affected by the project environment, such as project complexity, organizational support, managerial support, and the general socio-economic business environment. Also people-oriented influences factors that satisfy personal and professional needs seem to have the strongest effect on project team performance, Thamhain, (2005).

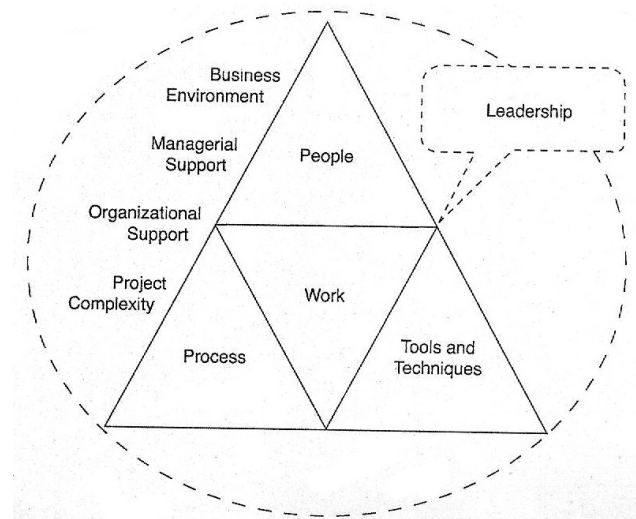


Fig. 1. Influences to Team Performance.

The engineering manager must acquire a range of new people with related skills such as team building, communications and motivation. The new manager must also learn that time is now the most difficult commodity to manage as greater and greater demands are made on this scarce resource. In addition to managing people, engineering managers find themselves interfacing to a greater extent with the many different functions within an organization—such as finance, manufacturing and marketing – and in order to communicate effectively they must understand the basic principles of these functions. Budgets and project plans need to be prepared and managed and managers who do not understand these concepts will not be successful in their positions.

INDUSTRY NEED ASSESSMENT

Normally there is a bridge between academia and industry; therefore as part of the community services, relationship must always be strengthened with industry, through several means such as site visits, inviting industry managers to be part of the academic department advisory

committee or a guest speakers in departmental technical workshops or seminars.

Engineering Management Skills

Engineers typically find themselves in a dilemma four to six years after graduation, when technical management position becomes available. They quickly become aware that such positions require new knowledge and skills which their previous professional training has not provided. At this point they either frantically try to discover on their own the methods and concepts that will allow them to understand the management process, or about read management texts and return to school. Although dozens of books have been written on managing almost every other business function, only a handful of books have recently appeared dealing with managing technical functions, Shannon (1980).

Statistically, eighty (80) percent of all engineers will end up in some sport of managerial position during their working careers. In most of these positions engineers will manage professional personnel who perform technical functions. Technical functions are concerned with creating something new or improving the old. This is a future-oriented, "one-time" activity directed toward innovation and change. The resources required and the final results are highly uncertain and unpredictable. The technical manager must handle, motivate, and control highly trained, creative people in an uncertain environment that requires flexible planning, policies, and procedures. The activities of technical group must be planned and controlled just as much as the other operational business activities as current research show, Pavlak (2005) and Thamhain (2005). Therefore the urgent need assessment issue that was raised by both academia and industry has been executed in practical outcome which is utilized in technical elective course named as engineering management for junior and senior students in electrical and computer engineering departments.

Management Obligations

Government industrial legislation has increased steadily since the start of the industrial revolution. This is be influenced by trade union pressure, which has been cyclical in its strength.

Management within an organization clearly needs to be aware of this legislation, but managers must also understand the aims and reason behind Government regulations, and be able to work with government agencies to satisfy these requirements. In addition, modern management needs to maintain a greater awareness of the environmental and social obligation placed on organizations by the communities in which they operate, Smith (1994). The requirements and norms of present and future society must be understood and needs of present and future generations must also be fulfilled. This is not easy, especially since, as shown in Figure 2, the managers at the same time needs to resolve the conflict which can exist between the needs of society, employees, shareholders, customers and supplier, Summer (1991).

