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By Richard A. Swanson and Richard J. Torraco

Technical Training's Challenges and Goals

The foremost role of training in organizations is the development of workplace expertise. "Workplace expertise is the fuel of an organization" (Swanson, 1994). Technical training enjoys a special position in the human resource development profession as it focuses on developing *technical expertise* in employees and end users.

The locus of control for workplace expertise had been a struggle throughout the history of humanity. Examples from the early 1900s of management retaining workplace authority include the (1) de-skilling of jobs and (2) promoting workers with high technical skills from the hourly ranks to salaried positions.

This struggle over expertise and authority will not likely change, but the variations, as we enter the twenty-first century, will be a challenge to workers, trainers, organizations, and nations. *For example, while the United States ponders the merits of Germany's dual system of developing technical expertise, large German multinational corporations are choosing to not participate in it because of dual-system bureaucracy and its disconnect from the performance demands of their companies.* Today expertise can be developed and accessed in many ways and since expertise is only one of the ingredients of performance, an understanding of performance is important.

The *Taxonomy of Performance* (see figure on page 20) helps capture some of the performance issues facing organizations and technical trainers today and in the future (Swanson 1994).

The five levels of performance are:
(1) Understanding
(2) Operation
(3) Troubleshooting
(4) Improvement
(5) Invention.

These levels portray a hierarchy that frames the expertise required of a task or process. To achieve the required performance goals, technical training must be aimed at the right technical and/or information system and at the appropriate performance level. For example, having technical

training aimed at the *operation* performance level with workplace performance expectations at the *troubleshooting* performance level has been all too common and no longer tolerable.

Another example would be a corporation developing a new "System 2000." System 2000 will have some employees who need to *understand* the system in order to carry out their work while others may be required to *operate* it. In addition, some may be required to *troubleshoot* the System 2000 process as the product is being produced while others must *troubleshoot* the system itself. The reality is that multiple levels of technical training are required to sustain any technical system (e.g., System 2000) for a company to remain competitive and that training should connect directly to required performance.

Technical jobs (and technical training) in the workplace have often been separate for those who troubleshoot from those who operate technical systems. Today we are more likely to see these performance levels combined into one job. Furthermore, the Taxonomy of Performance concisely portrays the challenge of jumping from the performance requirement of *Maintaining the System* (including understanding, operating, and troubleshooting) to that of *Changing the System* (including improving and inventing).

Organizations face their technical performance requirements with both the burden and enlightenment of their own history. We have watched firms refuse to invest in technical training of their hourly employees because no equivalent training had ever been provided for their top salaried employees. When this happens the historic values struggle over expertise and power between those in power and workers requiring technical expertise comes into play. Unfortunately, this power struggle is still at work in many of today's organizations.

On the other hand, we have seen very expensive technical training systems being made available to workers on demand. These training systems, backed by sophisticated instructional technology, ensure the development of expertise and validate its attainment before the trainee is expected to perform on the job. *For a technology-based organization these programs can be some of the most expensive and strategic business investments they make.* In this example the economics of having or not having adequate technical expertise is what most likely elevated the value of technical training to the top of the investment list.

The good news about the future is that the best theory and research related to technical training is at work in our culture. We anticipate that this will be the case for some time. The theoretical domains that guide the technical training profession (as well as all areas of the human resource profession) are said to be: psychological, systems, and economic theories (Swanson, 1983). We will use these three domains as organizers to reflect off the history of technical training into the future.

Psychological Domain

The application of *psychological theory* to technical training has always been easily observed. Technical expertise has been an issue throughout recorded history along with means of developing experts. As for the future, advances in the psychological arenas of *artificial intelligence* and *problem solving* will likely have a significant impact on the future of technical training.

Technical Training Within the Human Resource Development Profession

Technical training has a unique role in the history of the human resource development profession. Technical-skills training—in the form of parent-child, master-apprentice workplace learning models—has existed throughout all recorded history of the human race.

Furthermore, technical-skills training gave birth to the training profession as we know it. The industrial revolution of the 1800s, and its pounding rate of technological change, demanded a training response. In the United States, the National Association for the Promotion of Industrial Education (later to become the American Vocational Association) in 1912 was founded on the heritage of advancing workplace industrial skills training. With a similar concern about technical workplace skills, the American Society for Training Directors (later to be named the American Society for Training and Development) was founded in 1945 *following* the dissolution of the 1940-1945 Training Within Industry Service of the United States War Manpower Commission (Dooley, 1945).

