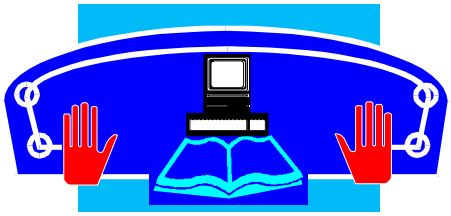

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Quality Training: What Top Companies Have Learned
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Quality Training: What Top Companies Have Learned

- *align program strategy with key corporate priorities*
- *solicit early and continuing top and line management involvement*
- *tie training to timely, on-the-job application*
- *select trainees by focusing on employees and managers who can best lead, motivate and train others*
- *reassess and revise offerings continuously to reflect the evolution of the total quality process*

Quality Training: What Top Companies Have Learned

by Kathryn L. Troy

Contents

From the President

Top management in many U.S. firms continues to search for ways to sustain the momentum of the transformation in corporate organization and culture begun in the 1980s. Evidence that corporate training programs promise to become a crucial tool in this effort is plentiful in those firms which have already embraced total quality as a management process. Training programs build quality awareness in employees, help managers to lead the quality movement in their units, and instill the skills needed to calculate costs and document improvements resulting from a quality focus.

This report draws on the insights of a panel of quality professionals whose firms are in the forefront of the total quality movement—the members of The Conference Board's U.S. Quality Council. Initiated by Council members, this research project enabled these professionals to compare and contrast their own training programs to those of firms with quality processes at a similar stage of advancement.

We would like to thank U.S. Quality Council members for sharing the results of their internal research project with the broader audience of Conference Board associates. This cooperative effort assists the Board in fulfilling a key element in its mission—the improvement of the business enterprise system.

PRESTON TOWNLEY
President and CEO

Survey Participants

The Conference Board's U.S. Quality Council, which meets quarterly, was organized in 1985 to provide a national forum on problems and issues in total quality. Member firms of the Council and their representatives surveyed in January, 1990, are as follows:

American Express Travel Related Services
MaryAnne E. Rasmussen
Senior Vice President,
Worldwide Service Quality

Corning Incorporated
David B. Luther
Senior Vice President and
Corporate Director, Quality

First National Bank of Chicago
Global Corporate Bank
Aleta Holub
Vice President, Manager,
Quality Assurance

FPL Group, Inc.
William J. Hensler
Director, Quality Services

Ford Motor Company
Ray J. Rogal
Director, Manufacturing Support
Plastic and Trim Products Division

Hospital Corporation of America (HCA)
Dr. Paul B. Batalden
Vice President for Medical Care

IBM Corporation
Laszlo J. Papay
Director of Market-Driven Quality Assessment

Johnson & Johnson
Johnson & Johnson Quality Institute
Gerald M. Cianfrocca
Director, Quality Improvement Process

3M Company
Douglas N. Anderson
Corporate Quality Director

Management Science America (MSA) Now:
Dun and Bradstreet Software Services, Inc.
Edward J. Kane
Vice President, Quality and Management Systems

Milliken & Company
Newt Hardie
Vice President, Quality

Westinghouse Electric Corporation
Jack H. Fooks
Vice President
Corporate Productivity and Quality

Xerox Corporation
John E. Kelsch
Director of Corporate Quality Office

Executive Summary

Early in 1990, 13 members of the Conference Board's U.S. Quality Council pooled their insights on key quality training issues by responding to a detailed, self-designed questionnaire. The firms represented on the Council are among the pioneers in the total quality movement (see Box on page 8). Their responses show that relevance and applicability are crucial to the success of quality training programs. The Council-member firms report that their quality training strategy is aligned with critical company priorities. Training curricula and courses help employees and managers link corporate priorities first to quality concepts and techniques and then to job-related tasks, problems and work processes.

The Council-members suggested the following key guidelines for companies initiating or reassessing quality training:

- Set training strategy by gathering data through a top-down/bottom-up process. Performance reviews are an opportune time to assess employee training needs. Other sources of feedback include employee surveys and exit interviews. Corporate mission, goals and strategies should be factored into the process, preferably with the involvement of top management or a senior-level training task force. Senior management involvement is crucial when initiating a total quality process and an accompanying training program. Top management's continued involvement elevates the status of the training process. In one company, members of top management are participants in the first class in each new training course; in another firm, a top executive kicks off every quality training course.

- Focus the training effort. Initially, training many people is less important than training the right people—managers who will return to their units to lead the quality training effort or skilled employees who can be trained to serve as trainers or coaches for their work group. "Just-in-time" training works best—trainees need to apply their new knowledge and skills immediately after training takes place. Corporate training departments or outside groups may design and deliver training courses, but line management is responsible for seeing that training occurs. Line managers need to be involved early and often to assure their "buy-in" to the training process.

- Classroom training is a primary vehicle for training delivery, but alternative approaches can be successful. Among those used by Council-member firms are small group workshops closely aligned to on-the-job application; live, interactive television broadcasts; and self-study materials. Often, quality training is incorporated into other corporate training courses, but most member-firms report offering several specific courses such as quality awareness, customer sensitivity, quality improvement process, statistical process control, design of experiments and benchmarking.

- Continuous improvement is the rule with quality training as with quality processes. Help from outside experts or quality gurus can be valuable when designing or improving courses or soliciting technical expertise. Council-member firms report that such input ultimately becomes an ingredient in their own customized training program. Training needs evolve as the quality process takes hold. Many member firms placed heavy emphasis on quality awareness and attitudinal change during the introductory phases of the total quality process, but now devote as much as 80 percent of their training hours to skill building.

Typically, evaluation forms are used to assess the success of individual courses. Ascertaining the overall effectiveness of quality training remains a challenge, but some current indicators include the ability of employees to apply new skills on the job, performance measurement statistics, customer and employee survey results, and employee turnover statistics.

Glossary of Commonly Used Quality Terms

Total Quality: A commitment to meet customer expectations by doing the right things the right way the first time and 100 percent of the time at a cost that represents value to the customer.

Total Quality Management: Integrating quality with management systems and performance indicators to cover all functions and results—cost, delivery, scheduling and benefits.

Benchmarking: A technique pioneered by Xerox that compares a company's performance and practices to those of leading competitors and to non-competing firms viewed as outstanding in their industry.

Cost of Quality: The total cost of not meeting customer requirements, including cost of appraisal, prevention, failure and lost opportunities.

Process Management: Techniques used to define, document, measure and continuously improve a series of cross-functional actions or operations. Effective "management" requires the establishment of ownership and accountability for each process.

Statistical Process Control: The use of statistical tools and techniques to examine a problem or ongoing process in order to identify its components and quantify the amount of change or stability.

Design of Experiments: Use of statistical tools and practical research designs to test the effectiveness of alternate approaches to a problem or project and make decisions based upon the findings.