All these are shareholders in the organization and their interest must be kept in mind, while the manager works within the confines of the legal framework, social responsibilities and competitive pressures.

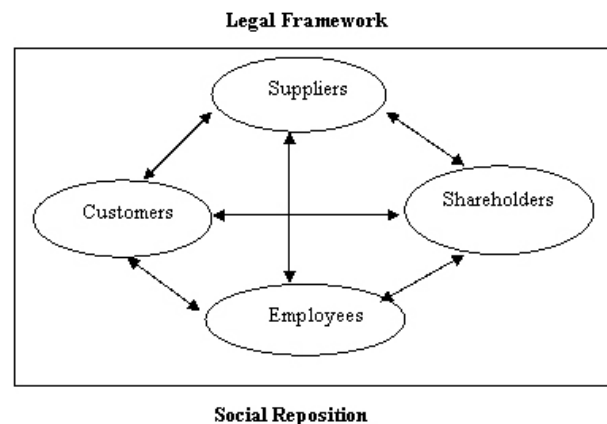


Fig. 2. Management Responsibilities and Constraints.

The obligation to employees of the company is often forgotten. It is important that employees are adequately trained and developed. The surroundings should be such enjoyable with their work and have the opportunity to express themselves, while contributing to the success of their organization. Some of the obligations placed on management are easy to define and relatively easy to follow, such as the need to avoid prejudice on the grounds of race, religion or sex, Echiejile (1995). Others are more difficult to quantify and legislate against such as those

relating ethical matters. Therefore, fresh graduate from an engineering school normally lacks these experience and knowledge, yet as a result of the need assessment process in Gaza strip, these issues and more were addressed in the EM course at IUG.

EM – COURSE IMPLEMENTATION

As a result of that tight relation between faculty of engineering at IUG and local industry in Palestine, the integration of an engineering management course was proposed, introduced and yet implemented as explained in the following sections.

Course Description

The course is an introduction to engineering management, there are many aspects of management which need to be studied and learned. Management covers a wide range of discipline and skills and this course presents an insight into all the functions within an organization which the engineering manager is likely to come into contact with. The course relates theory to practice by presenting a large number of case studies throughout the course. This course will be customized for computer and electrical engineering students only. Case study exercises are included at the end of each unit for use in classroom exercises and discussions. Also student are heavily exposed to Microsoft Project Software through the entire course, Hussein (2009).

Topics Covered

Based on the feedback of the surrounding industry, local market inputs and a current research of the similar courses that is offered in universities world wide, the content of our course is selected; therefore the EM course topics normally (but not limited) covers the following related topics:

- Introduction to Engineering Management.
- Role & Scope of Engineering Management.
- Forecasting and Planning.
- Formal Organization.
- Informal Organization.
- MS Project Software.
- Staffing and Hiring.
- Obsolescence.
- Team Building.

- Conflict Resolution.
- Creativity and Barriers to Creativity.
- Creativity Enhancement.
- Total Quality Management (TQM).
- Motorola Six Sigma.
- Motivation.
- Leadership.
- Time Management.
- Communications.
- Systems Engineering.
- Systems Life Cycle.
- Project Selection and Project Control.
- Engineers and the Law.
- Engineering Ethics.
- Work Breakdown Structure.
- Budgeting and Cost Estimates.
- Scheduling Networks –PERT / CPM.
- Unwritten Laws of Engineering.

Blended e- Course through a Virtual Environment

In order to provide more challenges, excitement and motivation to students, this course was designed to be a Web Based course through the well known virtual WebCT software, and later was moved to an open source Moodle software to support the traditional way of teaching this course, therefore the registered student must go through an extensive short training through e-Learning Center in order to be familiarize with software. At IUG. This flexibility gave the student unlimited access and opportunity to communicate with course instructor, teaching assistant and peer students as well through the communication tools in these e-learning friendly software. Yet the following key points for effective practice drawn out from this dynamical online course, Cook *et al* (2006):

- As the students had a mixed level of ICT and e-Learning experience, a work based learning/ learner managed learning approach and a set of activities were adopted to allow each individual to progress at his/her own level.
- This approach to learning many initially prove a challenge where participants are used to a traditional transmission, content driven approach. Adapting and applying this framework to an online model demand some innovative pedagogical design.

