Professional Engineers Should Educate Future Professionals About Professionalism

Walter L. Elden, P. E., IEEE, NSPE/FES
System Safety Society
Professional Activities Committee

ABSTRACT: *The educators of future engineer professionals should themselves be licensed registered Professional Engineers if we are ever to prepare the student to go out into the industry world motivated and equipped to function as a Professional. The paper discusses the lack of this approach today and proposed basic course/seminars on Professionalism deemed necessary to be imparted to the student. Two models of the future are presented for the undergraduate and the graduate engineering levels.*

INTRODUCTION

New engineering graduates who enter industry are for the most part neither equipped nor motivated by present educational processes to strive to become Registered Professional Engineers when they join industry and are not knowledgeable about basic Engineering law, a Code of Ethics, nor the legal liability implications and public responsibility forthe safety of their own designs. Additionally, few engineers really understand what professionalism is all about.

The educators of all future engineers should themselves be licensed Registered Professional Engineers in order to set professional examples for the developing Engineering aspirant to see before him every day in class. Otherwise, as so aptly stated by IEEE's past Presidential write-in candidate, Mr. Irwin Feerst, "What we'll continue to perpetuate is Amateurs Teaching Amateurs."

As further evidence of support of this professional approach to educating future engineers, the Florida Engineering Society, in the March 1973 issue of its Journal, issued a policy statement which "recommends that effective as soon as possible the engineering educators in the State of Florida who are engaged in the instruction of courses in the areas of engineering design, synthesis and analysis be required to be a Registered Professional Engineer at the appointment of Associate Professor." Further, the Florida Engineering Society "recommends that, for the future, engineering educators with the title of Department Chairman, Department Head, or Dean, should be at the time of the appointment Registered Professional Engineers." It is interesting to note, that according to the National Society of Professional Engineers, "where a high percentage of the faculty is registered, usually a high percentage of the students will take the Engineer-In-Training examination as the first step toward professional qualification."

It is recommended in addition, that there should be instituted at the undergraduate and graduate level in each engineering school's curriculum a required course on Professional Matters. The paper proposes two course-content models of the future which would be aimed at either a scheduled course or a series of professional seminars sufficient to prepare and motivate the student to become a true professional early in his career and to prepare him to become an advanced professional engineer-manager.

With these new approaches implemented to educating the future engineer, once he enters industry he will have received not only proper technical but professional educational tools as well. Results of these steps should be seen later on in safer product designs for the general public in the years to come along with achieving reasonable profit returns for his employer.

PROFESSIONALISM FOR THE ENGINEER

To an engineer, professionalism involves more than skill. Although knowledge and skill may exist without professionalism, professionalism can develop only where competence creates a proper atmosphere. Competence alone is impersonal. Professionalism, in contrast, is an individual state of mind, a way of thinking, a way of working and living, a way of adding something valuable on top of competence. Professionalism is the use of skill and knowledge:

– with honesty and integrity,

– with one's best effort, knowing that frequently neither client nor employer can evaluate that effort,

– with avoidance of all possible conflicts of interest,

– with the consciousness that the profession of engineering is often judged by the performance of a single individual.

Professionalism for an engineer begins with good moral character, because he occupies a position of trust where he personally must set the standards. He must make difficult dicisions which may differ from those his company or his client desires.

Professionalism for an engineer means:

– striving to improve his work until it becomes a model for those in the field, as a minimum using the most up-to-date techniques and procedures,

– proper credit for work done and ideas developed by subordinates,

– loyalty to his employer or client, always with concern for the public safety, in construction, product design, plant operation, and all other phases of engineering,

– leadership of less experienced colleagues and subordinates toward personal and professional development and an enthusiasm for the profession,

– activity in technical societies in order to keep current in his field, and encouragement of those working under him to improve their technical competence the same way,

– participation also in professional societies, thereby demonstrating his interest in the profession and encouraging his co-workers to recognize the technical and the professional as of equal ranking importance,

– registration, not simply because it may be a legal requirement, but more particularly as a demonstration to his co-workers and the public that this is one important hallmark of a professional, a willingness to go beyond the minimum to help and encourage others to realize their full potential.

Professionalism includes also special facets related to particular areas of practice. For the engineer in government or the engineer in private practice professionalism means capitalizing a special opportunity to project the profession to the public as a constructive force in society. For the engineer in industry, professionalism means the establishment of performance standards and safety criteria which protect the purchaser while maintaining a satisfactory return to the manufacturer. For the engineer in education professionalism means practicing at the frontier of knowledge in some field and pushing against that boundary, thus impressing on his students that boundaries need not be and rarely are static.