Quality Training: What Top Companies Have Learned

"Buy-in," or taking ownership of innovation and change, has become a goal of paramount importance in much of Corporate America. When employees and managers "buy -in," top management has successfully engaged them as partners in the change process. Perhaps the most significant and far-reaching shift in U.S. firms during the last decade is a growing emphasis on managing for total quality. Challenged to make quality the business of everyone in the corporation, firms have set out to transform the way they work. Training has become a vital element in efforts to raise employee awareness, to equip them with problem-solving and statistical skills, and to prepare managers and supervisors to build work teams and facilitate group dynamics. (See Box for a brief Glossary of quality termisology.)

Training Strategy and Curriculum

Members of the Conference Board's U.S. Quality Council start with corporate strategy and build their training programs by assessing needs through a simultaneous "top-down and bottom-up" process. "All quality-related training, at all levels within the company, is clearly focused toward three principal priorities," says the Manager of Ford Motor Company's Quality Education and Training Center. These include an implementation strategy that dovetails with Ford's "Mission, Values and Guiding Principles" (MVGP), customer satisfaction, and continuous improvement. The First National Bank of Chicago's technique is similar: "Our quality training strategy focuses primarily on four of the company 's six commitment statements," the firm's Vice President, Quality Assurance, reports. (See Box on p. 10 for details.) With the company's long-range strategic plan, corporate goals and mission as a backdrop, firms make a periodic assessment of business requirements, performance requirements and education requirements. At Florida Power & Light (FPL) corporate business plans result in the selection of priority activities and help identify training needs at every level of the organization to be supported by quality training. The corporate vision that was established at FPL in 1984 is to become, within the next decade, the best managed electric utility in the country. According to the firm's Director, Quality Improvement, "the vision requires the highest degree of customer satisfaction and is achieved by the Quality Improvement Process—a management system and a corporate culture. " Exhibit 1 shows the role of education and training in supporting the Quality Improvement Process.

Employee needs are factored into the training equation through a variety of methods, but the annual performance review process is probably the most important. At American Express Travel Related Services, managers are responsible for preparing a training plan for each employee reporting to them, based on discussion with the employee. When setting its quality training strategy, First Chicago also considers results from its employee surveys and suggestion system, customer satisfaction data/research, and benchmarking with companics known for quality service delivery.

Typical Courses

It is not always possible or even desirable to separate quality training from other company training courses. Says Milliken's Vice President, Quality: "All training is quality training, but in the traditional view some courses are more directly associated with quality. " Typical quality courses Council members report include:

Quality Awareness: Targeted at helping employees understand the basics. Total quality is defined and its relationship to the corporate culture is explored.

Corporate Training Strategies are Aligned with Corporate Priorities...

Ford

The Company's overall quality training strategy focuses on three key corporate priorities:

- Implement management and operating "practices consistent with the Company Mission, Values, Guiding Principles and Total Quality Excellence
- Meet customer needs and expectations
- Achieve continuous quality improvement

This training policy is continually monitored by senior executives from each business unit, such as the Quality Strategy Committee, which represents the 30 top executives from all functional disciplines within the Company's North American Automotive Operations.

First Chicago

Quality training focuses on these company commitment statements:

- Our commitment to the customer is our highest priority. (Customer focus training curriculum includes tourses in "Leading Customer Focus" and "Creating Customer Focus")
- Our commitment to our people is the key to our success. (Training in development and job skills, including "Process Improvement" and "Tools and Techniques")
- Our commitment "to teamwork means working together within and between businesses. (Courses focused on team building, such as "Facilitator" training and provision for work groups to attend training as a team)
- Our commitment to integrity, excellence and professionalism in all we do. (Training in Quality Awareness, Tools and Techniques and courses such as "Managing for Excellence" and "Leadership Strategies"

...and are Frequently Reassessed

Xerox

Quality strategy assessments are conducted throughout the company on a periodic basis and annually within operating units:

- Benchmark data are compiled from Fuji, Xerox and leading U.S.&d overseas companies and feedback is provided to senior staff at operating units, including quality officers, quality training managers and the corporate quality office.
- Quality training requirements are developed by a task force of representatives from each operating unit working in conjunction with corporate training.
- Prior to implementation, training strategy is validated via personal interviews with Xerox line management.

Employees are introduced to the quality improvement process, the costs of quality, problem solving, teamwork, an emphasis on customer satisfaction, and so on.

Team Building: Courses stress a cooperative approach to goal setting, identifying and solving problems, project implementation and evaluation, etc. Managers learn group dynamics skills and the key principles of group leadership.

Process Management Training: Helps employees and managers learn the tools and techniques to define, document and continuously improve processes while moving toward a goal of zero defects.

Customer Awareness Training: Helps employees and managers become attuned to demands and expectations of markets and product/service users.

Quality Measurement: Courses equip employees and managers with the tools to gauge the impact of poor quality on basic processes and functions, to establish controls, develop and apply cost systems, test activities and processes against external standards (benchmarking), etc.

Statistics Training: Refines the ability of employees and managers to engage in continuous improvement of processes, design experiments, and to reach decisions based on collection and analysis of data.

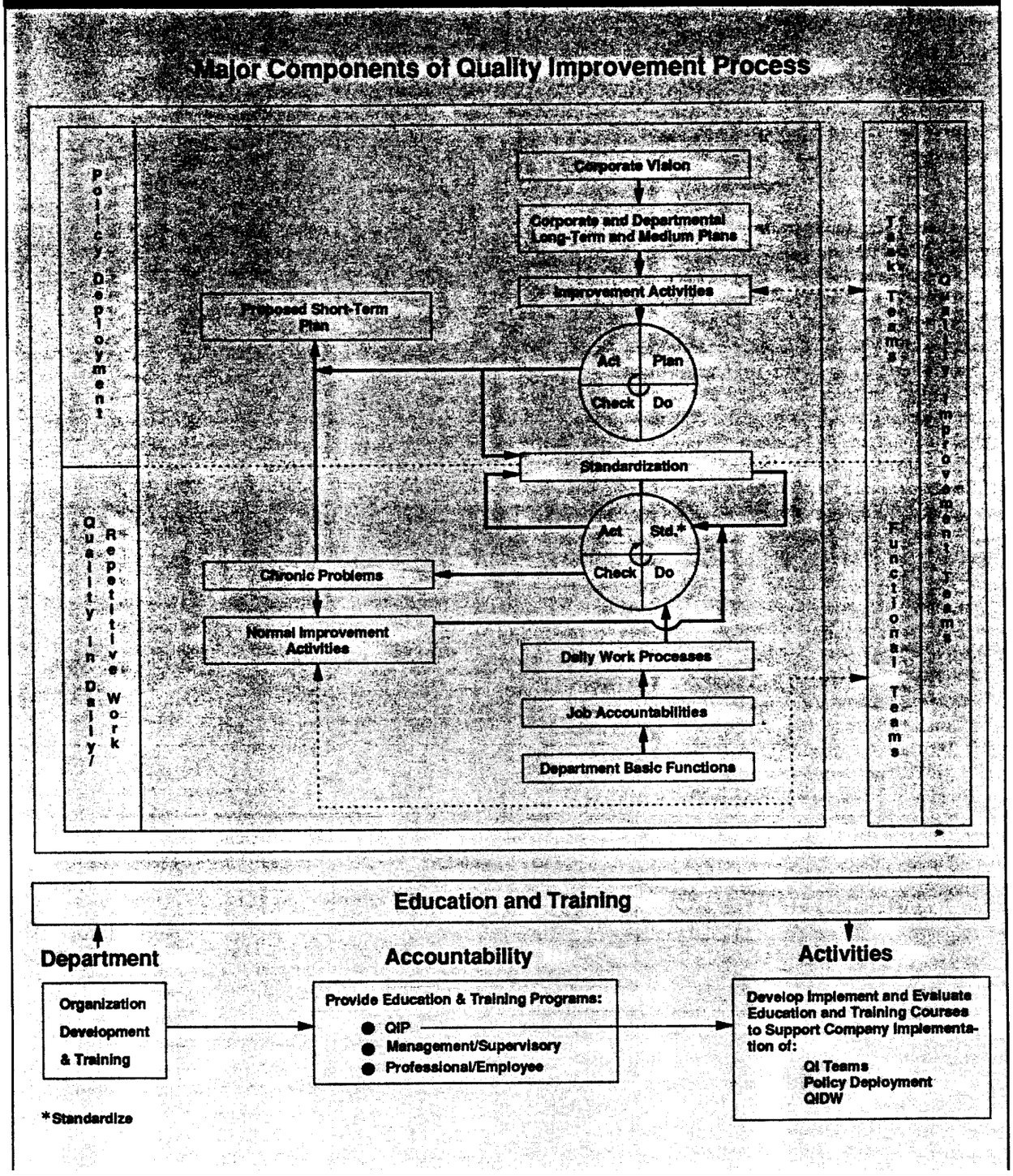
A few courses, such as quality awareness, may be mandatory for all employees, with other training prescribed for managers or special groups of employees (see Box on p. 12). In addition, quality concepts are integrated into other corporate training courses. (More extensive course descriptions appear in the Appendix.)

