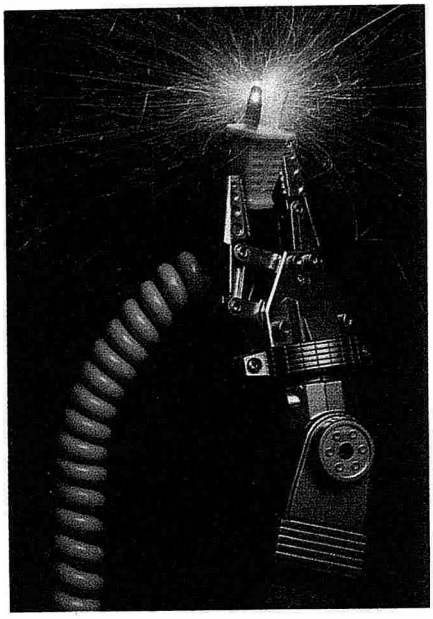
**Buyer beware: Plant modernization strategies involving robotics technology might include vendor training. But that training may not be reaching enough people and may be insufficient.**



*Garry Gay*

# Robotics Training

By JOHN E. ETTLIE, MARIKA L. VOSSLER, and JANICE A. KLEIN

As more U.S. manufacturers modernize their plants to compete more effectively with foreign firms, the need for training and education in new skill areas grows. Although vendors of automation technology—robotics—provide a large share of the training—from basic safety and operation to advanced repair and programming—experience shows that the right people might not be getting the right training.

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## The evidence

Professors Margaret Graham and Steve Rosenthal of Boston University studied eight flexible manufacturing installations in the U.S. and found that foremen are almost always the last to be trained—if they are trained at all. If foremen or other key actors in the modernization process are excluded from direct training, then the burden falls on those who are trained to train others. If suppliers of automation are training the trainers, do these people get help in how to train as well as technical expertise?

In another recent survey the National Commission for Employment Policy reported that most of the 16 plants studied "did little formal training, relying on the school systems and other institutions, such as the military, to provide the background workers needed to perform their tasks." Further, when a new machine was purchased, vendors normally confined training to "a few of the company's engineering staff, who then informally trained the workers."

Are supervisors and operators excluded from automation supplier training? And if so, what is the extent of this exclusion and its impact on robot installation and use?

In a 1985 *Training & Development Journal* article, Herman Birnbrauer said, "Much on-the-job training is considered to be the most expensive and least effective training method used," and argued strongly that the training function be upgraded to join this "hi-tech era." That successful companies today train more than unsuccessful firms supports his logic.

## How is supplier training used?

In an effort to understand how moderniz-

ing firms use supplier training for new technology, we examined the training database of a major U.S. robot supplier. The database includes information on job titles for more than 4,500 trainees in 203 firms or major divisions of companies that purchased at least one robot between 1981 and 1986. Results of our analysis appear in Table 1.

Only 23 (11 percent) of the 203 firms that purchased robots and used vendor training included operators. The average number of operators trained per firm was less than one. Supervisors don't fare much better. Fifty firms (25 percent) included supervisors, with the average number per firm at about 0.5.

On the other hand, skilled trades received vendor training in 126 (62 percent) of the cases, and engineers in 138 (68 percent). What's more, suppliers tell us that the engineers and skilled trades get more advanced training, such as programming, in addition to the basics others receive.

These results indicate that supervisors and operators usually do not receive training at vendor schools, and vendor reports suggest that the training they receive is typically restricted to the basics. Does this pattern of customer choice in who is trained affect the outcome of the robot installation?

## The outcomes

The robotics manufacturer we worked with has kept a list of 23 troubled robots since about 1984. The term "troubled" indicates a problem, often chronic in nature, that the customer can't solve. Eighty-three percent of the troubled robots were on the list two weeks, and some remained for months, even after the vendor attempted to fix or reengineer the application. In two cases customers withheld payment. The results of these analyses appear in Table 2.

Not surprisingly, members of skilled trades and engineers with vendor-provided training show up in a significant number of the troubled robot cases, and more often than not operators weren't trained when a troubled robot was listed. In 17 (about 74 percent) of the 23 troubled cases, which is beyond the chance level ($p = .017$), the operator wasn't vendor trained. Supervisors, on the other hand were about evenly split on vendor training for troubled cases.