Case Studies

The Course includes several case studies

that are assigned to students to be worked out and presented as group. Therefore the class will be divided up into teams. Each team will be assigned as many cases as there are team members, these case studies are customized and designed for areas that of interest to electrical and computer engineering students, such as but not limited to electronics, communications, software , network

Table 1. Grade Distribution for Case Studies.

Evaluation of student as manager by teammates	2.5%
Evaluation of student participation by managers	2.5%
Evaluation of team presentations by class	10%
Evaluation of team presentations by Instructor	10%

and hardware areas that need good leadership and project management. Each student will serve as team manager for the preparation and presentation of one case and as a team member for the other cases. The team will prepare a fifteen (15) minute presentation of their analysis and proposed solution

for the case utilizing the most applicable concepts discussed in the text and found in the literature. Teams are urged to seek out information that might be helpful from sources other than the class text. Presentations should not be merely a summary of the case, rather they should include an analysis and identification of the basic problem or problems, suggested recommendations for solution of the problem or problems., the theoretical justification for recommendations and expected results if the recommendations are followed. Visual aides are encouraged where appropriate. Student also utilized Microsoft Project Software during their oral presentations. The preparation and presentation of these case studies will constitute 25% of each student’s final grade. This will be determined as shown in Table 1.

The first two categories are evaluated according to tables 2 and 3 respectively as shown below:

Table 2. Team Member Evaluation.

Case Study: _____

Team Member: _____

Cooperativeness	Poor	Fair	Okay	Good	Excellent
Quality of Work	Poor	Fair	Okay	Good	Excellent
Quantity of Work	Poor	Fair	Okay	Good	Excellent
Reliability	Poor	Fair	Okay	Good	Excellent
Overall Performance	Poor	Fair	Okay	Good	Excellent

Definitions

Cooperativeness	Perceived attitude towards working with leader and other team members.
Quality of Work	Was the contribution of this team member good and useful?
Quantity of Work	Did the team member contribute his/her fair share to efforts?
Reliability	Was the team member reliable in terms of getting the job done without a lot of follow up or badgering?
Overall Performance	Your satisfaction with presentation outcomes.

Helpful Comments

Table 3. Team Manager Evaluation.

Case Study: _____

Team Member: _____

Organization	Poor	Fair	Okay	Good	Excellent
Delegation	Poor	Fair	Okay	Good	Excellent
Follow up	Poor	Fair	Okay	Good	Excellent
People Skills	Poor	Fair	Okay	Good	Excellent
Overall Performance	Poor	Fair	Okay	Good	Excellent
Definitions					
Organization	Ability to arrange and manage team meetings.				
Delegation	Using each member of the team to get the job done.				
Follow up	Checking to see if team members got their part done.				
People Skills	Handling of team members in terms of motivation, settling disagreements, etc.				
Overall Performance	Your satisfaction with the manger leadership and case management.				
Helpful Comments					

Course Project

Students (as they are exposed to heavy training through course lectures, class discussion, and many well defined case studies) are required to come up and design their own unique case study as group. Some valuable suggestions and directions are normally given to them, some of these directions are to design their own dream engineering company that they like to have and establish in future. On the other hand they must incorporate some engineering management problem that may come into encounter with, which others may visit some local engineering companies and interview their key managers and see what the problems they are having are and how they worked out. Therefore, this project is requiring the utilization of MS Project software and a good search efforts through the Internet or other sources, on the other hand many novel ideas are encouraged in this direction, especially through the internet.