Allocating Training Hours

In the introductory stages of the total quality process, firms place a priority on courses which help employees to understand and accept new practices—an effort to forge a new mindset among employees. "Training is the beginning of the learning journey in total quality. We link training to the concept that quality is a basic business strategy," says a quality executive of Hospital Corporation o-f America (HCA). As the process takes hold, there may be a shift in emphasis, with training focused on skill-development and enhancement. Council members' practices can be summarized using two major training categories:

Skill Training: Overall, Council-member firms currently place the greatest emphasis on training employees in job skills and knowledge—this category represents at least half of the training time reported by most of these executives, and 85 to 90 percent of the training hours at Corning, IBM and 3M. At Xerox, all employees attended a four hour course in quality orientation during 1984 to coincide with the launch of the firm's quality strategy. As each Xerox unit started its quality program in the 1984-1988 period, employees participated in 48 hours of training which included 4 hours devoted to introduction to quality, 8 hours to

Exhibit 1: Florida Power & Light: Organization Development & Training Link to the Corporate Vision



mission and team building, and 16 hours focused on problem solving. Other core modules are delivered in a combined training sequence:

Course Title	*Hours*
Concepts of Quality	4
Interactive Skills	6
Quality Improvement Process and Application (application continues after classroom training)	12
Role of Manager/Individual in Implementation	2

Supplemental quality training at Xerox includes a number of courses such as Measures of Quality, Benchmarking and the Manager as Facilitator.

Johnson & Johnson (J&J) has increased its training emphasis recently. Job skills and knowledge now account for about 60 to 70 percent of training activities, about the same as in earlier years, but the absolute level of effort has doubled. The other 30 to 40 percent is distributed among quality improvement strategies and implementation, tools and techniques, personal behavioral change and attitudinal change.

Behavioral and Attitudinal Change: Emphasis on attitudinal change at other Council firms accounts for 6 to 25 percent of the training effort. Service organizations such as HCA, First Chicago and American Express stress customer knowledge, sensitivity and awareness (see Exhibit 2). Ford's efforts in this category focus on the company's MVGP priority, participative management, and employee involvement.

The IBM philosophy is that education can play a role in attitudinal change, but that the role of executive, functional, and department managers is equally important. They are encouraged to initiate attitudinal change, using "appropriate educational support." Corning and Westinghouse placed greater emphasis on attitudinal change during the start-up of their quality effort than they do currently. "Training was introduced as the change agent to make quality happen," says Corning's chief quality executive. Behavioral and attitudinal change accounted for three quarters of all training in the early days. "Today, the ratio is reversed and close to 90 percent of training time is spent on job skills and knowledge. "

Training in personal behavior change is offered primarily to managers and supervisory personnel. The leadership aspect is stressed: "Applying total quality strategy requires a change in behavior from a managing to a leading role." First Chicago's executive notes. At Westinghouse, such training is a large part of curriculum at the Productivity and Quality Center. Behavior change is sometimes crucial for those who must "manage improvement and lead improvement processes. " says the firm's Vice President, Corporate Productivity and Quality.

Is Quality Training Mandatory?

Training requirements generally vary by job level. This is a sampling of practices reported by The Conference Board's U.S. Quality Council members:

American Express Travel Related Services

A variety of quality courses are directed at associates (workers) and management. Many courses stress the need to "put the customer first" and link customer satisfaction to bottom-line payback.

Corning

Quality training is a condition of employment. Required courses vary with job level.

First Chicago

Several courses are mandatory. These include Management Practices for all management personnel and Customer Focus training for all customer contact personnel.' The goal is a minimum of 40 hours of quality/job skills training for all employees; the firm is considering raising this to 80 percent in 1991.

IBM

Since 1989, training in "Market-Driven Quality" is required for all employees.'

Milliken

Several courses are mandatory, including Human Relations and Public Speaking the Quality Improvement Process, (all management and selected administrators), Basic Statistical Process Control (nonmanagement and manufacturing management), Benchmarking (senior arid middle management)

3M

All supervisory/management levels have been trained in total quality management concepts. They in turn train their employees.

Making Training Happen: Whose Responsibility?

There is no such thing as too much top management involvement in quality, practitioners suggest, and members of the Quality Council point to such involvement in training in their companies, both at the macro and micro level. Xerox's training initiative dates back to late 1983, when its President appointed a corporate vice president of quality, a quality implementation team of senior managers, and a quality training task force. "Our 'Leadership Through Quality' effort continues to be driven from the top," the company reports.

IBM's Chairman issued "a clear and concise message for IBM to be totally market-driven: Market-driven = Quality = Excellence. This directive guides the evolution of the firm's quality training strategy. The intent is to deliver the right education to the right people at the right time," IBM's Director of Quality

Exhibit 2: American Express Travel Related Services Stresses Customer Service

Who Teaches Quality?

At American Express we not only practice quality, we teach it.

American Express customers expect and deserve quality products, service, and commitment. American Express employees expect and deserve quality training and education.

The goal is to graduate 'Masters' in Quality Customer Service.

In response to customer and employee expectations, American Express Travel Management Services has established **Quality University** uniquely qualified to meet the needs of customers through the **"teaching of quality"** to employees.