## Changing the training decision

The possibility emerges from our results that the training of operators and supervisors is usually left to chance in domestic plants that adopt robotic systems. Many customers don't budget for training beyond what vendors provide, and in the case of operators, and to a lesser extent supervisors, this is likely to be associated with problems in robotics technology.

**It isn't surprising that engineers and skilled trades are trained to the exclusion of operators and supervisors**

Any number of forces influence the customer's decision about who to train when new technology is adopted. The first application of a robot, for example, is likely to be an important and symbolic financial event in the company. It isn't surprising that engineers and skilled trades are trained and operators and supervisors are not; engineers plan new technology projects, and skilled trades install and maintain new technology in manufacturing. But we must break this pattern if we expect to integrate new technology into a smoothly functioning, modern manufacturing firm.

We are particularly concerned about training for first-line supervisors, the individuals who ultimately must provide the day-to-day training and problem solving once the technical experts (engineers and skilled trades) have set up the system. One machinery manufacturer learned the lesson the hard way. In an initial attempt to automate its fully integrated cell including CNC and robotics, the company relied almost solely on division engineering staff and vendors for technical expertise and neglected to get input from supervisors. The system never became totally operational, and the robot has since been removed from the cell.

For the company's second cell, the first-line supervisor, selected well in advance of the equipment procurement process, participated in the design phase of the system. In addition, the supervisor and cell operators attended a four-week vendor training program at the vendor site that included both classroom and hands-on training on the actual equipment.

Supervisors have a great deal of influence

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**Table 1—Who receives vendor-provided robotics training?**

| Job Title | At Least One Trained (%) | Average Per Firm |
|---|---|---|
| Operators | 23 (11%) | 0.8 |
| Skilled trades | 126 (62%) | 3.9 |
| Supervisors | 50 (25%) | 0.5 |
| Engineers | 138 (68%) | 1.8 |
| Superintendents | 7 (3.5%) | 0.04 |
| Managers | 10 (5%) | 0.05 |

*(n = 203 firms or business units, 1981–1986)*

**Table 2—Troubled robot: Who was trained?**

| Job Title | At Least One Trained: No (%) | At Least One Trained: Yes (%) | Binomial Probability |
|---|---|---|---|
| Operator | 17 (73.9%) | 6 (26.1%) | $p = .017$ |
| Supervisor | 12 (52.2%) | 11 (47.8%) | n.s. |
| Skilled trade | 7 (30.4%) | 16 (69.6%) | $p = .047$ |
| Engineer | 5 (12.7%) | 18 (78.3%) | $p = .005$ |

*(n = 23 firms or business units, 1984–1986)*

over operator selection, and their knowledge of system requirements can prevent poor operator performance. A case in point was a new integrated manufacturing line for an automotive engine component. A first-line supervisor recommended an hourly employee for training to operate the new line, but the individual lasted only three weeks on the project. Follow-up with the supervisor revealed that the man selected had been a difficult employee for the foreman and, because the system was to be located in another department, the foreman saw an opportunity to transfer this employee out of his supervisory area. This problem could have been avoided if the foreman would have been involved in operator selection.

It is evident from these examples that supervisor and operator selection and training influence the success or failure of new technology. We have entered a period in American manufacturing when technology is being drawn like a gun in an economic shoot-out with foreign competitors. But is technology enough? Probably not, if training strategies continue to fall short of technology's demands.

## Training in the modernization strategy

We contend that modernization strategies too often give lip service to training without really understanding its importance. This failure to understand the role of training for modernization has two important outcomes. First, the modernizing firm undersubsidizes both training and education. The modernizing firm needs training facilities as well as experts and key members who are trained as trainers. Second, many factory-of-the-future projects involve new and enlarged jobs that bear little resemblance to traditional job titles used to analyze robotics training data.

Quick-fix technology solutions can't improve the competitive position of domestic manufacturing. But this generation of programmable production technology will only achieve its full potential if it is integrated. As islands of automation are coupled, the distinction between jobs in plants will break down and a better-educated workforce will implement new management techniques for stockless production.

For many firms, U.S. and foreign, this day is nearly here. Revitalized training and education policies can do much to hasten the transition of firms to a new era of manufacturing.