Effect of e-course on Case studies and Projects

The role of the project manager is to control the evolution and execution of the project on behalf of the promoter. This role will require a

degree of executive authority in order to coordinate activities effectively and take responsibility of progress. It will be a necessary to define the extent of such delegated authority, and means by which instructions will be received with regard to those decisions which the project manager in empowered to make, Smith (2002). As the traditional course teaching is supported by the advanced Information Communications technology (WebCT and recent years we moved toward and free open source of Moodle), students find that a very powerful tool to communicate with course around the clock, and emails can be very effected if it has a level of accuracy, the findings point to a new way to leverage e-mail content to “manage by e-mail”, Wasiak, *et al* (2011).

Not only that but also recently they are communication with each other by using **Face book** with the coordination of the course teaching assistants. Normally at the end of the course there is an electronic survey the student must fill in order to evaluate the effectiveness of learning during the course, really the feedback is tremendous in effecting students managerial skills especially during case studies, as the use the virtual environmental

to communicate and submit and get a good feedback from both the instructor as well the teaching assistants before the deliver as a team (a face to face) presentation for each case, also the training, talents and skills that students get and accumulate during the case studies ; they implement during the course project, and really this project is used as the dream company that student wish to establish and hence to manage effectively as it is demonstrated below in section 4 (interview 3).

METHODOLOGY

The focus of this section is to illustrate examples of people that they were orally interviewed for the relevance of this unique course, the interview samples were conducted for fifty individuals, as follows: first group current enrolled males students , second group is designated for current enrolled female students, third group is our graduate engineers who are currently working in the field, fourth group is conducted with some engineering managers in private sectors, the last fifth group were interviewed are some engineering managers in governmental sectors .Interviews 1-8 below give a useful feedback from the different perspective samples of some of the people involved (current enrolled student, engineers who previously enrolled and currently working in the field, and engineering managers at local engineering companies).

Interview 1- Male student “ ... this course was is new experience, therefore a lot of concepts which were formally covered. I was adapted to this new culture of learning, which was an enhancement not only to my technical skills but also to my thinking in terms of engineering management.”

Interview 2- Female student “...It was a very great pleasure for me to take this course . Indeed this course was the most useful and enjoyable one for me as I gained a lot of benefit from the items we had learnt.”

Interview 3 - Male Engineer (just graduate) “... Recently I and my team mates won the second place in a Google competition for e-marketing and really the idea came during course project in engineering management that we took during as an elective in our senior year. I really would like to make a suggestion to the administration of

Faculty of engineering at IUG to make this course a required course rather than an elective one .

Interview 4- Male Engineer (after one year of graduation) “... This course provided me great amazing experience such as managerial one, the importance of time management improving our team work skills, English skills, a good ways for researching, the confidence we built through the investigation and the oral presentation of case studies and course project with the utilization of MS Project and other general things in life. Hence, I highly recommend this must course for all of my fellow engineers.”

Interview 5- Female Engineer (after three years of graduation) “... This course connected me with the real and practical world of engineering, I was able to understand my direct manger as well the upper management during my first eighteen months (18) in the company, as a result I really was adopted to the new environment and team work as well.

Interview 6 - Male Engineer (after five years of graduation) “... Recently I was promoted as a group manager, and when I was offered the position, I did not hesitate to accept the new post, and this due to the confident and the leadership skills that I build during my enrollment in an engineering course at IUG, also as I am entering my second year of as a manger, I am really enjoying and doing well.

Interview 7- An Engineering Manager at a local Wireless Communication Company “... As engineering managers, we are so pleased to see that faculty of engineering at IUG, finally realized the importance of teaching such a course to their students, who they are eventually our potential future employees.”

Interview 8- An Engineering General Manager at the Ministry of Communications and Information Technology ” ...Due to the importance to the new engineering graduates, we really strongly recommend this course to be a required as a core course rather than a technical elective one.”