Upon Graduation from Quality University, students are not only prepared for their job, they have also developed confidence in themselves – knowing that they are empowered to help the customer.

What is Quality University?

Quality University is a philosophy. It's a total approach to customer satisfaction that begins with dedication to the growth and development of American Express employees, and results in commitment to meeting the needs and expectations of American Express customers.

To give our philosophy substance, Quality University is made up of a series of basic and advanced-level training programs that meet educational needs, both universal and unique, of TMS employees.

One principle of Quality University that sets it apart from other training programs, is the **"Moment of Truth"** concept.

Students learn to create positive moments of truth with customers and co-workers that result in interactions that focus on the needs and interests of the customer.

A "Moment of Truth" occurs when an American Express employee is challenged with a customer need and is able to embrace it – undemanding it so completely that be or she meets that need quickly and efficiently.

Quality University Curriculum

School of Customer **Service**

Students not only learn technical skills needed in their vocation, they also learn about products, problem solving, improving relations with co-workers, and understanding customers and their individual needs.

Innovative teaching methods, such as bringing customers to class, are used to make learning both practical and fun.

Students complete a nine-course "core curriculum" that includes the following:

- **'Putting People First'**
- **'Developing a Relationship with Your Customer'**
- **'Wellness at Work'**
- **'Understanding Your TMS Customer'**

The core is incorporated into the students' advanced program of study, or "major," which is tailored to meet the specific needs of their career.

School of Management

The challenge of managing a diverse employee population with varying degrees of experience, changing needs and growing responsibilities is met with Quality University's **School of Management.**

The School of Management not only develops leaders skilled in managing operational and personnel issues, it provides managers and supervisors with the skills needed to develop their employees.

explains. At IBM, education in skill and knowledge categories is the responsibility of functional education units such as engineering and manufacturing technology, software systems, business and planning. These units provide selected quality training which is job/skill specific. IBM's quality improvement education group is responsible for companywide quality education and has a cross functional mission. The group is expected to develop programs which improve quality skills and disciplines, provide tools and techniques, place emphasis on process management solutions, and support the implementation of IBM's "Market-Driven Principles."

When moving from conceptualization to implementation, many Council firms opted to begin quality training at the top:

- Coming's first class was made up of its six senior officers. The company's Chairman is usually the first person to take every new quality class.
- Milliken starts at the top with courses on Management of Change and proceeds to such offerings as "The Process of Quality Improvement," "Participative Management, " "Statistical Process Control," "Design of Experiments" and "Benchmarking."
- Johnson & Johnson's corporate organization is highly decentralized. Its "family of companies" includes 175 separate operating units in 55 countries, each led by a president or managing director. Each unit has its own management board. Quality is part of management education and training for all operating unit presidents or managing directors as well as for their management board team and those who report directly to board members. All other operating unit personnel receive training in quality awareness and individual tools and techniques. Other training, such as courses in "Business Process Quality Management" and "Statistically Based Continuous Improvement," is offered as the needs become apparent.

Involving Line Management

Line managers, functional groups (such as industrial engineering), and union committees may also have considerable input into training design. At Ford, for example, factors such as product diversity and worldwide geographic dispersion dictate a decentralized approach. The responsibility for selection and delivery of training lies with line management in individual Ford units—which receive guidance and support from the corporate quality/reliability and employee relations functions. "Although there is a basic company quality strategy, quality issues within various business units have great diversity," explains the Manager of the firm's Quality Education and Training Center.

Coming's quality officer reports that at plants where High Performance Team efforts are in place, "union-management committees make training decisions for the whole plant, based on well-developed analyses of work requirements. "

Ultimately, line management has the responsibility for assuring that quality training takes place. "The organization development and training department is responsible for making corporate-level training available, including quality improvement tools and techniques training; the individual department managers are responsible for selecting and sending their employees to be trained," says FPL's quality executive. At J&J, management at each operating company is responsible for implementing training. In those units, the quality education process is monitored at the top of the organization: An education subcommittee headed by a board level (or director level) manager is responsible to a board level quality improvement team. At American Express Travel Related Services, the human resources department maintains training profiles for employees and monitors individuals' progress to make sure some training is completed.

Training coordination is sometimes a designated staff responsibility. Xerox assigns an officer or manager to each of its major units who "acts as an honest broker" for functional management by providing assessment and feedback on the training process and subsequent application of developed skills. Quality coordinators work with functional managers at MSA as "facilitators" or "catalysts" to the training process.

The Training Environment

Classroom training is the preferred mode for delivering training in most, but not all, of the firms. Xerox, IBM, Milliken, American Express and HCA report that 60 to 80 percent of their quality training is classroom based. Tailored workshops, rather than "central generic training" is the 3M approach (see Exhibit 3). On-the-job training accounts for about 60 percent of MSA'S effort and about 30 percent of the effort at Westinghouse, American Express, and First Chicago. In addition to an emphasis on classroom training, IBM also makes significant use of interactive television (see Box on next page for training delivery strategies).

In general, responsibility for training design is shared by the corporate education and training department and the quality executive or a task force of company executives. Companies such as Ford, Corning, IBM and Westinghouse have separate Centers or Institutes that help to set corporate standards for quality training and deliver many, but not all, quality courses (see Box on page 16).

Most Council members report that their company has used quality training experts from outside firms. The experts may be asked to provide training or materials, or to stimulate and guide corporate training efforts. Consulting groups include such well-known names as Deming, Juran, Crosby, Feigenbaum, and The Tom Peters Group, among others. Often, outsiders are used to gain specific expertise, such as stimulating organizational and cultural change, promoting customer sensitivity, or developing skills in process management and statistical control. FPL used input from Japanese counselors and developed its own training programs and materials. First Chicago pilots some outside materials as part of a process that eventually leads to a customized package. Outsiders are used to meet the need for specific skills and tools at 3M. "If this need greatly expands, we develop our own internal training capabilities," says the firm's quality executive.

Measuring Investment and Gauging Results

Not all Council member firms measure investment in quality training separately from other training

Exhibit 3: 3M Company Trains Through Workshops, Program Description, Corporate Quality

Program:	**Management Workshop**
Format:	**Workshop**
Topics Covered:	**Managing change to meet the strategic planning and quality improvement processes; brainstorming, priority** setting task team techniques **and** establishing **action** plans.
Who Should Take This comae:	**All Division** Management
Program:	**Quality Improvement Workshop**
Format:	**Workshop**
Topics Covered:	Analysis of **needs;** tools for **managing** change; breakthrough project-by **project;** holding the **gains; functional analysis;** quantifying relative **produc quality;** developing annual quality **improvement plans** and task team **techniques.** Video tapes are **used** in **addition** to class discussion.
Purpose:	**Quality** Improvement - Phase **II** builds on the 8 elements of **Managing** Total **Quality** with emphasis on **tools** required to manage **change through** quality improvement. **The** session is given in a workshop **environment with** personnel assigned t task teams and projects **chosen** by lewd management.
Who Should Take This Course:	**All** Division and Staff Department Management

Classroom vs. Workplace Training Delivery Strategies Vary

Corning

Training is delivered in four ways:

- Classroom training provided by the company: Basically these are proprietary courses that are considered "core" and very important. This includes Corning's Quality Institute and other training that the company is satisfied that it does well.
- Classroom training ~e~ve~'b~ local colleges: Under contract with Combing, a local college center in the headquarters area develops and '&livers-y training courses. "This unique and innovative approach so far has worked very well," says the Senior Vice President and Corporate Director, Quality.
- Classroom training given by employee instructors at unit sites: About 400 employees have been taught to teach. "They become experts ott some slice of subject matter and have become the secret weapon of quality . . . the morale boost is world class, for them and their students," according to the fii's quality executive.
- Outside delivery vehicles: This includes an on-line, fee-based service which responds to employees subject matter requests with an informed guide to the best courses, The direction: "To off-load all training that can be better done by others.'