When the contemporary training profession was born in the United States in the early 1900s, there was little demand for management training. The human faculties of intelligence, leadership, and industriousness were thought to be innate, not characteristics to be developed through training.

While the training profession acknowledges a number of schemes for segmenting its components, technical-skills training is almost always listed. Among the three *major types* of training identified today are:

- *Technical-skills training:* focused on people-system, people-thing work behavior
- *Management training:* focused on people-idea, people-people work behavior
- *Motivational training:* focused on people-beliefs, people-values work behavior (Swanson, 1982).

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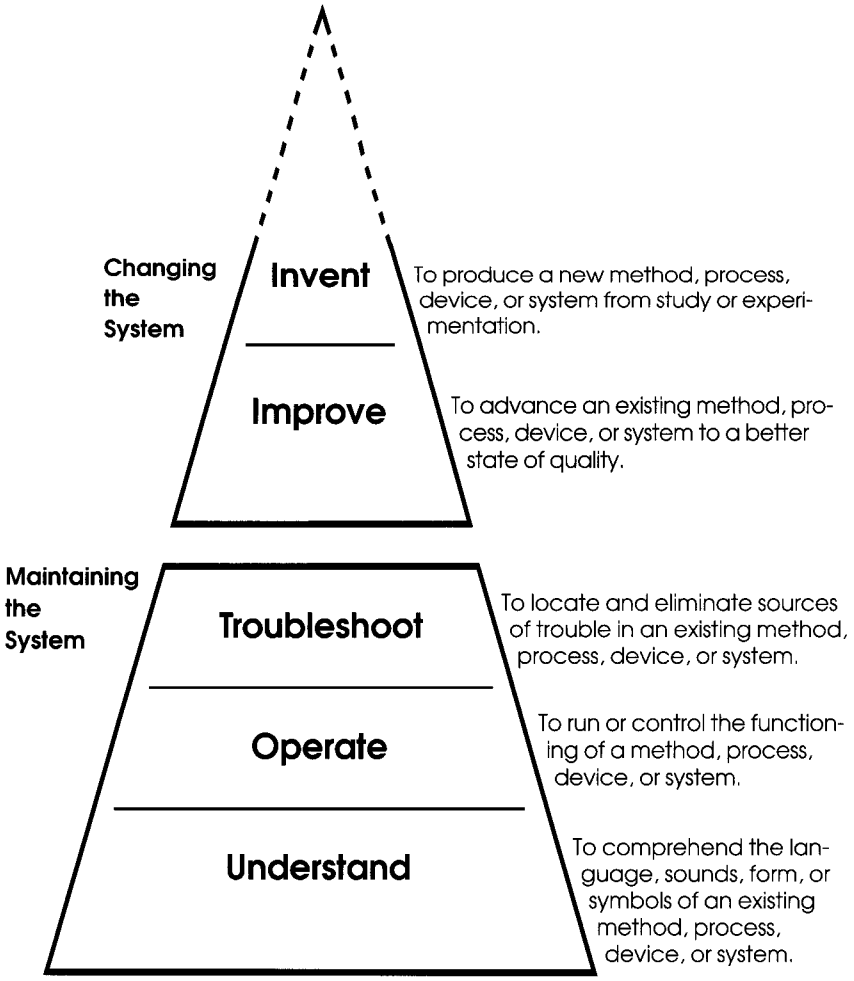
TAXONOMY OF PERFORMANCE



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Artificial intelligence. Artificial intelligence is an outgrowth of our ability to understand, document, and replicate expertise. This advancing body of theory and practice is creating the ability to document and pass on technical expertise in new ways. What we previously thought to be the outcome of years of work experience can be compressed as a result of the deeper understanding derived from new analysis tools. Furthermore, what has formerly been the domain of human expertise is increasingly being built into technical systems—smart systems able to troubleshoot and repair themselves.