COURSE EVALUATION AND FEEDBACK

We aren't born knowing how to be effective. We learn from our parents or guardians, from our teachers, from our peers, and from supervisors and mentors. We learn from workshops and

seminars, from books, and from trial and error. Developing our effectiveness is a life-long process. Sometimes we get more help than other times. For example, when we join an organization as a professional, we generally receive lots of help. The organization benefits if we are successful, and so it takes steps to ensure that we are on the right track, Landis (2006).

Industry executives are well aware that new engineering graduates have a long way to go before they can “earn their salary.” New hired engineers are thus provided with formal training, on-the-job training, close supervision, progressively more challenging assignments, rotating work assignments, and time to mature. Strangely, when new students (or, in fact, new faculty) come to the university, they are left primarily on their own to figure out how to be successful. Academic organizations seem more interested in evaluating their newest members than in doing things to ensure that they succeed. Within engineering education, this “sink or swim” approach is not working. Most drop out, flunk out, or change their majors. And many of those who do graduate fail to work up to their full potential. Therefore this course comes as an urgent and important step in training of engineering students at IUG for new and uncertain career a life with completely different culture than the university campus life has been evaluated by both students and industry managers.

CONCLUSION

1. This must course was initiated based on an industry need assessment.
2. Student find this course and an excellent chance in house training for managerial skills that their normal major course can't provide that to them.
3. Through the course project students present excellent outcomes and in some cases a promising new ideas.
4. Flexibility was a key component to this (WebCT/ Moodle) online model design. Contingency plans were built into every phase of the learning event to ease the concept of engineering management learning process to the registered students.
5. Due to the very positive feedback from our graduate who took the course, the course needs to be moved from an elective group

of courses to be a required one and among the core courses for electrical and computer engineering students.

6. Due to the good reputation and importance of this unique and well handled course, other engineering discipline in faculty of engineering at IUG, are thinking seriously to incorporate such a course for their students.
7. Finally it is hoped this research paper can serve as a pilot course that can be transparent to other local, regional and international engineering schools who's debating the utilization for such a course in their curriculum.

REFERENCES

- Cook, J, et al. (2006) Blending Formal AND Informal Learning within an International Learning Network. Networked Learning Conference, Berlin, Germany.**
- Echiejile, L (1995) The business case for diversity, Professional Manager. IEEE Engineering Management Review, July: 8-11.**
- Hussein, MT (2010) An Engineering Management Course Shaping Future of Electrical and Computer Engineering Students at Islamic University of Gaza (IUG). 2nd International Conference on Engineering Systems Management and its Applications (ICESMA2010), American University of Sharajah, Sharajah, UAE.**
- Hussein, MT (2009) Engineering Management class notes. EL- Manara Publishing Library, Gaza City.**
- Kotnour, T (2005) Engineering Management: Past, Present, and Future. Engineering Management Journal, 33(3): 39-52.**
- Landis, R (2006) Enhancing Student Success through a Model Introduction to Engineering Course Instructor's Guide. 2ⁿ Edition, Spring, California State University, Los Angeles.**
- Mazda, F (2000) Engineering Management, Addison-Wesley, Harlow, England.**
- Shannon, R (1980) Engineering Management, John Wiley & Sons, New York.**
- Pavlak, A (2005) Project Troubleshooting : Tiger Teams for Reactive Risk Management. IEEE Engineering Management Review, 33(1): 36**
- Thamhain, H (2005) Team Leadership Effectiveness in Technology-Based**

- Project Environments. *IEEE Engineering Management Review*, **33** (2): 11-25.
- Smith, C** (1994) The new corporate philanthropy. *Harvard Business Review*, May- June: 105-16.
- Summer, L** (1991) Standards, product liability and consumer. *IEEE Engineering Management Review*, February: 19-25.
- Smith, NJ** (2002) *Engineering Project Management*. 2nd Edition, Black Publishing Company. Oxford, UK.
- Wasiak, J, et al.** (2011) Managing by E-Mail: What can Do for Engineering Project Mngement". *IEEE Transactions on Engineering Management*, **58**(3): 445-456.