First National Bank of Chicago

- Classroom training is provided primarily by corporate training with the remainder delivered by a "train the trainer" approach. The company hopes to continue to move further toward training delivery by line management.
- On-the-job training is supplemented through follow-up by trainers who coach employees and insure that both employee and manager are best applying the employee's newly-learned skills.
- Quality seminars and Conferences are used to provide ourside, "third party endorsements" of the quality process. A key goal is to promote employee buy-in, but the experience also facilitates idea gathering and benchmarking.

Florida Power & Light

Classroom training is the primary vehicle. This includes use of line personnel as instructors, an FPL-produced video, group exercises, study groups, lectures, case studies, special projects.

- On-the-job training is accomplished through quality improvement team meetings and unit/department meetings. Other approaches have included Japanese Union of Scientists and Engineers (J. U.S.E.), counselor clinics, and internal', television.
- Other resources include the corporate library collection of literature "and video materials for self study., Computer-based training is under consideration.

IBM

- Classroom training represents 'the bulk '(80-85'prc~t) of all quality education. Whenever feasible, classroom training is offered at the employee's location.
- % Live interactive television broadcasts from central studios to selected sites are the second most predominant means of delivering education.
- On-the-job training typically occurs in conjunction with formal training mechanisms, and in the context of existing business and performance requirements.
- Self-study methods include programmed learning, audio and video cassettes, computer-based training, and interactive video-disc.
- Participation in symposia, forums, professional society meetings, graduate work study, and professional development is supported. Generally, such participation is voluntary, but IBM does appoint selected professionals to "be the corporate representative in specific instances.

Westinghouse

The Productivity and Quality Center provides classroom training which represents about 30 percent of total quality training. No outside resources are used.

- Classroom training is also provided at the local level to fit needs and practices of individual company units.
- The corporate training department provides courses at off-site locations with both in-house and outside support resources.
- Special total quality conferences are sponsored by internal corporate councils.
- External seminars and courses are supported as the need is perceived by local management.

endeavors. Among those who do track quality training, Milliken and Ford collect data on dollars and hours per employee. Corning and MSA gauge hours per employee. MSA also tracks the percentage of managers who have attended the quality management seminar and the percentage of employees who have received quality training, against a target of 100 percent.

Evaluation forms are a major tool in assessing the effestiveness of individual quality course offerings. These forms vary widely, but usually ask participants in a course to rate its content. length, materials, and instructor. Practices vary with the company and the course, and forms may contain either rating scales or open-ended items, or use some combination of the two, Evaluators probe for insights on the most and least positive points of the course, its applicability to an individual's job, and the degree to which it meets a trainee's objectives (see Exhibit 4).

Devising a method to evaluate the overall effectiveness of quality training is a tougher assignment, and several Council members report that their firms are still perfecting evaluation techniques. IBM's approach is derived from the System's Approach to Education (SATE) process applied to all company training. It considers:

1) Reactions: How learners react to specific learning events and activities.

2) **Knowledge/Skill:** Whether learners actually gain the knowledge and skills the course is designed to teach.

3) **Application:** Whether learners can apply what they learned during the instruction when they return to their jobs.

4) **Business Results:** What happens to the business as a result of education efforts.

In addition to its post-training evaluation forms, Xerox uses three to six month follow-up surveys on some courses, and does some individual performance tracking. Other firms report factoring in such data as customer and employee survey results, employee turnover rates, performance measurement statistics, and employee interviews and talk sessions.

Exhibit 4: Course Evaluation Forms

Open-Ended Response

Hospital Corporation of America

Continuous Improvement of
Quality Improvement Workshops
Pre-Workshop Information, Preparatory Reading Material, etc.
Notable Strengths *Suggested Improvements*

The Workbook, Audio Visuals, Materials, etc.
Notable Strengths *Suggested Improvements*

The Workshop
Unit I: Introduction
Notable Strengths *Suggested Improvements*

Unit II: Quality in Health Care Today Why HQIP?
Notable Strengths *Suggested Improvements*

Unit V: Team Meeting I
Notable Strengths *Suggested Improvements*

Please Comment Specifically on The Work of Each Instructor
Instructor Name _____
Notable Strengths *Suggested Improvements*

Any Other Comments You Feel Would Be Helpful:
Please Rate the Overall Workshop By Circling the Most Appropriate Number:

Outstanding	Very Good	Good	Fair	Poor
5	4	3	2	1

Westinghouse

Total Quality Seminar Evaluation Sheet

1. What did you find most valuable about this seminar?

2. What did you find least valuable about this seminar?

3. What would you recommend to improve this seminar?

4. Please rate the overall value of this seminar.

0	1	2	3	4	5	6	7	8	9	10
No Value					Moderately Valuable				Extreme Valuabl	

Exhibit 4: Course Evaluation Forms (Continued)

Scaled Response

3M Company

Managing Total Quality Facilitator Workshop Evaluation

In an effort to continuously improve our products and services, we would like your feedback on the MTQ workshop you just completed.

Session Date_____

Overall Impression

Please rate the following:

Content - Concepts and application of MTQ are clearly understood.

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

Facilitation - Facilitator(s) were knowledgeable, clear, and enthusiastic.

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

Learning Environment - Workshop structure and facilities were conducive to the learning experience

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

Applicability - Your know the material and/or understand what needs to be done to present Managing Total Qualtiy to you organization.

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

Materials - Manuals, Leader's Guide, videos, etc., are understandable, usable.