Problem-Solving Methods. Problem solving has been one of the highest forms of technical work behavior and, thus, one of the ultimate outcomes of technical training. There has been a historic struggle over the theory versus system-specific prerequisites to technical problem solving. The theory perspective holds that having the underlying theory (e.g., mechanical, electrical) will best prepare the person to deal with complex technical problems. The second perspective argues for system- and task-specific knowledge and processes needed to solve that system's problems. The range of technical systems and technical problems in the workplace begs for training and expertise that can encompass as much technical breadth as possible. This desire for general problem-solving methods, however, is in conflict with the research conclusion that system- and task-specific problem-solving methods work best.

Thus, from the *psychological* perspective, the future will take technical training down two tracks: (1) the use of communication technology to gain real-time access to highly specialized technical expertise via computer hookups, satellite transmissions to human experts and data-based expertise and (2) the elevation of technical training content to the highest generalizable level while insuring adequate expertise to meet performance standards.

SYSTEMS DOMAIN

The application of *systems theory* to technical training is experienced at both the technical content and training process levels. The general acceptance of systems theory in almost all disciplines and the shift in thinking from a *closed system* view to an *open system* view will continue to impact technical training. The history of technical training is imbedded in products, tasks, and machinery that are self-contained either in the person or the equipment. This traditional bounded system or closed system view of the world is increasingly less relevant to real-world practices. *When the technical system view is broadened beyond the machine to include the operator and the machine, the internal customer and then the external customer, the system becomes an open system.*

Systems Thinking. Not long ago the idea of systems thinking was primarily the purview of the technical side of the organization. Today, almost all disciplines acknowledge systems theory. And, as information systems and socio-technical systems begin to dominate, technical training must now struggle to keep up with the reality of the workplace.

Open Systems. Systems thinking for technical training has historically

been focused on hardware systems and on a closed systems perspective. These conditions formerly placed the *designers* of production systems in a technical training leadership-related role even though they had little or no training expertise. Today that same hardware system may be viewed as only part of the production system with the operator, the customer, and the insertion of the new realities of the global economy creating a whole new systems view (Senge, 1990).

Thus, from the *systems* perspective, the future of technical training will take two major tracks: (1) the need to train systems thinking skills throughout the workforce and (2) open systems thinking that demands new ways of connecting the technical training function to the core, often-changing organizational processes and to identifying systemic technical training content.

Economic Domain

The application of *economic theory* to the future of technical training is at both the *strategic financial* and training *program investment* levels. Decisions to invent, buy, and integrate new technology into the organization—including the costs to develop the workforce expertise to operate, maintain, and improve the new technology—will increasingly be critical to the success or failure of organizations.

Economic Forecasting of Technical Training Benefits. To truly become a business partner, technical training must be viewed as any other financial investment. Technical training leaders will need to become more skilled at dealing with the economic impact of technical training. To do this, technical trainers need to lead the way in determining the forecasted performance values, costs, and resulting benefits of technical training (Fitz-Enz, 1990; Swanson and Gradous, 1988; Swanson, 1992).

High-Tech/Low-Tech Technical Training Options. From an economic perspective a "one-size-fits-all" ap-

proach to the technical training function can no longer meet the requirements of any organization. There have been tremendous developments in high-tech training technology including the use of simulators, interactive video, and computer-based instruction. These are important developments and, generally, costly alternatives that are not always responsive or cost-effective. From an economic perspective low-tech options, such as structured on-the-job training (Jacobs, 1992), can be serious rivals in meeting organizational performance requirements.

From the *economic* perspective, the future of technical training will take two major tracks:
(1) the need to strategically align technical training through the financial forecasting of the benefits technical training can add to the strategic options under consideration, and
(2) the ability to select the most cost-effective technical training options (e.g., from interactive videos to on-the-job training).

Conclusion

The history of technical training teaches us that economic, political, and technological changes require concomitant changes in workplace expertise and performance. While reaction to such environmental forces will always influence technical training's content and process, it is evident that the pace and complexity of change is accelerating.

Rather than merely being responsive, technical training needs to pursue more ways to join forces with the instigators and recipients of workplace-related change. Such alliances will reduce the lag time between workplace change and workplace capability to interact with it, and increase the likelihood of wise decisions around how to develop and unleash technical expertise in the workplace. ■

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