

CQI IN PROFESSIONAL DEVELOPMENT OF ENGINEERS: Dynamics, Obligations and Myths

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ABSTRACT: Professional development or continuing education of practicing engineers has become paramount to our international competitiveness. Whether such educational efforts are directed at learning new technologies and processes; simply updating existing skills and knowledge, or even completely retraining engineers for new careers; training is now an integral engineering activity. That is why this issue must be under constant scrutiny. Considerations of quality are many in every aspect of the engineer's work including further education. There are many popular concepts of quality including TQM, Kaizen, QFD, Employee Involvement and Empowerment. The author strongly believes that Continuous Quality Improvement or CQI is the best approach to ensuring quality in engineering development programs.

TRAINING NEEDS AND ASSESSMENT: Training of engineering professionals is a critical component of the U.S. competitiveness across global markets. Since there is a great variety of differences in education and work experience among engineers; two issues must be considered closely; including the determination of training needs and assessment of training efforts. Needs analysis allows the trainer to identify objectives for a training program. One simple way of determining this is to look at the job description and then look at the employee's performance.¹ The discrepancy between the expectations and the actual performance can form the basis of identifiable needs.

This basic approach allows a trainer to know exactly what is expected of the employee so that we know exactly what to train for and what to measure against when we evaluate the training program. Once some set of objectives have been compiled for the needs analysis stage, a trainer should then proceed to determine the level of each performance which is expected. There are two basic steps in the determination of performance levels: level of needed performance and level of present skill or understanding.²

Although there are many more methods to conduct needs analysis, the foregoing discussion presents a solid base. Many programs are also increasingly designed for highly complex jobs and require more detailed analysis. In such cases, a trainer will expand this stage of program design to include task inventories. Based on experience, the author has found that a basic procedure in compiling task inventories is highly beneficial. Such procedure should include the following in order: get information from the task/job experts, observe task, review written job procedure and other sources; define a preliminary task list; observe expert performance and discuss with task expert; refine task inventory; verify with management; and develop final list for actual training. Subsequent to implementation, assessment of training is an important step.

Evaluation results are typically used by three sources: engineer trainee, trainer, and management/organization.³ Trainees need to know what they have learned and thus what remains to be learned. From this viewpoint, evaluation is conducted to facilitate the learning process. Trainers need evaluation as an instructional tool to continuously improve and modify the program. For trainers to be successful at this task, pretest and posttest measurements are highly beneficial. Finally the management of the organization has a need to know evaluation results. In this context, decisions as to program administration, expansion, discontinuance, and resource commitment levels can be made. This is the time and place to establish the “worth” of a given program.

APPLICATION OF CQI PRINCIPLES TO ENGINEERING DEVELOPMENT:

Continuous quality improvement is a way of thinking and doing, the process of improving all functions at all times. It is a philosophy of pursuing continuous improvement in every process through the combined efforts of all organizational members.⁴ It includes streamlining work processes to make them as simple as possible, orienting work toward customer satisfaction, solving problems at the working level and providing high level support for change and continuous improvement.

As a result of implementation experiences, the Coast Guard found that several ingredients are necessary for CQI's successful adoption. These elements were: (1) Leadership; (2) Training; (3) Organization; (4) Total Involvement; and (5) Measurement.⁵ It is imperative that top management define where it is that the organization is going. The ultimate success of CQI rests on the involvement of the entire work force. Top management must lead; middle management must support and provide resources; the work force must do the work. The ability to measure where we are and what has changed is critical to success. An adaptation of quality principles to engineering would typically include the undertaking, identifying or accomplishing the following structured steps⁶: 1. Mission (What); 2. Customers/Requirement (Who); 3. Current Status; 4. Improved Status; 5. Barriers; 6. Solution Identification; 7. Implementation of Ideas; 8. Assessment; 9. Standardize and/or Modify; and 10. Conclusion And Lessons.

DYNAMICS OF QUALITY PEOPLE: Engineers, as people, the environment and conditions under which they perform their tasks are also important concerns for quality. A classic study of how they interact with others and work in groups would include project groups, committees, staff groups, work teams and task forces.⁷

Project group is an organizational unit at the lowest line level that works in direct pursuit of organizational goals; a set of people who are recognized by the formal organization to be assigned to and responsible for a given set of tasks, which are objectives of the organization. This might be one project, or it might consist of a series of related projects (related by task type or the group's qualifications). A committee is a traditional approach to creating organizational structures outside the line organization when additional interactions between line and staff organizations are required. It is appointed and charged by upper management, and usually has a finite life, although ongoing committees are not uncommon.

Staff groups are other traditional alternatives to the line organization, established in the traditional organization to deal with issues that are generally common to many, if not all, of the

line components of the organization. A work team is a nontraditional structure which has the following characteristics that distinguish it from a committee or staff group:

Deals with a specific aspect of continuous improvement within a project group or common to several project groups.

Its change evolves continuously depending on external circumstances, and ideally it is almost totally self-directed.

Its life is not specified, and it is expected to last as long as the process that it is charged to improve, although obviously both the people and the type of membership will evolve.

A task force is equivalent in all respects to the work team, with two exceptions (1) it is charged to address a specific problem as opposed to the constant improvement of a process, and (2) it is expected to have a finite life due to its charge.

MANAGEMENT OBLIGATIONS: One of the key elements put forth by Deming (1986) and many other writers on quality management is the importance of top management involvement in and support of the atmosphere and the process. Indeed, Deming's experience indicated that 94% of troubles and possibilities for improvement are due to "common causes" - that is, conditions that belong to the system rather than to the individual employee, and are thus the responsibility of management.⁸ Another researcher stated that:

1. The workers work in the system. The manager should work on the system to improve it with (the workers') help.
2. The involvement of top management is essential to the success of the program. Assent is not enough.
3. When there is a problem, 85% of the time it will be with the system, not with the workers.⁹

At a TQM seminar sponsored by the National Society of Professional Engineers, the importance of managerial leadership was described as follows: Managerial leadership means consistency directed toward achieving a vision. You are a leader if your people are lining up to help you achieve your vision of the organization in the future.¹⁰

QUALITY MYTHS: Many view the quality concern in engineering development programs as the management "idea" of the day or a passing fad, it is NOT. A continuous concern for quality is nothing short of a major transformation; a universally sought goal and certainly a paradigm shift.¹¹ Considered as whole then, CQI is a concept which must impact everything; including trainer preparation, training material preparation, conduct of educational efforts and assessment.¹² As compared to a systems approach, the input (engineers & trainers); the process (training itself) and the output (developed professionals) must be under scrutiny and have a goal of constant improvement.

EPILOGUE: We can no longer afford to ignore the quality of professional development programs in engineering. It is entirely a myth that by next year, a new fad will replace CQI. As the premier part of the U.S. technical workforce, engineers need to implement and maintain new goals and ideals that were not even thought of 15 or 20 years ago. As a global economy, we need to continuously improve our development efforts, management must "lead" and support such efforts. Through a review of pertinent concepts, it has been the intention of this author to explore

such quality considerations and challenge the engineering profession to re-evaluate personal and organizational perceptions.

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