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

Individual Sessions

Rate the following:

Quality, A New Understanding (New Definition)

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

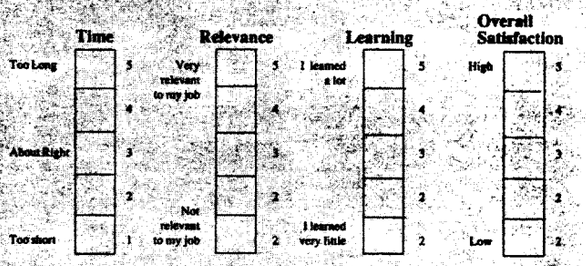
Quality, Management Teamwork (Easy Ride or Hospitality House Case Study)

Poor	Fair	Good	Excellent
0 1	2 3 4	5 6 7	8 9

Xerox

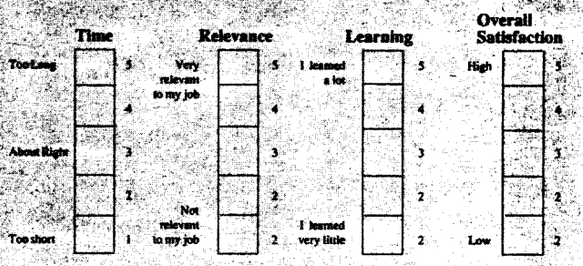
Session Assessment **Quality Improvement Process**

Class Session, part I



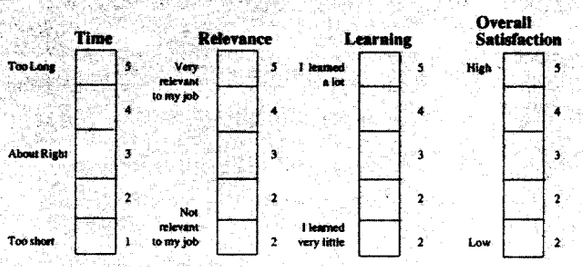
Session Assessment Quality Improvement Process

Reading Assignment



Session Assessment Quality Improvement Process

Videotape



What Works? Council Members Reflect

As the pace of internal change quickened in the 1980s, employees struggled to relate major shifts in corporate structure, mission, goals, and business thrust to their daily work routine. Some chagrined workers complained that management gave them too little guidance. Quality Council members identify relevance and applicability as crucial factors in successful training for total quality. At Xerox, "application is built-in to training." Such training "helps empower individuals to use tools to solve problems and make improvements." In fact, if members had it to do over again, several say that they would opt for an earlier introduction of training in "process improvement," techniques to prevent errors and reduce the variability in work processes. Rather than exhorting employees to "do it right the first time," they would equip them up front with the skills to improve their performance.

Other suggestions derived from quality training experience:

1) Target the training effort. Placing emphasis on the number of people trained is not as important as reaching the right people—those who can use training to lead and train others.

2) **Provide for early and continuous involvement of all layers of management as well as supervisors in quality training.** Corning used training to drive the total quality strategy throughout the company. At Xerox, training has "instilled the need for quality improvement in operating unit management. " Once executives and supervisors understand their role in leading through quality, they can help employees to become more open to training in quality awareness as well as in the use of basic tools and techniques. For 3M, training is a "subset of the total quality strategy. "

3) **Stress timely application of training.** Quality executives underscore the need to cut the time lag between training and application, noting that training and on-the-job application should be "virtually simultaneous. " Executives also suggest that team initiation and team building needs to be tied into training early in the process, with parts of the curricula oriented to team projects. Whenever possible, team members should be trained together. "We administered quality training by layer in the company," Coming's Senior Vice President for Quality reflects. "Not the dumbest thing we ever did, but close. By the time the last person in a unit got trained, the first person had forgotten that he or she had gone in the first place."

4) **Tailor training curricula and materials to company/business unit needs.** Generic, off-the-shelf training courses are likely to be less effective than home-grown approaches, experience suggests. Although some firms started with commercial programs, they soon customized them to fit their own training strategies and priorities.

Practitioners stress that their training courses are consistent with their corporate culture and business priorities. For example:

- Service-oriented firms such as American Express and First National Bank of Chicago place heavy emphasis on developing customer-sensitive attitudes in their quality training.
- HCA adapted all of the basic language and theory in its introductory quality courses to specific hospital applications. The objective is to build knowledge of hospitals as systems; of work as a process: and of those who benefit from hospital activities—customers. This knowledge is then integrated with learning about organizational policy and intent.
- Milliken & Company uses an outside contractor to ensure consistency of delivery in its training for statistical process control, then follows up with immediate on-the-job application. This firm also offers training in multiple skills to its production associates (workers),

and reinforces this training commitment with a job rotation program.

5) **Rework training programs as needs change.** Continuous improvement is one of the cornerstones of the total quality process; training should reflect this commitment. Several Council members suggest that firms need to plan for new course offerings and forge a strategy for updating employee skills as the quality process evolves. Ford sees corporate quality training adaptable to all major functional areas, with training standards that reflect "the complexity of systems, products and services" within diverse businesses worldwide.

6) **Consider using employees as trainers. Com-**panies such as Corning, FPL and MSA attribute part of their training success to the use of line employees as instructors for key quality courses. The job-related know-how of employee-trainers enhances the credibility of the quality training process and sends employees "a real message" about the importance of the endeavor.

7) Investigate alternate training technologies. Although many Council firms stress classroom training, some are having success with automated, computer-based techniques—effective in meeting the needs of a diverse work force. These firms advise making such tools available early in the training process.

Appendix

The following sampling of quality curriculum and courses was drawn from material submitted by members of the Conference Board's U.S. Quality Council. The sampling begins with a curriculum overview. The course grouping which follows progresses from quality awareness and customer sensitivity material to more specific offerings in quality measurement, process improvement, and statistics.

Quality Training at Florida Power & Light: An Overview

Implementation of QI Education and Training			
Eligible Population	*Course Title (Year Developed) *Externally developed*	*Course Length (Days)*	*Content*
Executives	Statistical Concepts for Executives (1988)*	2*	SQC and reliability tools
Managers and Above	Orientation for Managers (1983)	1	Introduction to QIP
	Leadership for Managers I (1984)	3	Managing QI teams
	Leadership for Managers II (1985)	3	Policy deployment
	Leadership for Managers III (1986)	1	Quality in daily work
	Statistical Concepts for Managers (1988)	5	SQC and reliability tools
Managers, Supervisors, Selected Staff	Application Expert (1987)	15*	Statistical application
Supervisors	Supervisor/Foreman Awareness (1983)	1	Introduction to QIP
	Supervising for Quality (1986)	5	Supervising teams, policy deployment and QIDW
	Supervising Teams (1988)	2	Supervisory facilitation of teams
	QIDW Workshop (1989)	2	QIDW for new supervisors
Facilitators Team Leaders	Techniques I (1985)	3*	Selected SQC tools
	Techniques I (1988)	5	Scatter diagrams and controls charts
Facilitators	Facilitator Training (1983)	5	QIP administration and facilitating skills
Team Leaders	Team Leader Training (1982)	5	QC tools, group dynamics
New Employees, Team Members	Fundamentals of Quality Improvement I (1990)	3	QI Process and tools
Totals	**15 courses developed by FPL**	**61**	**QIP**

Westinghouse

Management/Employee Total Quality Awareness Seminar

Who: All employees would benefit from attending a total quality awareness seminar. The material in the course can be adapted to address audiences of management, professional, clerical or hourly employees, or a combination of those.

Length: One-half or one day sessions are available.

What: What is total quality? What is excellence in an organization? Can it really be measured? Is quality improvement going to do us any good? How does this differ from programs that have been offered in the past? These and many other questions will be discussed. Since total quality was introduced to Westinghouse, this course has been a valuable way of introducing organizations to it, and it is a valuable way to show what total quality can mean to your organization.