Professionalism means active participation in community life for each engineer. Engineering can achieve general recognition as a profession as engineers are visible to others. Professionalism shows up strongest in the realm of civic and public service, particularly in service to the public and the community and to those less fortunate."

The above direct quotation is taken from the Florida Engineering Society and presents the best discussion of what constitutes professionalism found to date by the writer.

Model I of the Future – Undergraduate Professional Engineering: Here, a Model of the Future is presented which addresses those skill and topics areas which each new graduate engineer must possess to upgrade the professional quality of engineering service rendered to the public, client, or employer. Table 1 lists the undergraduate skill areas.

Table 1. Professional Engineering Skill Areas at Undergraduate Level Model I of the Future

SKILL AREA

1. Code of Ethics
2. Professional Employment Guidelines
3. Handling and Motivation of People (Performance, Appraisal, Discipline)
4. Combatting Obsolescence of Older Engineers
5. Planning (Product, Program, Schedule, PERT)
6. Specifications and Contracts (Interpretation, Negotiations)
7. Work Breakdown Structure (Definition, Task Descriptions)
8. Proposal Writing (Program, Technical, Costs)
9. Cost Estimating (Labor, Material, Other) and Cost Controls
10. Subcontracts (Negotiation, Administration)
11. Economic Analysis (Time dependent alternatives)
12. Project Monitoring and Performance Assessment
13. Engineering Design, Drawings, Specs, Test Plans, Standard Practices
14. Safety, Reliability, Maintainability
15. Producibility and Quality Control
16. Test and Evaluation Methods
17. Field Installation, Customer Service, Design Changes
18. Marketing Interface/New Business Development
19. Customer Relations

It is envisioned that this material would be presented to the student at the beginning of the senior year, would run for the entire year, and would provide at least one hour's discussion each week. The instructors would be a combination of resident engineering professors and visiting engineers from nearby industry. It is strongly recommended that licensed P.E.'s volunteer their services from the NSPE (Professional) as well as IEEE (Technical) society local chapters to inject feedback from the real world into the corps of the next year's apprentice engineer.

Significant laws, codes and regulations of a Federal, State and local nature which protect the public safety would be introduced and highlighted. Of significance would be the particular state registration law, the Occupational Safety and Health Act (OSHA) and the Consumer Porduct Safety Act (CPSA). Court proceedings, law suits, working with lawyers as expert witness would be explained. Next, the NSPE Code of Ethics would be introduced and explained. The concept of conduct compliance, policing and enforcement would be emphasized.

The importance of maintaining ones' technical competency and skills would be stressed. Ways and means to continue one's education to combat technical obsolesence would be discussed. The importance of belonging to and participating in both Professional and Technical societies would be stressed.

An overview, with specifics, would be imparted explaining the five major practice areas of engineering; government, education, consulting, industry and construction. Invited local speakers could provide valuable first hand experience feedback to the student.

The importance of the engineer in providing volunteer services to his community is stressed. Examples of ways to serve on boards, advisory groups, and committees are explained. Projecting the professional image of engineering through modest public relations efforts is discussed.

The jointly endorsed Professional Employment Guidelines would be thoroughly discussed to acquaint the individual with those generally accepted practice standards for the employer and employee. Current salary and fringe benefit survey findings would be explained to aid the young engineer in choosing his field and preparing his career goals. In conjunction with career planning, factors which greatly affect one's being laid off would be discussed based upon current research findings. This would be aimed at aiding the engineer to perform better for his employer so both benefit. Lastly, appropriate counseling would be provided to ascertain 100 percent of the graduates apply and become examined to be certified as Engineers-In Training. This will assure a new group of engineer apprentices enter industry well prepared and motivated to sustain the initial high professional outlook in his early career leading to full license as registered PE's a few years hence.

MODEL II OF THE FUTURE – GRADUATE PROFESSIONAL ENGINEER – MANAGEMENT

If the undergraduate is prepared well professionally, and let's assume that with Model I of the Future implemented that this will occur, then, in about 4 years from receiving the Bachelor's Degree, and being certified as an EIT, he becomes a licensed Registered Professional Engineer with his state. A few years after this will occur the period where the Engineer begins a transition to Engineer-Manager, progressively acquiring more and more supervisory, task leader, and later project engineering responsibilities. The engineer will need to acquire new skills and assume a much broader perspective. Additionally, he will be called upon to start dealing more and more with people and money, and less and less with things and materials.