Key Benefits of Attendance

This course helps to:

- Instill an understanding of the total quality concepts.
- Provide awareness about who your customer is, both external and internal.
- Motivate the organization to focus on total quality in daily work.
- Provide an awareness of processes and how to manage them.
- Identify some tools and techniques to improve total quality, and manage change.

Outline:

- Understanding total quality
- Change management
- Accountability and quality measures
- Quality improvement teams and problem solving techniques
- Process management
- The total quality improvement process

Special Features

- The seminar is taught through a series of lectures and workshops.
- Tools and techniques are stressed in workshop sessions which use as a resource actual organizational information. The results of the workshops can be further developed after returning to the workplace.

Xerox

New Employee Orientation and Quality Training

Prerequisite: None

Length: Five days

Audience: All new Xerox employees

Description: This course is designed as a supplement to the orientation a new employee receives in his/her work group. It will provide participants with an introduction to Xerox' history, business priorities, and culture. It will also train new employees in problem solving and the quality improvement processes. The focus of the course is customer satisfaction through effective communication and disciplined use of leadership through quality processes.

Westinghouse

Quality Performance Measures/Quality Costs

Who: Managers and professionals involved in the development of quality performance measures. All white collar personnel can benefit from this program.

Length: Two days

What: It has often been said that what you cannot measure, you cannot manage. For organizations striving for total quality, this becomes even more important, especially as you try to get a grasp of measures in the office areas. This seminar highlights ways to define specific performance criteria for each function in your organization, and how those criteria can be measured quantitatively before and after completion of improvement programs.

Key Benefits of Attendance

In this course, participants will learn:

- The impact of poor quality on sales, profits, and jobs.
- How to develop measures of quality performance for:
  - Marketing
  - Order entry
  - Engineering
  - Purchasing
  - Accounting
  - Production planning
  - Manufacturing
  - Field service
- To monitor the process of quality improvement.
- Techniques on how to convert measures into dollars
- How to establish a quality cost system (cost of non-quality).

Outline

. Development of measures
  - Analyzing data
  - Measuring results
  - Structuring reports
- Application of quality cost systems
- Examination of obstacles with some possible remedies

Xerox

Measures of Quality

Prerequisite: Basic Leadership Through Quality Training

Length: Three days, plus 10 hours of prework

Audience: Exempt employees

Description: This course is designed to provide participants with a basic understanding of:

- How to apply the organizing and monitoring phases of the quality improvement process to outputs.
- How to measure the key characteristics of outputs and processes to prepare for benchmarking activities.
- How to inspect their own and others' application of the quality processes.
- How to use data collection and analysis as the basis for decision making.

Benchmarking

Prerequisite: Basic Leadership Through Quality Training

Length: Two days

Audience: Individuals who are participating in, using data from, or directing benchmarking activities.

Description: This course is designed to provide participants with basic techniques involved in conducting a benchmarking activity. Key topics include standardizing the benchmarking process, developing sources of information, and pitfalls to avoid. Application of the key concepts will be provided through group exercises.

Process Management

MSA

Process Management Methodology

Instruction method: Team coaching

Purpose: To introduce process improvement teams to the tools and techniques used to define, document, and improve their processes.

Audience: Process improvement teams

Description: The team members will be introduced to the steps to be followed and the tools and techniques to be used to complete each of the following six actions:

- Organize
- Document
- Measure
- Analyze
- Redesign
- Implement/review and continuous improvement

Duration: One-on-one coaching of the teams by quality coordinators and/or quality trainers.

Prerequisites: Quality concepts

IBM

Defect Prevention Process

Media: Classroom

Schedule: Two days

Audience: Anyone who wishes to continually improve processes with the eventual goal of defect extinction and improvement of quality. Maximum benefit results when five or more students from a similar work activity within a product or component attend the same class session.

Prerequisites: Six months experience in your current assignment is required. Each student must bring to the class the records of between five and eight recent defects or process problems, which s/he has created and for which the causes of injection are known.

Description: DPP training provides students with tools and methods to implement a program of defect reduction and continual process improvement in their work area. This is taught and reinforced through the use of interactive dialogues between the instructors and the students as well as the extensive use of coached breakout sessions in which students practice the skills and procedures taught, using real defects from their own work.

DPP supports corporate policy on process ownership and improvement by recognizing specific roles and responsibilities for workers and managers:

- Through coached causal analysis session, workers learn methods for holding constructive, non-threatening meetings in which each person can freely discuss errors, ferret out the causes, and suggest concrete, identifiable actions leading to prevention of the defect.
- Management, on the other hand, is introduced as process owner—the "keeper of the purse"—in funding process improvements and bringing those suggestions to fruition.

This partnership is viewed as key to the success of DPP and is continually emphasized throughout the course.

The skills taught in the breakout sessions are primarily oriented toward coaching interpersonal and effective meeting techniques which are essential to the success of any process which relies on cooperation among members of groups. While these are key to holding constructive DPP activities, students comment favorably on their application toward their other work.

Objective: At the completion of this course, participants will be able to:

- Institute change in products and quality through process improvement.
- Assist managers in adhering to principles expressed in Corporate Instructions 101 and 105, as well as Executive Instruction 1.
- Engage in independent study to further increase their knowledge.
- Become an effective advocate of the above.

Westinghouse

Quality Improvement Teams/Quality Circle Training

Who: All individuals who manage, lead, or participate in the Total Quality Improvement Process.

Length: Four days

What: This program will assist you in better managing, leading, or participating on improvement teams, which are an integral part of the Total Quality Improvement Process. Multi-functional teams and groups provide an active avenue for employees at all levels in the organization to have an input into how the improvement is effected. For teams to be effective, certain techniques are required.

Key Benefits of Attendance

In this course you will learn:

- Techniques to build and maintain committed and results oriented teams.
- To better utilize the Total Quality Improvement Process.
- Problem solving processes and techniques for gathering, prioritizing, analyzing, and solving quality problems.
- Ways of managing teams for optimum results and utilization.
- The difference between quality improvement teams and quality circles, and where each is appropriate.
- How to structure and prioritize quality improvement projects.

Outline

- The problem solving process and techniques
- Group dynamics
- Total Quality and the Total Quality Improvement Process
- Performance measures
- Quality improvement plans
- Quality improvement teams

Special Features

This seminar is taught through a series of lectures and workshops that emphasize important tools and techniques utilized by Quality Improvement Teams.

Xerox

Manager as Facilitator

Prerequisite: Basic Leadership Through Quality Training

Length: Two days

Audience: Meeting leaders

Description: This course is designed to provide expertise and practice in conducting and facilitating small group meetings. Mining Group Gold is the text for the course.

3M Company

Program: Quality Circle/Problem Solving Team Leader Training

Format: Workshop

Topics Covered: Key principles of group leadership; problem solving process (goal setting, problem identification/selection/analyzation, solution generation/selection, gaining approval and support, implementation, and follow-up); problem solving techniques/tools (brainstorming, nominal group technique, priority worksheet, force field analysis, cause and effect analysis, check sheets. Pareto diagram, evaluation worksheet and grid, action register, and management presentation); group dynamics skills (conducting meetings, listening, handling conflict, and group process).

Who Should Take This Course: Any current or potential leaders or facilitators of problem solving teams.

Focus on Customers and Markets

Westinghouse

Leading Customer Focus

Who: This course is intended for all managers of employees who have direct customer contact. Applicants can be of interfunctional or cross-functional makeup.

Length: Three days

What: Leading customer focus is a three-day seminar that helps managers of customer contact people develop the skills necessary to improve customer focus in their work units and build superior relationships with customers.

Key Benefits of Attendance

The purpose of this course is to help attendees to:

- Define customer focus and understand its importance in terms of their business.
- Through the use of employee feedback, examine their strengths and areas for improvement in the management practices that lead to customer focus.
- Develop the skills and familiarity with tools necessary to work effectively with customers, employees, and colleagues.
- Have clear priority areas for improving customer focus in their work units.

Special Features

Sponsored by the Marketing Advisory Council, leading customer focus is part of the Westinghouse Customer Focus process.

IBM

Market-Driven Requirements Overview - CENET

Media: Interactive TV (CENET or ISEN)

Schedule: One day

Audience: Managers are professionals who recognize the need to be more market-driven. Those who work on products or services, hardware or software, systems or solutions. Those whose work impacts the market's perception of IBM quality (regardless of whether or not they have direct contact with customers.

Prerequisites: Executive Instruction 1.

Description: New procedures for enabling customers to identify, define and prioritize their wants and needs is the central theme of this course. The course will describe-how we can:

- Listen to the voice of the customer in a way that reveals their buying decision attitudes, perceptions, and motivations.
- Distinguish requirements from requests so that we can separate one shot demands from general market requirements.
- Integrate customer's wants, needs, and priorities into design parameters and specifications.

Objective: After competing this course, the participants will be able to:

- Describe the guidelines for understanding the market at a deeper level than has been achievable in the past.
- Describe how a matrix planning system links this deeper level information about the market's wants and needs to offering design parameters.
- Refer to the market-driven assessment checklist to assess any given project on its market-driven status.

Market-Driven Requirements Capturing Process Workshop

Media: Classroom

Schedule: Three days

Audience: Managers and professionals from planning, development, design, industry marketing or lines of business who recognize a need to use market surveys to obtain and/or validate known customer requirements for proposed new IBM offerings in a competitive marketplace across a random selection of the total market (customers plus prospects) in an unbiased (i.e., IBM not identified) manner. Particularly those planning to use QFD (quality function deployment) to link market-driven requirements to product design and development.

Prerequisites: Course QTQ30001 "Market-Driven Requirements Overview-CENET" (available on videotape from most site education managers). Also, familiarity with Executive Instruction 1. Also, have read The House of Quality by Professor John Hauser (May/June 1988 issue of Harvard Business Review).

Description: This course will cover the following:

- Identification of the three market data elements that are prerequisites for using quality function deployment planning matrices.
- What "getting into the customer's head" means and how best to do it both on a "trial" basis and on a "full scale" basis.
- How market perceptions predict competitive selections.
- How "benefit segmentation" identifies and sizes market nes.c h

Objective: Students will learn how to initiate and administer sophisticated.market research procedures that "gets into the heads" of the market. In addition, they will learn how to interpret, present and use the information generated by this procedure to provide early market-driven guidance for new product planning which will:

- Validate requirements information obtained from key accounts.
- Serve as a common focus for the whole product management team (i.e., development, marketing, finance, service and others).
- Be available before beginning design and development begins.
- Enable you to stabilize market-driven requirements early in the design phase.
- Start you off on quality function deployment matrix planning.

Johnson & Johnson

Statistically Based Continuous Improvement

Description: The following two training courses should be considered when implementing statistically based continuous improvement (SBCI).

"Advising SBCI Teams" is a training course that helps develop an internal resource to provide technical support to employee teams. It provides a knowledge of statistical analysis techniques that can accelerate group problem solving. This course is only intended for technical professionals who have some prior knowledge of descriptive statistics.

"Teaching SBCI" is a train-the-trainer course. It helps develop an internal resource for training additional employees in the use of statistical tools to cause continuous improvement. SBCI implementation experience is a prerequisite for this course.

	Advising SBCI Teams	*Teaching SBCI*
Length:	1 week	1 week

Target Audience: Team Advisors Company Instructor

IBM

Data Handling Statistics

Audience: This course is intended for managers and non-managers from non-technical functions and departments who have not had prior education or training in statistical concepts or data handling.

Prerequisite: Prospective students should have a general mathematical background and be prepared to bring to class a set of 25 to 100 data points (measurements) representing information with which they work and for which they require more sophisticated data handling expertise. . . ." - ?" *Abstract:* This seminar has been developed for those with a limited mathematics background. Ii&aches skills to improve their capability to gather, organize, analyze, interpret, and display data encountered in their environment. The seminar includes an introduction to and application of statistical concepts, the use of charts and graphs in non-technical functions, and computational aids, such as* statistical calculator and personal computer. Students will be able to apply acquired skills to measure and control quality in their workplace.

Objective: Students relatively unskilled in mathematics will be able to more effectively gather, analyze, and present data encountered on their job. These acquired skills will enable them to measure and control quality in their work place. They will also be able to make better use of data presented by fellow workers.

IBM

Taguchi Methods - Perspectives and Evaluation

Audience: Individuals who have job-related responsibility in analyzing data, designing experiments, and reaching a decision on data. Those who practice statistics from quality, product, process, research, designers, manufacturing, and development functions establishing specifications will greatly benefit. Other areas from administrative, staff and service functions using statistics will also gain from the broad base of data which is in need of optimization.

Prerequisite:

- An introductory statistics background as relates to averages and variation.
- A conceptual understanding of experimental designs and their methods of analysis.

Description: This four-day class is designed to understand the Taguchi methods and analysis towards design of experiments. The Taguchi method effectively improves productivity. The product cycle can be decreased through understanding the design concept relationships. During the course, the student will review basic statistical and design of experiments concepts, understand Dr. Taguchi's quality" definition, and through examples use the analytical tools which are part of the Taguchi methods. Taguchi's use of orthogonal arrays and linear graphs along with the concept of his design philosophy as 'it relates to 'parameter, tolerance, and system design will be evaluated. The Taguchi Quality Loss Function and Signal to Noise Ratios are applied to case examples throughout the class. Finally, a comparison is made to the more traditional design of experiment methods.

Objective: After completing the course, the student , should be able to describe Taguchi's:

- Contributions to analysis of experimental results.
- Use of orthogonal arrays to analysis of data and design of experiments.
- Quality definition and design concepts as they relate to parameter, tolerance, and system design.
- Quality loss function, signal to noise, and inner and outer noise as they relate to parameter design.
- Analytical method and comparison with the more traditional approaches.

Related Conference Board Publications

The Road to Total Quality, RB239, 1990.

Making Total Quality Happen, R937, *1990.* (Conference highlights.)

Current practices in Measuring Quality, RB234, 1989.

Total Quality Performance, R909, 1988. (Conference highlights.)

Global Perspectives on Total Quality, R958, 1991.