Today's engineering task leader and program managers are called upon by industry top management to assume the very top leadership in running either the engineering design effort as a functional task element of an integrated program or to head the entire program as the overall manager. Since most program managers generally are chosen from the engineering department, a lot have difficulty taking off thier previous engineering hat when they manage. This causes conflict between a strong engineering task leader and his program manager. At any event, each takes on a new roll, but in particular, the program manager does the most.

Contemporary engineer-managers and program managers lack sufficient project engineering/management skills today in other than specific engineer technical design areas. Generally, the author attributes this to a lack on industry's part to allocate properly resources and to prepare future supervisors and middle managers. This comes about from great pressures to achieve short term cost and schedule objectives. As a result, the engineer who is given supervisory responsibilities has to learn "on the job" without benefit of professionally based education in new skills, attitudes and methods and when he performs poorly, he generally feels it economically. In some instances, the author has concluded that it might be better off to bring in a person from outside of engineering, particularly as proposal or program manager of a large engineering/production effort, to administer the program and deal with the people, rather than to use unskilled engineer supervisors.

It can be argued that consulting professional engineers not in industry may not need to be proficient in many of the proposed engineer management skills. Nevertheless, the greater number of future PE's will be engaged in industry, and in that environment will need to be proficient in most of these skills.

The Model II of the future is given in Table 2. This is envisioned to be a graduate level required course of one semester duration, devoting 3 hours per week to the material. At the start, a review and re-emphasis of the Code of Ethics is established. Then, a review is made of the Professional Employment Guidelines adopted by the joint Engineering Societies. This is examined from the point of view of equipping the future Engineer-Manager for interviewing, hiring, appraising and handling engineering people employees in a professional manner. Specific topics and concepts are explained dealing with handling and motivation of employee and the important task of ways to effectively combat the older engineer obsolescence syndrome.

This then leads into specifics of planning, organizing, administration and control of the engineering project/program. This addresses the areas of specifications, contracts, work breakdown structuring, proposal writing, cost estimating, subcontracts, economic alternative analysis, and project monitoring.

Table 2 Professional Engineering Management Skill Areas at Graduate School Level — Model II of the Future

1. *Laws to Protect the Public Safety*
   Registration Law (NCEE, State)
   Federal Laws (OSHA, CPSA, etc.)
   State, Local Codes/Regulations
   Safety and Liability Legal Trends
   Law Suits, Court Proceedings, Expert Witness
2. *Code of Ethics*
   Conduct and Policing
3. *Technical Knowledge and Skill Proficiency*
   Competency
   Continuing Education
   Combatting Obsolescence
4. *Society Participation*
   Professional
   Technical
5. *Practice Fields*
   Government
   Education
   Consulting
   Industry
   Construction
6. *Community Service*
7. *Public Relations*
8. *Guidelines to Professional Employment*
   Joint Society Guidelines
9. *Salary and Fringe Benefit Survey Data*
   IEEE, EJC, NSPE
10. *Factors for Avoiding Being Laid Off the Job*
11. *Preparation and Examination for Engineer-In-Training*

For the Engineering Task Leader, he must understand and be capable of managing the completion of the overall engineering design effort. This ultimately leads to the preparation and issuing, under his control, of drawings, specs, test plans and procedures. He may have to personally sign and seal drawings. This will necessitate discussion of what constitutes accepted practice standards for engineering. An integral part of assuring that engineering design integrity is achieved, necessitate an understanding of the disciplines of safety, reliability, maintainability, producibility, quality control, test and evaluation methods.

In the concluding topics, the future engineer-manager is lectured on the areas outside of engineering requiring both an understanding and an involvement. Here, the logistics areas of field installation, customer service, design changes, marketing, new business planning/ development and customer relations are introduced and explained.

It is granted, that the Model II course proposed contains a tremendous array of topics and that each could be a course in itself. The course proposed must at least make the student to be aware, introduce basic and pertinent factors, provide a comprehensive direction of where to get hold of detailed material, and more importantly achieve success in motivating him to want to then do it on his own when he returns to industry.

CONCLUSION

Two models of the future have been proposed. The objectives are to utilize Professional Engineers to educate future Professionals about Professionalism. If we are successful, the benefits will be shared among the general public, industry, employed engineers and the profession as a whole.